Author:
Davies, Roger H

Title:
A New Theory for Improving Stakeholder Value from Strategic Change Programmes

From wishful thinking to causal certainty

A New Theory for Improving Stakeholder Value from Strategic Change Programmes

From wishful thinking to causal certainty

Roger Hurle Davies

A dissertation submitted to the University of Bristol in accordance with the requirements for award of the degree of PhD in the Faculty of Engineering.

Faculty of Engineering

October 2020

Word count: seventy nine thousand, nine hundred and seventeen

Abstract

This research addresses the critical and urgent imperative to create value from transformational change programmes which is economically viable, ecologically sustainable and equitable across stakeholders in a world of increasingly finite resources. Three essential prerequisites are needed to realise intentional value from change: effective strategy, efficient execution and coherent linkage between them to ensure that the right things are done the right way. However, widespread failure of programmes to deliver stakeholder value is evidenced. Rather than inadequate methods and techniques, it is argued that patterns of flawed causal thinking and behaviour operating at a Meta level account for the failure. The patterns map to fractured interfaces between change programme disciplines. It is proposed that these flaws can be corrected by applying a simple, precise and rigorous approach centred on value and grounded in causality. A new value theory is proposed comprising principles which map to failure patterns, supported by a learning-centric framework. The research draws together convergent findings from experiential learning, literature research, subject expert interviews and rapid prototyping using dynamic simulation. The approach is developed and validated through case studies under a Critical Realism philosophical foundation. There exists an opportunity to affect a shift towards sustainable, equitable growth which creates a flourishing society, by harnessing technological breakthroughs deployed effectively using advances across neuroscience and learning. It is proposed that Value Productivity, which combines efficiency and effectiveness to integrate economy with prosperous wellbeing, provides a basis to realise this potential and can be implemented through the Value Management approach developed in this research.

Acknowledgements

I am indebted to a great many people for this work.

Concerning the University of Bristol (UoB), I owe completion to Colin Taylor, my Supervisor who enabled the research and never lost faith, even when I did, and Neil Carhart, who took over after Colin retired and provided invaluable mentoring in finalising the thesis. My thanks also to Ruth Deakin-Crick who introduced me to the UoB Systems Centre and infused me with new ways of looking at learning, Oksana Kasyutich for enabling my enrolment and fee scholarship funding, Sally Heslop for invaluable feedback and James Webley for repeated library support in the tools of research. I am also grateful to Shaofu Huang for his commitment to data aspects and, with Bobby Stuijfzand, central role in validation. Thanks also to Anders Johansson who provided great support and feedback in his annual reviews.

The Bacs case study, which provided extraordinary opportunities to develop, test and hone the prerequisite capabilities for successful deployment of the new theory and framework, was made possible only through the perpetual vision, leadership and encouragement of David Core and willingness by Anne Pieckielon to risk funding new, unproven methods. Also, Martin Prior chaired critical early workshops and provided ongoing support across many areas.

On the Impact Dynamics team, Rich Harding transformed the Market Dynamics Model (MDM) into a dependable operational asset, as he did previously with the Value Management Toolset™, and also brought his economics and statistics grounding to bear at key points. Alex Jackson provided a safe pair of hands during the most critical period, including MDM verification, and enhanced the Toolset to incorporate advances from the research. Helen Tracy innovated customer segmentation by learning dispositions for the MDM and, along with Shaofu Huang, provided essential steers for incorporating the Learning Journey and Learning Power concepts. Sami Stouli injected economic wisdom and expertise in relation to causal inference, together with integration of econometric and systemic modelling.

For case studies used to validate the framework, successful outcomes were the result of highly committed people, freely sharing their expertise and fully engaged in a language and approach completely new to them. The io oil and gas team comprised: Graham Inman, Roy St-Pier, Chris Freeman, Julio Herbas, Tim Highfield and Tim Hawes. Special thanks to Himadri Singh, who not only supported me but helped build the model, and CEO Richard Dyson for permission to use the case for this research. For KWMC, I thank Craig White and Melissa Mean for their energetic support and Carolyn Hassan, Founder and Director, both for permission to use the case and interview. My thanks to Seb Cox for collaborating in the System Eyes model, entirely online from Calgary.

Many subject experts shared their time and knowledge: Antonio Nieto-Rodriguez, David Shephard, Elaine Fletcher, Helen Tracey, Jon Collins, Joseph Lowe, Patrick Hoverstadt, Rich Harding, Sami Stouli, Tim Pontin, David Core, Steve Jenner, Tom Gilb, Shaofu Huang, Andrew Hudson and Anita Bradshaw.

Not forgetting Kim James and Carol McKenzie, who many years ago introduced me to Systems Thinking and changed my life forever with their key teaching that energy of difference creates value and causal alignment of intention delivers it.

Finally, my partner, Jacqui, without whose unwavering support this achievement would not have been possible.

Author's Declaration

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Research Degree Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, the work is the candidate's own work. Work done in collaboration with, or with the assistance of, others, is indicated as such. Any views expressed in the dissertation are those of the author.

SIGNED: .... DATE: ....

Table of Contents

List of Figures

List of Tables

PART I CONTEXT AND RESEARCH

Part I sets out a contextual foundation by establishing the core problem, why it matters, how it is being caused, redress for the causes and key prerequisite capabilities for them to be effective.

1 Introduction

1.1 Purpose of the Research

The purpose of this research is to investigate how incorporating learning frameworks and systems thinking into value management frameworks can improve stakeholder value from strategic change programmes.

Programmes are the primary vehicle for translating potential benefits of change into reality and any failure to fulfil this role directly damages our economies, societies and wellbeing. Many programmes fail to meet projected financial returns on investment and some deliver negative returns. Financial inadequacy is mirrored in non-financial outcomes; stakeholders are simply not benefiting from the full potential presented by technological and other advances.

Conversely, correction offers profound increased value across all stakeholders at both micro and macro levels. There exists need for urgency and certainty in resolving the problem, which evidence shows is endemic across economies, sectors, industries and applications; a pattern which points to systemic factors at play. The impact of COVID-19 intensifies imperatives argued in this work prior to the pandemic, and implications are introduced at relevant points in the thesis.

The highest purpose driving this research is an immediate need to address the inability of change programmes to deliver value to stakeholders. At a macro socio-economic level, this failure translates into lost opportunity to resolve two of the greatest and inextricably linked challenges facing humankind, inequality and ecological limits; reconciling prosperity with sustainable growth (Jackson, 2017, p. 3). Corroborating over forty years of experiential practice and learning in business transformation and coaching with this academic research, it is concluded that the problem is neither rooted in technology nor delivery process but patterns of thinking and behaviour driven by flawed mental models of cause and effect.

These paradigms, couched in linear thinking, are inadequate for the increased scope, pace and interconnectedness of today's business, societal and economic landscapes, constituting Complex Adaptive Systems (CAS) (Miller *et al.*, 2007; Boulton *et al.*, 2015) containing wicked problems (Rittel *et al.*, 1973b; Watkins *et al.*, 2015). Flawed mental models are mirrored and perpetuated by physical models, together with associated support tools and measurement systems predicated on static, one-way, linear causality; diametrically opposite to the real world.

Over this 40 year period, technology, particularly Information Technology (IT), has enabled extraordinary and increasingly dependable functional capabilities, greatly assisted by open standards and protocols. Similarly, advances in software languages, system architectures and professionalisation of project and programme management provide greater certainty of delivering technical solutions on time, to specification and within budget. Parallel breakthroughs in neuroscience inform how we approach human aspects of change, notably behaviour and decision-making through learning. However, despite all these advances in technology, process and neural understanding, improved functional outputs from change initiatives are not reflected in value delivered to, or experienced by, stakeholders.

This failure represents immense waste and misdirection of resources, along with inequality. To put this in context, there is strong evidence of failure rates up to 70% (Hammer *et al.*, 1993; Kotter, 2008; Keller *et al.*, 2009), which when lost benefits are included with programme cost the impact equates to around 8% of GDP for IT programmes alone (Sessions, 2009). Further, with 30% lower productivity than comparable economies, the UK headroom for improvement equates to £600 Billion per year in terms of GDP (Humphrey, 2017). This research explores how technology, process and human behaviour can be integrated into a value-centric new theory and learning framework, grounded in causal thinking, which recouples deliverable capabilities from change programmes with intended stakeholder outcomes.

A fundamental hypothesis, to be explored through this research, is that highly dependent change programme disciplines, powerful in their own right, are disconnected causally in both function and time and that this fracture is the primary reason for failure to deliver stakeholder value. This decoupling is evidenced at both physical and mental levels and the work proposes integrating strategy and execution through causal alignment at all levels in space and time. It is proposed that focusing on value, framed as energy exchange, holds a key to success. To this end, it is shown that value is a function of effectiveness, 'doing the right things', and efficiency, 'doing things right', constructed mathematically from inputs, outputs and outcomes; a tenet permeated throughout the thesis.

Approaching causal coupling between strategy and execution using Meta level principles and framework, integrating strengths of existing disciplines through rapid, purpose-directed learning, systemic thinking and dynamics modelling using new value-centric measures, represents white space for this research.

An important qualification is needed in regard to references concerning Neuro-linguistic Programming (NLP) in which the Author is a Master Practitioner. NLP provides concepts, techniques and tools for practical application of neuroscience, which are relevant to this work but very poorly covered in research, leaving them vulnerable academically. To this end, credible original sources underpinning all aspects of NLP used in this research are duly referenced, and corroborated through subject expert interview (Shephard, 2017), included in Appendix A1.

1.2 Structure of the Thesis

The thesis is organised into twelve chapters grouped under five parts as outlined below, using graphics to depict the essence of what is covered in detail within each chapter. Four appendices are included to provide further information and evidence.

PART I CONTEXT AND RESEARCH

Part I sets out a contextual foundation by establishing five things: the core problem, why it matters, causes, potential redress and identifies key prerequisites for the new value theory and framework to be effective.

Chapter 1 Introduction

Chapter 1 provides a thesis overview, this section, in the form of chapter outlines which summarise and link cross-disciplinary subject areas covered under the research. The purpose and core research question are defined, together with definitions of key terms incorporated within the question.

Chapter 2 Problem Space Review

Chapter 2 examines why change programme failure matters, arguing the case for a new value-centric theory and framework needed to address problems associated with CAS through a contextual foundation comprising five related perspectives: meaning, sustainability, productivity, potential and delivery. Value Meaning defines value as a relationship between outcomes and the inputs needed to realise them through outputs. Value Sustainability concerns the imperative for balancing equitably distributed growth with ecological limits. Value Productivity is proposed as a complementary outcome measure to address limitations of conventional productivity measures, which focus on input and output, in achieving this sustainable and equitable growth. Value Potential considers how technological advances offer the means to realise productivity improvements, while Value Delivery discusses the extent and impact of change programme failure to translate this potential into stakeholder value.

The key conclusion is that Value Productivity, the product of effectiveness and efficiency, provides a basis for steering change programmes to deliver outcomes which balance economic sustainability through equitable growth with ecological sustainability as shown in Figure 1.1.

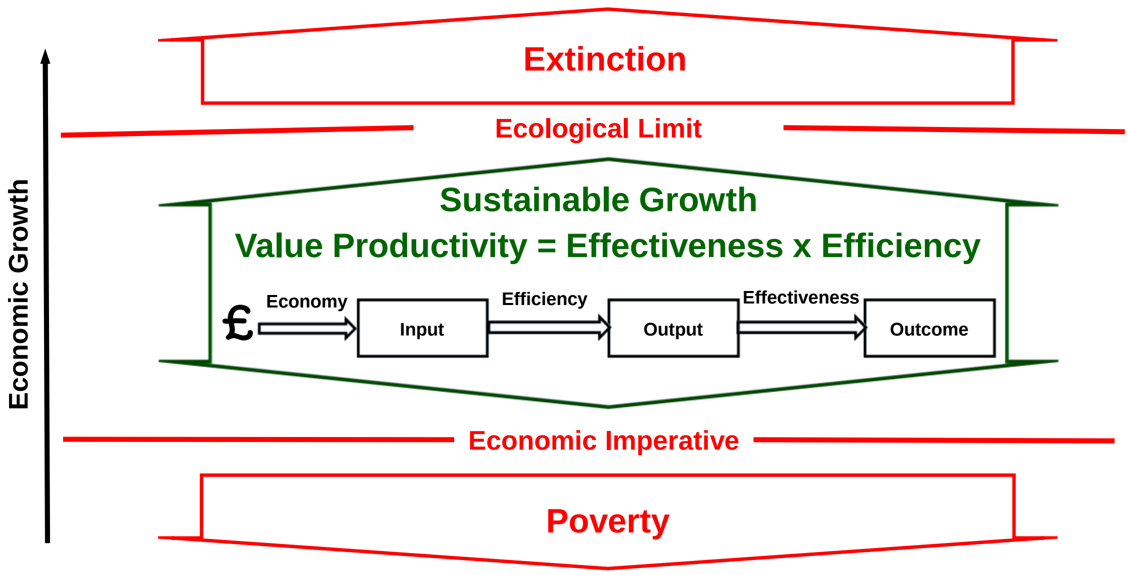

Figure 1.1: Problem Space

Chapter 3 State of the Art Review

Having stated the case for improving stakeholder value from change programmes, Chapter 3 reviews state of the art thinking and practice through the lens of five disciplines which programmes are most commonly focused: strategy, investment, implementation, performance and change, as shown in Figure 1.2. Strategy is a causal hypothesis of cause and effect to achieve an intended state, expressed as a 'kernel' comprising three elements: diagnosis, guiding policy and coherent actions. Investment ensures that initiatives are financially viable and effective in delivering intended stakeholder outcomes, i.e. benefits, normally through a Business Case. Implementation translates strategy into actionable phases with deliverable capabilities essential for achieving strategy. Performance focuses on stakeholder value realisation by quantifying and tracking causal driver and outcome measures, lead and lag indicators respectively. These first four disciplines are orchestrated through the Change perspective, encompassing human behavioural aspects of transformation, in which learning is critical, and draws on mental and physical models of causal reality.

Change programme disciplines are related functionally, for example, how implemented deliverables link explicitly to strategic objectives, and temporally, how delivered capabilities translate into actual stakeholder outcomes over time. Advances have resulted in significant improvement within disciplines, for example, teaching of strategy and investment appraisal in business schools, professionalisation of programme management and adoption of performance management frameworks. However, the research pointed to fractures between disciplines both functionally and temporally.

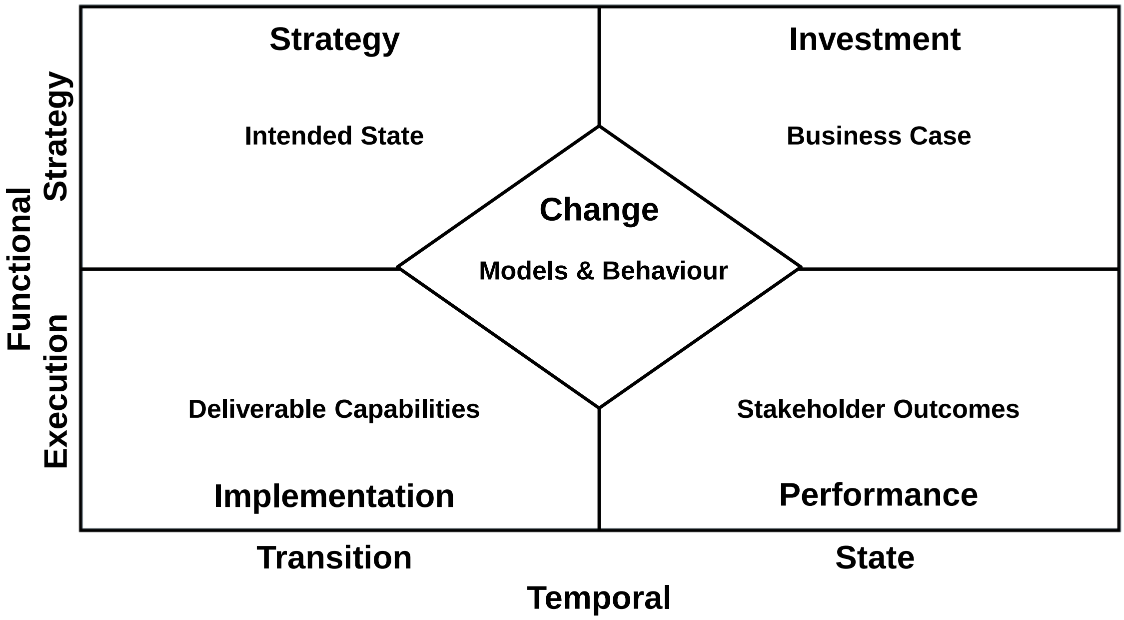

Figure 1.2: State of the Art

Chapter 4 Failure Patterns

Despite these advances, change programme failure to deliver stakeholder value remains high and potential productivity gains through technology elusive. Chapter 4 argues that this failure lies not in weaknesses ***within*** disciplines in their own right but the functional and temporal decoupling ***between*** the perspectives due to flawed causal thinking and behaviour. With reference to Figure 1.3, seven archetypal patterns are defined from the Author's experiential learning and corroborative research which map to interfaces between disciplines:

- 1 Value Inversion is an overall frame in which an assumed solution is chosen and implemented without adequate specification of, or causal linkage to, intended stakeholder purpose.
- 2 Value Imbalance involves conflict of intentions, where change programmes favour one or more stakeholder interests at the expense of others.
- 3 Value Mismatch refers to change programme focus on surface level problems and events rather than underlying patterns of cause and effect.
- 4 Value Uncoupling occurs when change programme deliverables are not linked causally to changes in drivers needed to realise intended stakeholder outcomes.
- 5 Value Fragility concerns change programmes architected to optimise delivery of functional outputs rather than resilient stakeholder value outcomes.
- 6 Value Exposure occurs when change programme costs are missed or understated, benefits misattributed or exaggerated and risks unaccounted for or underestimated.

- 7 Value Erosion is a consequence when change programme benefits are not tracked and neither adverse variances corrected nor positive opportunities harnessed during or after implementation.

Part I concludes by defining three prerequisites: Agile Learning, involving directed, powered learning, Causal Precision, requiring modelling of CAS and using insights to direct value creation, and Causal Certainty which concerns measure definition and quantification.

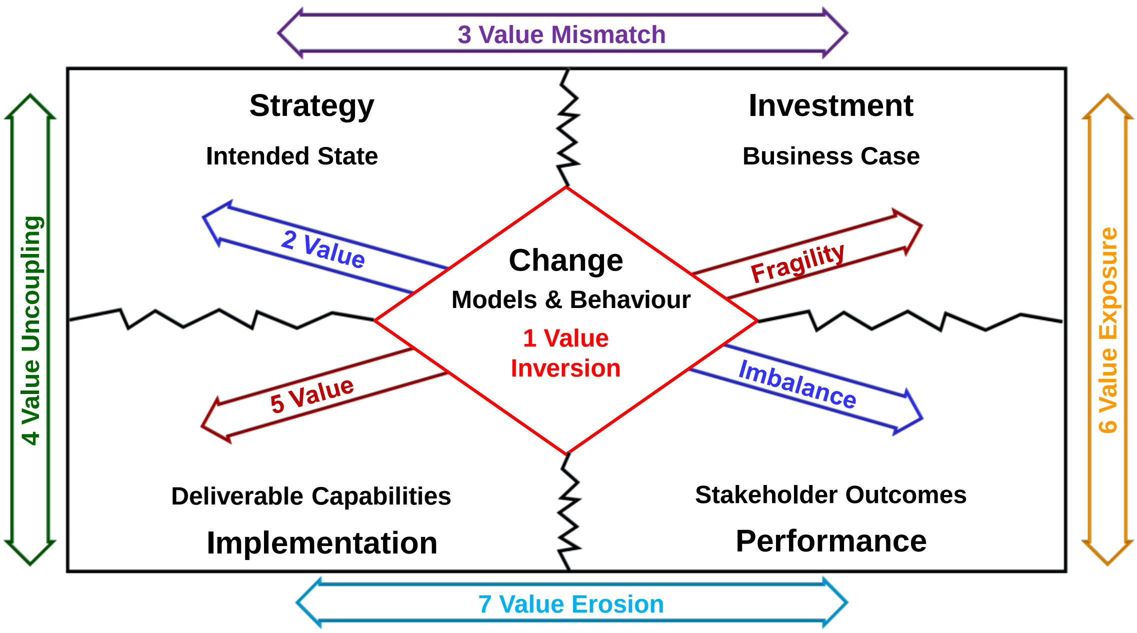

Figure 1.3: Failure Patterns

PART II RESEARCH PHILOSOPHY AND DESIGN

Having established the context, core problem and prerequisites in Part I, the research objectives and methodology for developing, testing and validating the new theory and framework are covered in Part II.

Chapter 5 Research Objectives and Methodology

Chapter 5 specifies research objectives followed by navigation through research philosophies to data collection and analysis methods. Specific choices are declared, together with rationale for selection, in particular, the prominent role of Critical Realism for the causal philosophical foundation, together with research design comprising integration of Action Research with Case Studies using rapid prototyping of dynamics modelling corroborated through interviews with subject experts. Criteria are defined against which prerequisites for the new theory are evaluated in Chapter 10. Figure 1.4 shows relationships between research methodology elements and how these map to thesis chapters.

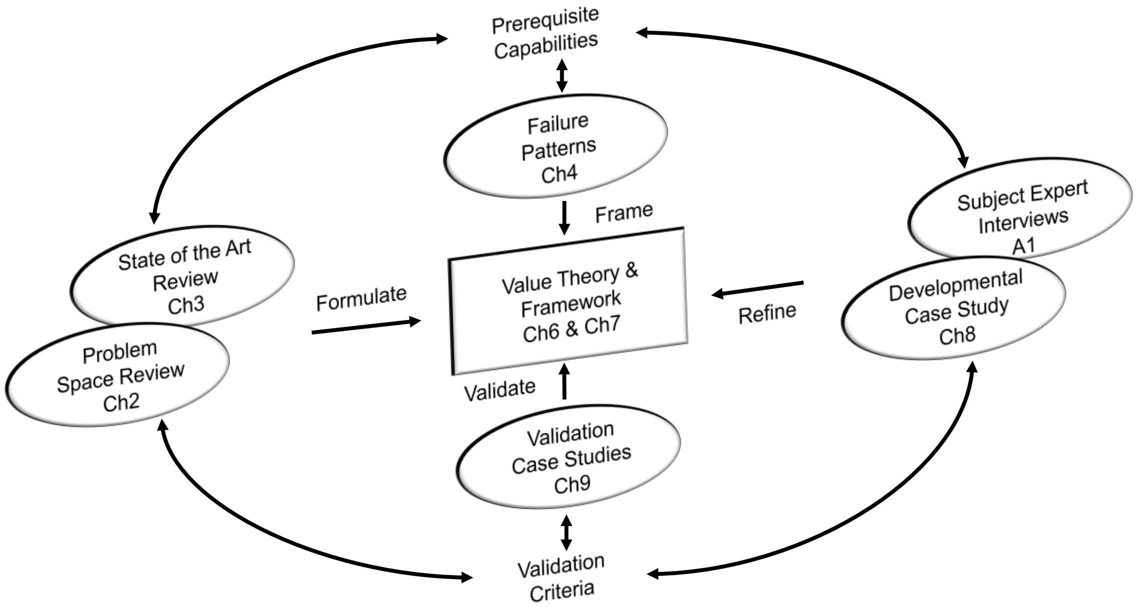

Figure 1.4: Research Design

PART III NEW THEORY AND FRAMEWORK

Part III formulates the new value theory by combining research from Part I with the Author's experiential research into seven Value Principles and constructing the Value Power Framework through which the principles are integrated. Principles and corresponding framework phases map to the failure patterns defined in Chapter 4.

Chapter 6 Formulation of the New Value Theory

Chapter 6 formulates the new value theory evolved from a synthesis of experiential learning, literature reviews and rapid prototype modelling using Action Research and Case Studies and corroborated through subject expert interviews. The new theory comprises seven Value Principles, corresponding to, and representing an archetypal resolution for, the seven problem patterns, as shown in Figure 1.5.

- 1 Value Frame bounds the problem in terms of purpose, causal drivers and relationships, together with capabilities needed to influence drivers to achieve the purpose; represented by a Why-How-What question order.
- 2 Value Intention architects stakeholder intentions to be mutually supportive, thereby increasing the flow of energy which creates value and reduces conflicts which destroy value.
- 3 Value Model causally aligns components of value: inputs, outputs and outcomes, to ensure freedom of energy in the value transformation process, removing bias and system gaming.

- 4 Value Programme couples deliverable capabilities with value drivers, eliminating waste to increase efficiency and release capacity for effective value creation.
- 5 Value Alignment targets, aligns and prioritises (TAPs) programme deliverables to optimise value through the interaction of magnitude and timing of value.
- 6 Value Certainty specifies precise criteria for success and exposure to risk, the negative potential consequences of uncertainty, through diverse perspectives integrating intuitive and analytical mental processes.
- 7 Value Track combines robust planning with perpetual monitoring of deliverables, performance drivers and stakeholder outcomes to achieve optimal balance between robust starting conditions and corrective feedback under conditions of uncertainty.

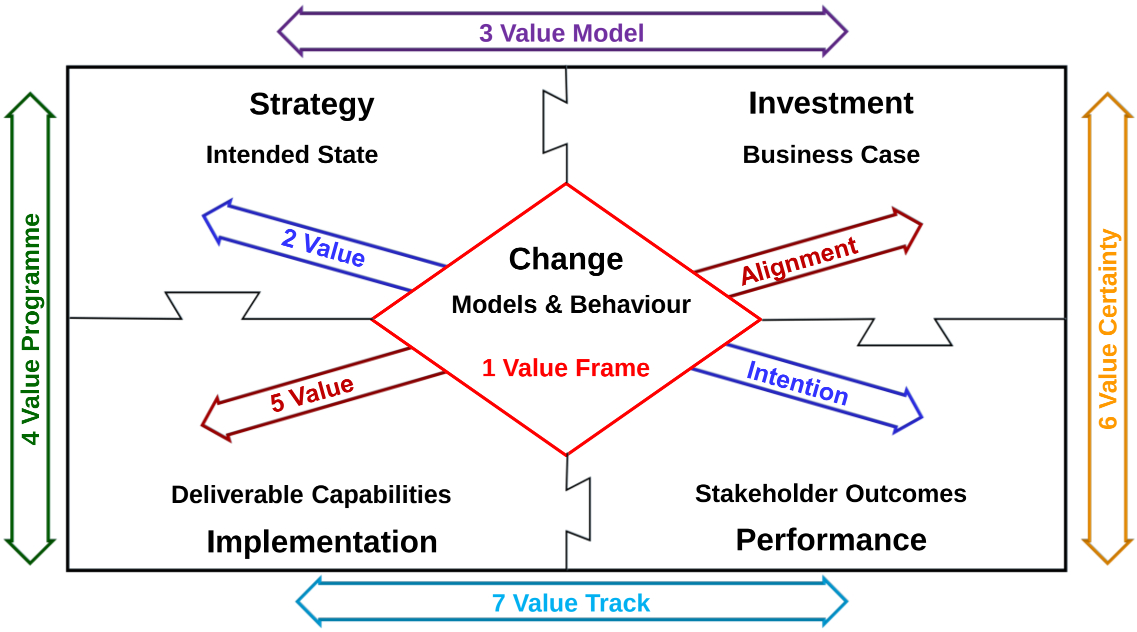

Figure 1.5: Value Principles

Chapter 7 Construction of the Value Power Framework

Chapter 7 develops a generic framework to support the new theory, comprising phases, structured in nested learning cycles around the value alignment frame as shown in Figure 1.6, which adopts corresponding colour coding to denote mapping against problem patterns and associated value principles. The resulting Value Power Framework is constructed in a number of build steps drawn from key aspects of research, related to but not directly mapped to problem patterns or principles:

- Step 1: Effectiveness, Efficiency and Efficacy
- Step 2: Learning Loops and Deming Cycles
- Step 3: Extended V-Model

- Step 4: Internal and External Learning Journeys
- Step 5: Learning Journeys in Extended V-Model
- Step 6: Causal Linkage
- Step 7: Directed Questions Mapped to the V-Model

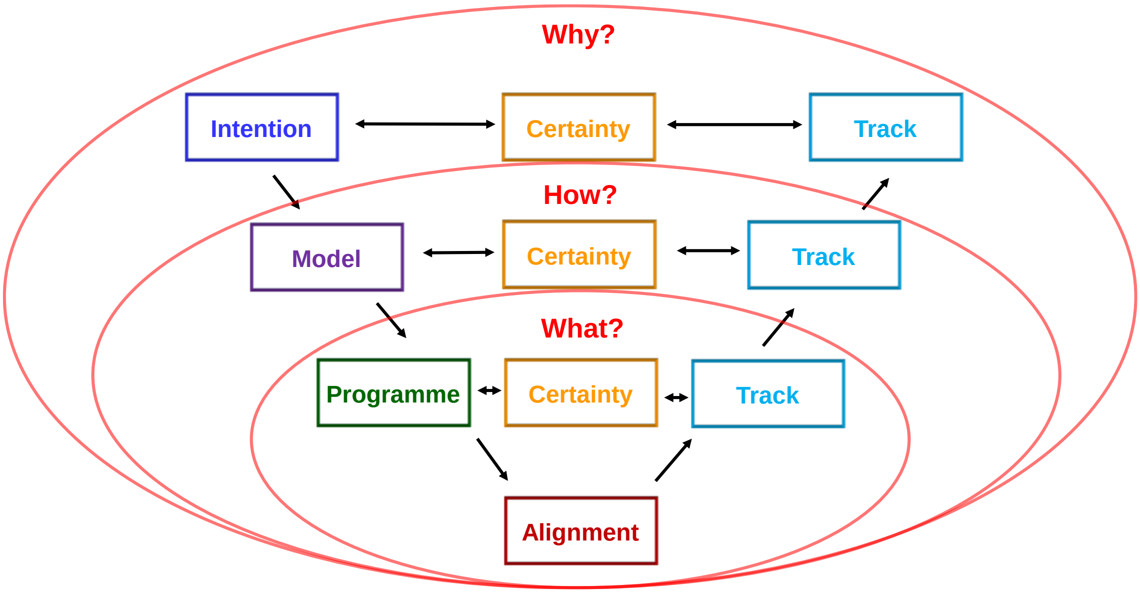

Figure 1.6: Value Power Framework

PART IV DEVELOPMENT AND VALIDATION

Part I concluded with three mutually reinforcing perquisite capabilities: Agile Learning, Causal Precision and Causal Certainty, for effective deployment of the Value Principles and Value Power Framework formulated in Part III: Part IV develops and tests solutions for these prerequisites through a longitudinal case study then validates the entire Value Power Framework using three diverse cross-sectional cases.

Chapter 8 Developmental Case Study

Chapter 8 describes the main developmental case study, Bacs Market Dynamics Model (MDM), which integrates business and academic research and outcomes. The five-year longitudinal case study evolves, tests and validates perquisite capabilities through achievement of associated objectives defined in Part I, shown in Figure 1.7 as simplified compound reinforcing feedback loops. The core tenet is transformation of purpose, ‘doing the right things’, into manifested performance, ‘doing things right’ through value transformation.

Agile Learning is the capability to specify purpose followed by rapid, certain translation into performance, the achievement of which focuses on directed and powered learning. This demands Causal Precision, the capability to model value transformation causally through achievement of two objectives, modelling CAS and deploying the model to direct value creation.

Causal Certainty refers to capability to define, source, transform, validate and apply measures to reduce uncertainty in value transformation, demanding precise specification and accurate quantification of measures and relationships, incorporated within the model.

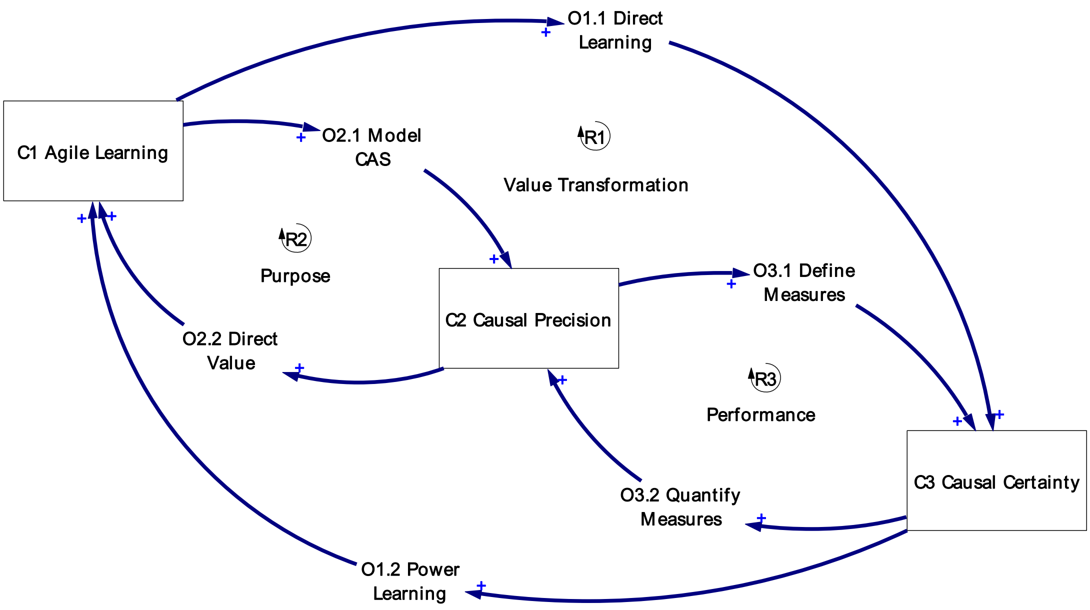

Figure 1.7: Prerequisite Capabilities and Objectives

Chapter 9 Validation Case Studies

Chapter 9 describes how the new theory is validated through deployment across three diverse cross-sectional case studies, spanning Oil and Gas, Citizen-led Housing and Building Information Modelling (BIM), which exercise the entire framework as shown in Figure 1.8. Each case provides evidence at three levels of validation: process effectiveness, outcome success and client before and after feedback, covering both general viability and specific, unique value realised through the approach. Process effectiveness is evidenced through declaration and description of artefacts produced at each framework phase. Outcome success is demonstrated by deliverables from the process, corroborated by client statements. Clients also provided detailed responses to before and after questionnaires specified in Chapter 5. Client responses are included.

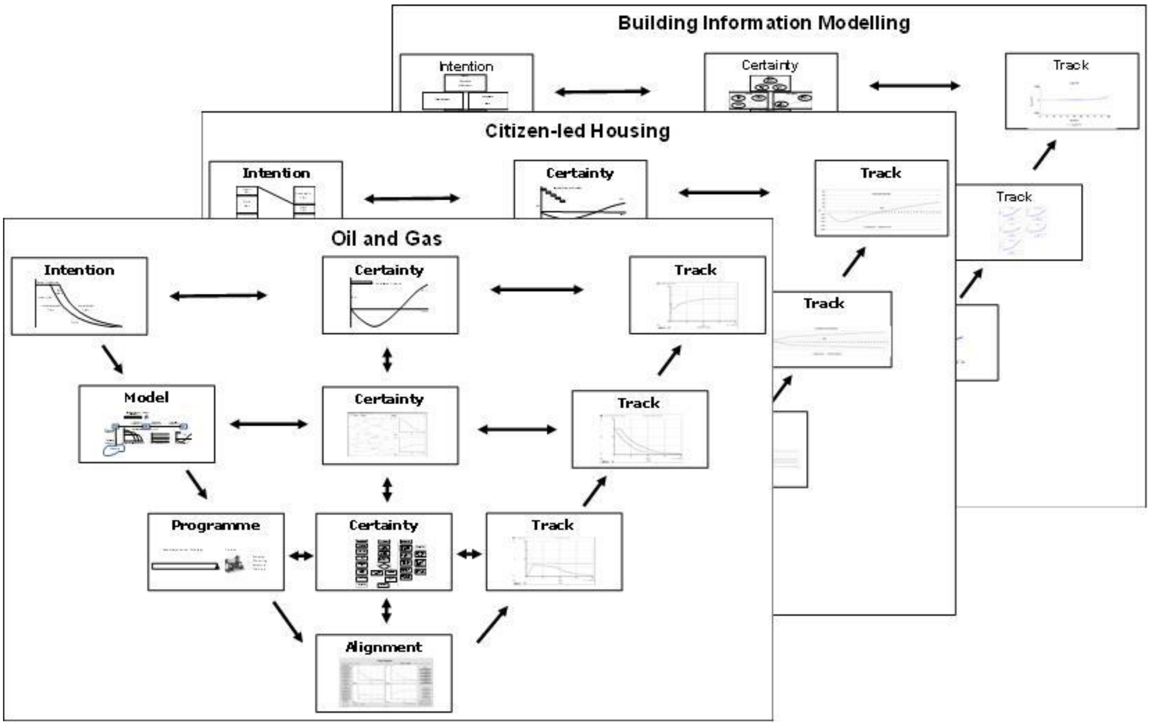

Figure 1.8: Validation Case Studies

PART V EVALUATION AND DISCUSSION

Having constructed the new value theory and framework in Part III, then developed prerequisite capabilities for, and validated, effective deployment in Part IV, this final part includes a critical assessment of implementation and discusses how the Value Management approach is embedded functionally and in time through Dynamic Integration. The final chapter provides conclusions and summarises novel contributions from the research.

Chapter 10 Evaluation of Implementation

Chapter 10 provides a critical assessment of implementation from two perspectives: first, solutions to perquisite objectives developed through the longitudinal case study, covered in Chapter 8, secondly, efficacy cross contexts through the validation case studies, Chapter 9, as shown in Figure 1.9. Prerequisite objectives are evaluated against success criteria and evidence defined in Chapter 5 under Part II.

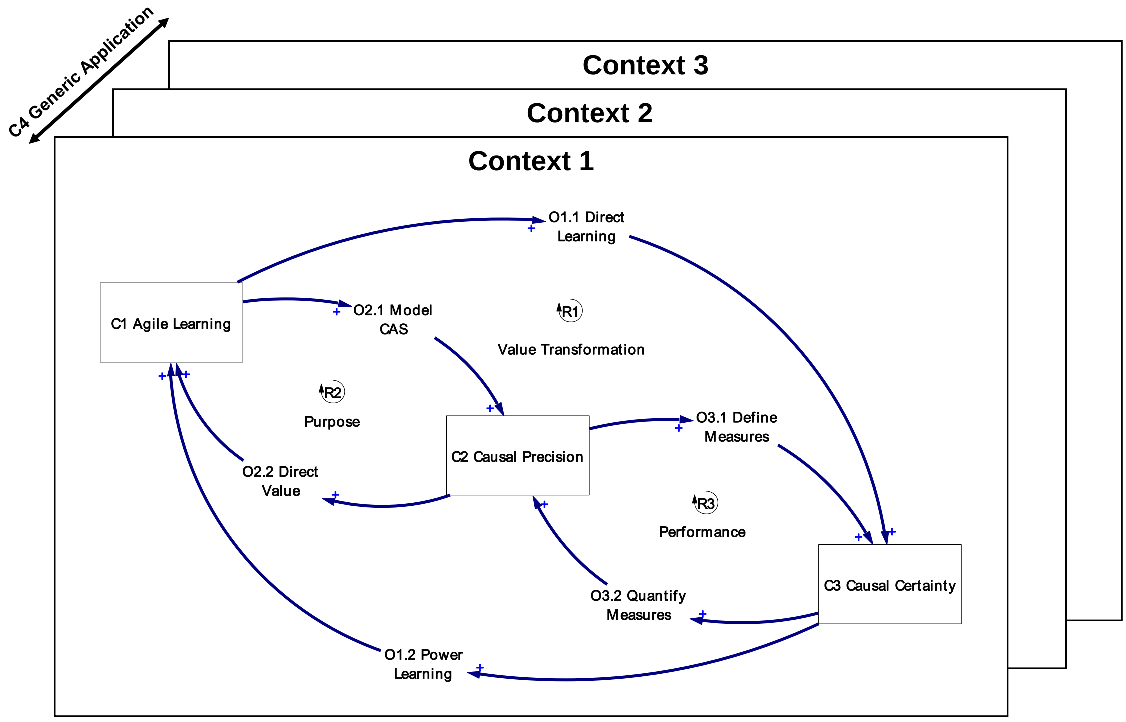

Figure 1.9: Evaluation of Prerequisite Objectives and Generic Application

Chapter 11 Discussion: Dynamic Integration

Chapter 11 returns to a core tenet of this research; the need to recouple change programme disciplines. Dynamic Integration concerns causally coupling all change programme disciplines discussed in Chapters 3 and 4, together with deliverable capabilities, in order to maximise value in space and time. A programme is framed as a Value Journey, process for maturing the Value Power Framework over time, and portfolio as a broader canvas of Value Transformation. The value maturation process both develops and is informed by a Causal Architecture, which is perpetually honed and calibrated to provide an increasingly reliable causal compass for decision making and action.

The Value Power Framework is constructed and populated holistically through Value Breakthrough workshops designed to achieve the unreasonable but plausible by eliciting knowledge using a fractal process, Precise Simplicity, which combines system thinking and engineering disciplines with advances in neuroscience. Dynamic Integration ensures that any change is reflected causally across the entire programme and portfolio both functionally and in time, as depicted in Figure 1.10. This enables near real time management of the programme, business and stakeholder value, Performance Dynamics, which is supported by the Value Management Toolset™.

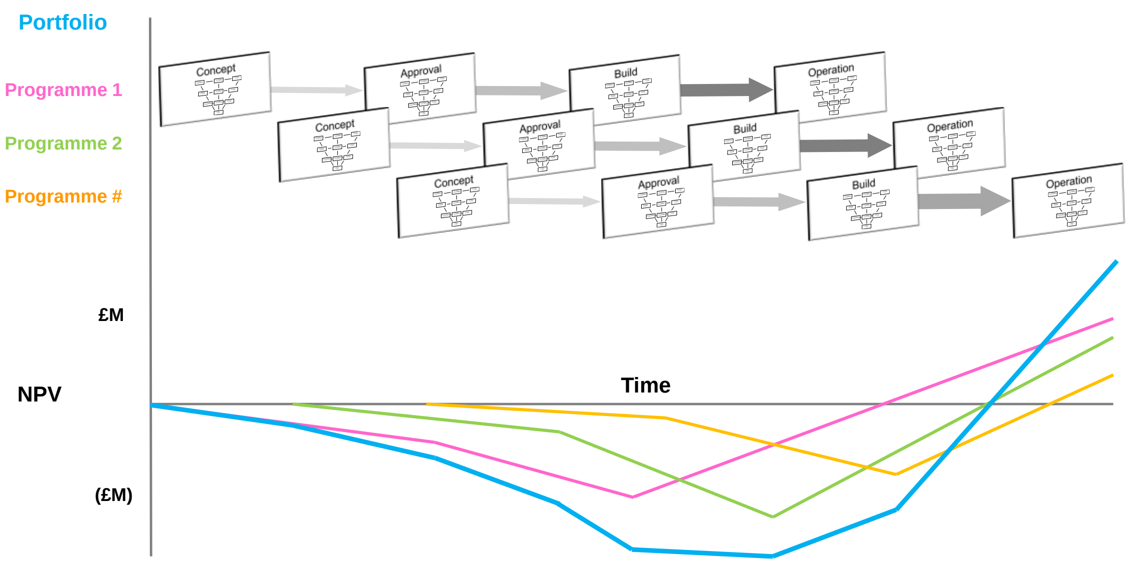

Figure 1.10: Dynamic Integration Programme Portfolio

Chapter 12 Conclusions

Chapter 12 draws together key findings from the research by weaving insights from each chapter into a coherent complete story, structured using the Value Power Framework as shown in Figure 1.11 with chapter references. Novel contributions are summarised as: Value Measures, Value Principles, Value Power Framework, Value Journey, Performance Dynamics, Precise Simplicity and Value Management Toolset™: Finally, the challenge and proposition are restated.

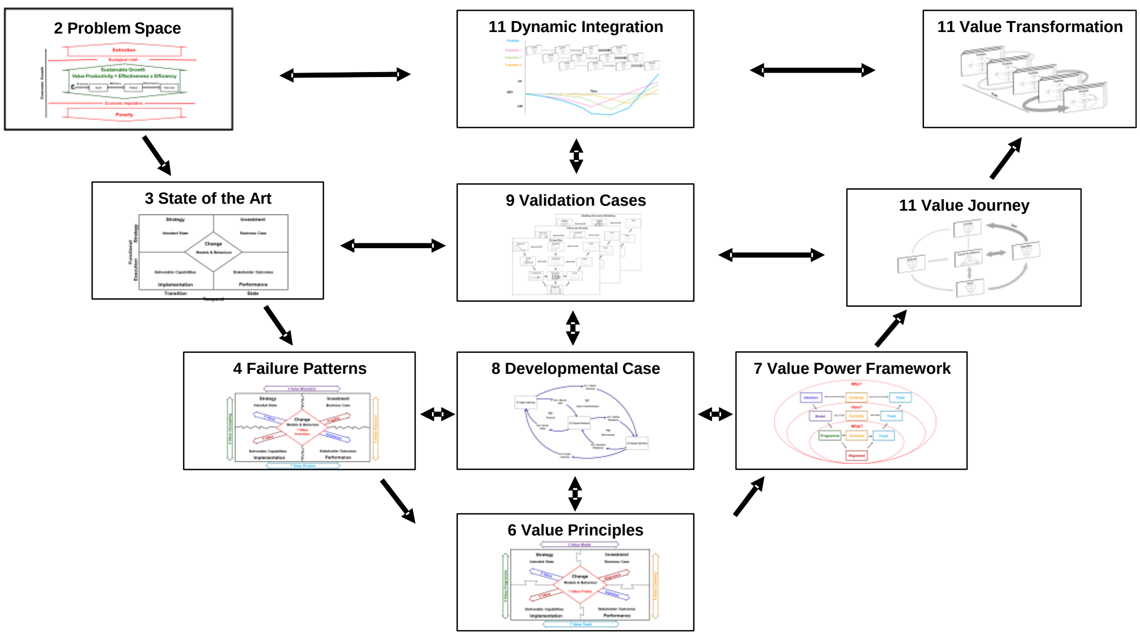

Figure 1.11: Conclusions

Appendices

Appendix A contains interviews with subject authorities, both to develop elements of the proposed new theory and to subject the most vulnerable and contentious emergent thinking to rigorous expert challenge and scrutiny. One interview is also devoted to the Bacs developmental case study. Appendix B details the developmental and validation case studies. Appendix C provides a Glossary of Terms and Appendix D Heuristics and Biases.

1.3 Core Research Question

The purpose of this research is encapsulated in the core research question stated below:

How can we improve delivery of stakeholder value from change programmes by integrating learning frameworks and systems thinking within value management frameworks?

1.4 Key Terms

In order to address the core research question and render results viable for practical application, it is necessary to define and validate a new theory and generic learning framework for enhancing change programmes to cause intentional resilient, equitable and sustainable stakeholder value with speed and certainty. To this end, key terms relating to this imperative are defined below and a full glossary provided in Appendix C.

Strategy

Strategy is defined for this research as set of hypotheses about cause and effect (Kaplan *et al.*, 1996, p. 149) to bring about a desired future (Business Dictionary, 2019g) comprising three core elements: diagnosis, policy and action (Rumelt, 2017). Strategic initiatives involve structural transformation in order to create intended stakeholder value. Transformation can be at one or more levels, for example, market served, processes needed to deliver value to that market or technology driving the processes. The critical consideration is that interventions are targeted, aligned and prioritised at the appropriate causal level, where greatest value can be created within the entire system most quickly. Strategy is explored further in Chapter 3.

Change Programmes

A programme is a group of associated projects related to strategic objectives managed in a co-ordinated way, often as part of a portfolio, to obtain benefits through change not available from managing them individually (OGC, 2007a, p. 4; Thiry, 2010, p. 14). For this research, the terms change programme and programme are used synonymously to mean any initiative, involving a shift from Business as Usual (BAU), aimed at delivering stakeholder value, including projects and portfolios. The scope of change programmes for this research is covered in Section 1.5.

Stakeholders

Stakeholders are people, or living agents, with an interest in outcomes from, and have some form of energy exchange with, the change programme or changed state resulting from the programme. There is increasing recognition for need to approach strategy from a stakeholder management perspective which focuses on the importance of purpose (Freeman, 2010; Freeman *et al.*, 2010).

Causality

Cause is something that brings about an effect or a result (Mirriam-Webster Dictionary, 2020a) and causality the relationship between cause and effect (Collins Dictionary, 2020). More specifically for this research, causality concerns relationships which link inputs and outputs with consequential stakeholder outcomes. The causal focus leads to Critical Realism (Bhaskar, 2008) as the philosophical foundation, together with Systems Thinking and dynamics modelling for mapping and quantification.

Sustainability

Sustainability concerns survival within an environment containing limited resources. In addition to ecological limits, value sustainability spans other forms of capital (Henriques *et al.*, 2004; Forum for the Future, 2017) which relate to different stakeholders and intentions. In this vein, interventions must avoid inappropriate short-termism, for example cost cutting expediencies to maximise short term shareholder return at the expense of longer term sustainability, which Kaiser *et al.* (2013) calls ‘Red Line Thinking’.

Intentional

Dictionary definitions of intention focus on something wanted or planned (Lexico Oxford, 2019a). However, for the new value theory, intention not only includes, but also goes beyond, want and desire, to the creation of reality (Zukav, 1991, p. 120). In neuroscience the tendency to manifest the subject to which attention is focused is explained through Confirmation Bias (Kahneman, 2011), an insight applied to the proposed new approach through precisely defined and causally aligned measures.

Generic Learning Framework

In addition to the theory, a framework orchestrating underlying principles must be universally applicable, for which a learning frame is adopted. The research draws on three interrelated aspects of learning: first, Learning Journey to manifest purpose through performance (Deakin Crick *et al.*, 2017a) as a continuous improvement process (Deming, 1994, p. 131), secondly, means to energise the process such as Learning Power (Deakin Crick *et al.*, 2015) and diversity (Epstein, 2019) and thirdly, learning levels (Argyris *et al.*, 1974; Tosey *et al.*, 2011).

Value

Stakeholder value provides a core frame for the conception, selection and execution of change programmes. In this respect, it is necessary to venture beyond common dictionary definitions which converge on: usefulness, importance and monetary price (Cambridge Dictionary, 2019g; Lexico Oxford, 2019b), to include values (Business Dictionary, 2015b) and values levels (Graves, 1970). A universal quantitative definition for value, as a measure of more for less, is constructed from inputs, outputs and outcomes and used as the foundation for a number of proposed value-centric measures, such as Value Productivity, Value for Money and Value Power.

Equitability

There is a paradox concerning poverty and inequality. Capitalist global economic growth has demonstrably reduced poverty (Rosling, 2018) whilst wealth is being shared increasingly unequally (Stiglitz, 2012). The current growth model requires exponential resource consumption which is ecologically unsustainable as predicted by Meadows *et al.* (1972). The research explores fresh approaches to achieve essential growth within sustainable limits (Reich, 2016; Raworth, 2017).

Resilience

At the time of writing the COVID-19 pandemic has exposed fundamental flaws in focusing on efficiency, for example fragility of global supply chains, thereby amplifying interest in resilience (Stockholm Resilience Centre, 2019). Rather than drifting back to the pre-COVID world, a radical reset is demanded, potentially around the concept of stakeholder capitalism (Schwab *et al.*, 2020) which encompasses sustainable and equitable value growth. Value is a measure of outcome in relation to input, for practical purposes benefit to cost, which is shown to be the product of effectiveness and efficiency. It is demonstrated that resilient value can be achieved through increased efficiency by eliminating waste, using Lean thinking (Womack *et al.*, 2003), not just to cut costs but, more critically, release resources and essential redundancy, requisite variety, for effective value creation (Beer, 1984; Ashby, 1991). For this it is argued that we need to embrace complexity and associated ambiguity.

Speed

The core challenges driving this research, inequality and ecological limits to growth, are critical and urgent; rendered even more so with the COVID-19 pandemic imposing widespread economic lockdown at the time of writing. The imperative for speed concerns the transitory nature of competitive advantage for commercial business (McGrath, 2013) and general necessity to address the problem of poor productivity (Humphrey, 2017) as a way to increase prosperity and fund public services.

Certainty

Transformational change programmes deal with complex, wicked problems involving inherently high levels of uncertainty and associated risk (Rittel *et al.*, 1973b). This research reframes the challenge as Certainty Management, encompassing new approaches to risk (Hubbard, 2009), prediction (Poundstone, 2014; Tetlock *et al.*, 2016) and measurement, particularly 'soft' intangible factors (Hubbard, 2014).

1.5 Scope of the Research

This section specifies the scope of the research by categorising change programmes into three dimensions, Shift, Type and Intervention, designated and defined by the Author.

1.5.1 Programme Shift

Shift refers to the degree of change involved in order to realise intended stakeholder outcomes in relation to a highest purpose. Shift relates to why? In this vein, a key distinction for business is between Run the Business (RtB) and Change the Business (CtB) (Jenner, 2012; Nieto-Rodriguez, 2012). RtB refers to growing the organisation under Business as Usual (BAU), centred on improvements within current structures, for example continuous improvement of existing processes and staff capability requirements. Conversely, CtB is a transformation in causal structure, involving a new or modified business model reflected in Target Operating Model (TOM) (Blenko *et al.*, 2014; Choo, 2017), often demanding a contextual shift in purpose and associated mission.

RtB typically involves single loop learning, while CtB initiatives require structural and contextual changes involving double and triple loop learning levels respectively (Tosey *et al.*, 2011; Engelbart, 2012); the latter two mapping to CtB. However, it is also critical to recognise and respect the difference and co-dependence between evolution, managing the right way within existing structures, and revolution, leading the right things through shifts in structure (Watzlawick *et al.*, 1974). The key lesson from this insight is that interventions must be both applied at appropriate causal levels and congruent, an imperative revisited under Precise Simplicity in Chapter 11. For example, a change in manager will not solve a systemic problem but neither will a necessary shift in structure prove effective without the right management.

This research focuses on CtB involving strategic transformation, which under today's volatile, uncertain, complex and ambiguous (VUCA) landscape (Watkins, 2016) containing wicked problems (Rittel *et al.*, 1973b; Watkins *et al.*, 2015) demands the capability to deal Complex Adaptive Systems (CAS) (Miller *et al.*, 2007). Consequently, reductionist RtB initiatives are not included within scope. However, BAU is essential for the transformation to be successful; CtB and RtB are equally important from a value perspective and embedding then harnessing a new BAU to deliver stakeholder value is deemed an integral part of a strategic change programme, drawing upon all three learning levels. Triple loop is needed to frame the change, double loop to design structures and single loop to implement programme deliverables within the new BAU resulting from the strategic shift. Integration of learning levels is reflected in the Value Power Framework constructed in Chapter 7.

1.5.2 Programme Type

Type concerns the broad causal process through which the transformations shift is to be realised. Type maps to how? Therefore, rather than group under sectors and industries, it is argued more appropriate to categorise programme type in terms of causal contribution to the highest purpose. To this end, four programme types are proposed on the grounds that, whilst not exhaustive, incorporate important aspects for the purpose of this research, improving stakeholder value reflected in prosperity, which includes wealth and wellbeing.

- Infrastructure: Physical building blocks and related support needed to sustain prosperity
- Defence: Securing prosperity in an imperfect world with threat of destructive aggression
- Organisational: Structuring and governing organisations through which we prosper
- Technological: Improving and supporting prosperity through innovation, particularly IT

Under these definitions, type includes the widest appropriate scope. For example, infrastructure encompasses markets, finance, cities, policing, healthcare, education and natural environment. Defence includes cyber security and intelligence. Organisational embraces learning, cultural and behavioural change. Technological refers to automation which normally includes IT.

When chunked up to purpose, the overlap and interdependence between types are rendered more obvious and explicit. For example, future cities (Infrastructure) cannot provide freedom and prosperity to citizens without effective structure and governance (Organisational) protected from cyber-attack through intelligence (Defence) using advances in IT (Technological). For this reason all four programmes types are included within scope and explored in more detail whilst recognising the imperative for their integration.

Infrastructure Programmes

Infrastructure programmes tend to be large and take many years to complete by which time the world has often moved on, rendering them vulnerable to failure; intended purpose no longer being appropriate. Recognition of infrastructure's importance and pressing need for refresh is reflected in government strategy (HMT, 2016). For the UK, it is estimated that £466bn will be required over ten years; only 20% provided through public funding, the remainder from private enterprise, demanding a financial return under the current capitalist economic model. Infrastructure is viewed as critical to improving UK productivity and in meeting green commitments.

Limited funding is driving the imperative to deliver greater value for money. This is reflected in state funded initiatives focusing on sustainability through Self-Monitoring Analysis and Reporting Technology (SMART) and green technologies in exploring future direction for infrastructure and the business models needed to support well–functioning markets in these sectors. Research initiatives include International Centre for Infrastructure Futures (ICIF) and UK Collaboratorium for Research on Infrastructure and Cities (UKCRIC); the University of Bristol being a partner in both. Recent research stresses the need for tighter integration between infrastructures, demanding a shift from siloed implementation to systemic integration (Rosenberg *et al.*, 2013). The Author argues that integration must go beyond infrastructures in order to achieve highest purpose.

Defence Programmes

In addition to national security, defence programmes are necessarily at the cutting edge of technology and innovation. Consequently, they provide a useful model for managing complexity spanning functional specialisms, such as electronics, software and mechanical hardware, demanding a combination of Systems Engineering (INCOSE, 2010) with advanced planning and tracking methods, e.g. Earned Value (Fleming *et al.*, 2000; Webb, 2003) discussed in Chapter 3.

Major programmes in the Defence sector, in which the Author was a Chief Mechanical Engineer, not only include military equipment but also logistical support systems, intelligence and cyber security. These programmes are similar to major infrastructure in size, scope and timescale, and also include another dimension; risk associated with the need to deploy cutting edge, unproven innovation in order future proof viability (Barry, 2018). This characteristic means that high levels of risk tend to persist late in the programme life.

Organisational Change Programmes

Organisational change programmes include transformation of entire business models, typically requiring major shifts in culture, process and product, to serve new and changing markets and stakeholder needs. This type of programme is covered generally under management of change. Leading proponents upon which the research draws include Kotter (1990); Kotter (1996); Drucker (2006) in the context of leadership, Gardner (2004) concerning shifts in mindset, Ackoff (1978); Ackoff *et al.* (2005) focusing on fundamental flaws in thinking and Slywotzky *et al.* (1999) covering archetypal business models.

IT Programmes

Information Technology (IT) Programmes, which includes Information Communications Technology (ICT) (Stevenson, 1997), comprise major hardware and software components, in practice imbedded in all other categories of programme. However, IT programmes are categorised separately, and taken to represent technological initiatives as a whole, because of their importance across change programmes in general and also their dominance in research and data relating to failure patterns and associated corrective strategies. IT is a major driver of change and has a critical role in productivity, a core tenet of this research.

1.5.3 Programme Intervention

Intervention concerns the specific nature and focus of change being implemented and relates to what? All programme types can involve elements and combinations of this sub-categorisation, examples of which include: product design, process reengineering, mergers, technology refresh. As with types, interventions are usually highly interrelated, thereby increasing complexity exponentially. For example, a new product demanding faster delivery processes crossing existing functional silos (Tett, 2015). The important point is that strategic change programmes can, and normally do, comprise combinations of shift, type and intervention. For example, a company facing extinction due to market shifts needs to transform its business model (Shift) demanding new organisational structures and IT refresh (Type) centred on new products and services (Intervention).

This degree of interdependence blurs boundaries between shift, type and intervention; are we doing a management of change, IT or process reengineering programme? To this end, the Author’s experience across all combinations spanning both private and public sectors established the need for transition from narrow programme typecasting to integration driven by stakeholder value.

2 Problem Space Review

2.1 Introduction

The core tenet of this research is improvement in magnitude and rate of stakeholder value delivery from change programmes, captured in two proposed new measures Value Productivity and Value Power respectively, introduced in 2.4 and expanded in Chapter 4. It is essential to justify the need for improved value delivery and identify ways in which it can be improved. This chapter addresses the former by exploring why change programmes are important and how failure to deliver intended stakeholder value matters at a macro level from five interrelated perspectives in relation to value: meaning, sustainability, productivity, potential and delivery. Three prerequisite capabilities for achieving improvement conclude Chapter 4: Agile Learning, Causal Precision and Causal Certainty, solutions to which are developed using a longitudinal case study in Chapter 8.

2.2 Value Meaning

Value is a core frame for this research and the first challenge is defining value as a quantitative measure which is universally applicable across all contexts. The common dictionary definitions converge on three aspects: monetary price, usefulness and importance (Cambridge Dictionary, 2019g; Lexico Oxford, 2019b), which raises two fundamental issues in the context of measurement: equating price to value, and the quantification of usefulness and importance.

2.2.1 Equating Price to Value

The implicit assumption of this mental model is that price equates to value and is therefore a definitive measure of usefulness and the importance of utility afforded by a product or service. It is a core premise in market economics that people only pay for things of value, so business is incentivised to deliver value in order to make a profit; self-interest benefiting others governed by Adam Smith's 'invisible hand' (Smith, 1776, p. 445). Advocates of market economics argue that price is determined by the 'value added'.

The flaw in this thinking is that it does not work universally (Reich, 2016; Raworth, 2017). Kaiser *et al.* (2013, p. 72) quotes Oscar Wilde who defines a cynic as "A man who knows the price of everything and the value of nothing" and Warren Buffet who said, "Price is what you pay, value is what you get." It is also important to distinguish between commodity and value. A commodity is differentiated only by price according to supply and demand, a uniformity referred to as fungibility (Moffatt, 2018). Conversely, products and services with real or perceived unique properties important to customers are differentiated by value. This research places much greater importance on the latter, whilst recognising the role of the former.

Value Inequality across Stakeholders

The coupling of price to value leads to imbalance of value realised between stakeholders. This is brought into focus by the COVID-19 pandemic, for example, in relation to food supply (Power *et al.*, 2020) and our perception of who and what is of true value (Schwab *et al.*, 2020). Real or perceived imbalances across stakeholders create distortions and conflicts, which both inhibit and destroy value; reasons included for Brexit (Centre for Social Investigation, 2018). For example, if staff perceive that they are undervalued they are likely to exhibit low engagement with consequential sub-optimum productivity, which research suggests is a major problem worldwide with some organisations maximising only 5% of their workforce (Gallup, 2015; Gallup, 2016a; Gallup, 2016b).

Mazzucato (2018b) exposes an increasing trend for businesses to consume available funding in value extracting activities, such as share buy-backs, self-serving dividends and anti-competitive strategic patenting. These practices not only favour a small number of stakeholders at the expense of others, but also crowd out competition and divert funding from investment in value creation. This is largely because these strategies are easier, involve less risk and are self-serving, providing extraordinary financial returns to executives. The trend is a systemic consequence of equating value to price, irrespective of whether the transaction is creative or extractive. This mental model is supported by governments globally and reflected in the measurement of Gross Domestic Product (GDP) (Stiglitz *et al.*, 2010). Mazzucato argues that this trend can only be corrected through a shift in the definition of value.

2.2.2 Quantification of Usefulness and Importance

Whereas price is an easily measurable quantity, usefulness and importance, are more difficult to quantify. Whilst price is largely determined by the market as a system, including distortions, usefulness and importance are stakeholder specific, raising the distinction between them. For example, Kaiser *et al.* (2013, p. 83 and p. 235) define value in terms of happiness for the customer and from a business perspective Net Present Value (NPV), the value of expected net cash flows discounted at the weighted opportunity cost of capital. Although the latter provides a strong quantitative definition of value for business, it still remains necessary to measure happiness for customers (Kaiser *et al.*, 2013, p. 2).

Usefulness is the state of having utility (Cambridge Dictionary, 2019f) in the context of a given requirement, for example access to and availability of a bridge to traverse a river or internet connectivity and download speed. Conversely, important concerns the degree of necessity or value (Cambridge Dictionary, 2019c) which that usefulness affords. It follows that something can be extremely useful in a context not important to the stakeholder; for example, no need for the bridge. Therefore, to be of value it must be both useful and important from a specific stakeholder perspective, which leads to the role of values.

The Role of Values

Whereas value relates the usefulness, importance and transactional price of something, values are important and lasting beliefs or ideals shared by the members of a culture about what is good or bad and desirable or undesirable (Business Dictionary, 2015b). Values are fundamental in personal change as things most meaningful and important to us as individuals and groups, motivating and influencing behaviour, defined as nominalisations such as fairness, creativity and engagement (Shephard, 2005b). Although values drive behaviour they are not processes. For example, ‘contributing to society’ is a process, not a value, whereas ‘contribution’ is a value and motivates the process of contributing.

The connection to value is that many soft factors engaged in value creation relate to values. Some are outcomes in their own right, such as wealth, health, security and happiness. Others are drivers enabling outcomes, for example, trust in financial systems enables transactions to create wealth. It follows that soft factors are increasingly critical in the dual roles of cause and outcome in value creation. Neurologically, values operate in hierarchies, the order influencing behaviour, for example, does a person value enjoyment over health? This means effective human change involves a shift in values hierarchy (Shephard, 2005b). In the context of Artificial Intelligence, discussed in 2.5, the Value-Alignment Problem (Sierra *et al.*, 2019) refers to how machine learning algorithms make potentially life and death choices; in an emergency does a driverless car crash or run down a person.

Closely related to values is the concept of values levels (Graves, 1970; Cowan *et al.*, 2005) as a means of defining human maturity in terms of the manner in which people relate to each other. Under this theory, values are the content and values levels the container (Shephard, 2005c). The importance of values levels in change design lies in the availability of reliable measurement tools and high degree of predictability of cultural behaviour such insights provide, a context expanded in Chapters 3 and 6.

2.2.3 Value as Costs and Benefits

The Institute of Value Management (2017) defines value as the relationship between satisfying needs and expectations and the resources required to achieve them. More succinctly, value is the relationship between benefit and cost, used synonymously to outcome and input respectively. In this vein, Davies *et al.* (2011, p. 31) define the Value Equation as a relationship between stakeholder outcomes and the cost of realising those benefits; Value = Benefit – Cost. In quotient form, Benefit / Cost, value can be expressed as the product of effectiveness, doing the right things, and efficiency, doing things right.

This proof, covered in Chapter 4, requires distinction between inputs, outputs and outcomes. Therefore, whereas economics studies the creation and distribution of wealth (Mirriam-Webster

Dictionary, 2019a), value can be defined as a measure of wealth creation in terms of stakeholder outcomes per unit of resource consumed, more for less. It follows that value is a measure of transformation, the effectiveness and efficiency with which resources are converted into another more useful form.

Hard and Soft Factors

Typically, only monetary factors are included within business cases (Jenner, 2017; Lowe, 2017). Importantly, this is also true for the measurement of GDP which drives policy and decision making at national and global levels (Economist, 2016; Masood, 2016). Confinement to 'hard' financial measures presents a major problem from a value perspective, because 'soft' non-financial factors, often relating to values, are critical for value creation. In recognition of their significance, there are two common approaches for dealing with intangible factors. The first is to incorporate only hard measures in financial calculations, the second to provide financial surrogates for intangible items so that they can be included in the quantitative financial analysis. For example, Lowe (2017), author of the HMT Green Book interviewed for this research, proposes that the benefit of time saving for customers through convenience can be represented by defining a financial value to time saved (HMT, 2011, pp. 59 -60). However, other subject experts advocate strongly that soft benefits should be measured and tracked but not manipulated using financial surrogates, preferring instead to map the causal influence of soft drivers on hard measures (Jenner, 2017; Gilb, 2017a).

2.2.4 Value as Energy Transformation

As a more radical solution, Odum (2007) defines a universal unit for measuring energy, Emergy, emanating from the sun and which can be applied across any domain. Recognising that it is incorrect to say a calorie of food is equivalent to a calorie of service, Odum (2007, p. 68), reconciles different forms of energy by framing the transformations as an energy hierarchy, in which he terms the conversion between levels 'Transformity'. Odum *et al.* (2000) provide a nomenclature for modelling how Emergy operates for any system, as a frame for value creation as energy transformation. Finally, Odum provides a solution for consolidating different forms of energy in an economic context, using the related concepts of Transformity, Emergy and universal currency Emdollars (Odum, 2007, pp. 252-280).

Inputs, Outputs and Outcomes

Odum (2007, p. 272) defines money as high quality information, which enables the value conversion process, shown as the dotted lines in Figure 2.1 adapted from Odum's postulation.

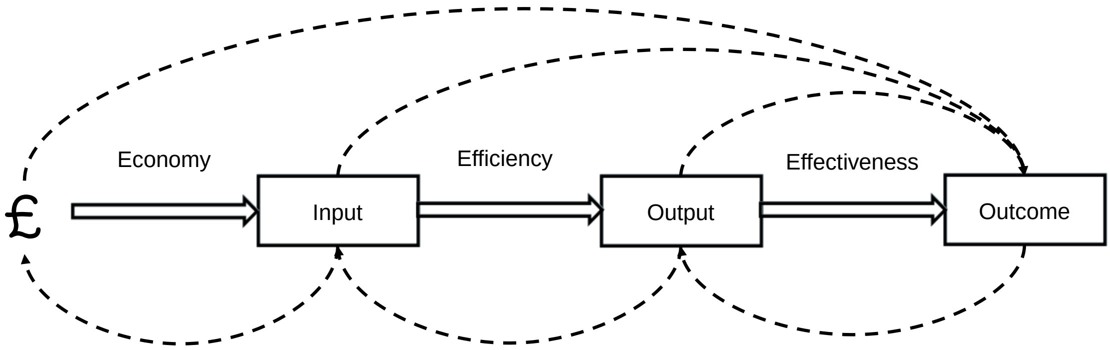

Figure 2.1: Value Transformity

From this structure, we can infer, noting that productivity is the reciprocal of transformity:

Economy = Input / Cost = Input Productivity (2.1)

Efficiency = Output / Input = Output Productivity (2.2)

Effectiveness = Outcome / Output = Outcome Productivity (2.3)

This frame provides the foundation for a number of value related equations constructed from inputs, outputs and outcomes, introduced in Section 2.4 and expanded in Chapter 4, which facilitate the integration of hard and soft factors together with financial and non-financial benefits. In Section 2.4.6 Value Productivity is defined as the product of effectiveness and efficiency:

Value Productivity = Outcome / Input = Effectiveness x Efficiency (2.4)

Key Conclusion: Value is a measure of outcomes in relation to associated resources consumed; more for less.

2.3 Value Sustainability

2.3.1 Sustainability in a Business Context

Sustainability concerns survival in a world of limited resources through carrying capacity (Brown *et al.*, 1987). In a commercial enterprise, products and services generate revenue whilst processes needed to develop, produce and deliver them consume resources, incurring financial cost. The difference between revenue and cost is margin, which is maximised by increasing the former and reducing the latter; the ‘efficiency mindset’. This fundamental linear relationship, reflected in a Profit and Loss Account, is the primary driver for most enterprises and, ultimately, must be respected for survival in the real world under capitalism.

However, financial systems built around efficiency models drive behaviour such as cost cutting expediencies to maximise short term profit, or austerity in the public sector, almost always at the expense of longer term sustainability in what Kaiser *et al.* (2013) calls ‘Red Line Thinking’. This is an example of violating the distinction between effectiveness and efficiency, the reconciliation for which we invoke cybernetics and the Law of Requisite Variety (Beer, 1984; Ashby, 1991) in Chapters 4 and 6.

2.3.2 Dominance of Gross Domestic Product

Definition of GDP

The dominant measure driving the entire global economy through policy and change is GDP, mathematically defined:

$$GDP = C + G + I + X - M \tag{2.5}$$

'C' and 'G' are consumer and government spending respectively. 'I' represents investment, 'X' export and 'M' imports (Smith, 2003, p. 62). By far the largest element is consumer spending, representing around two-thirds for the UK, 65% in 2019, compared with 18% government spending and 17% investment, with imports and exports roughly equal (CEIC, 2019). Dent (2018) observes strong correlation between demographics and economic cycles, with a lag of around 30 years, predicting major recessions accurately using 'spending wave' theory. This finding corroborates the need to integrate 'soft' behavioural factors in any change programme.

There are five key points in relation to GDP in context of the new value theory. First, GDP is primarily a measure of output rather than outcomes realised through that output. Secondly, the measure excludes important productive output which does not involve monetary transactions, such as care of the aged, or disabled by family members, except through state assistance incorporated within 'G'; an omission brutally exposed in the COVID-19 crisis (Nicola *et al.*, 2020; Schwab *et al.*, 2020). Thirdly, the bias of consumer spending encourages government policies which encourage debt-funded spending, which can lead to severe recessions when these spending bubbles burst. Fourthly, the focus on monetary transactions injects distortions, which introduce dangerous bias for incentives. For example, natural disasters such as earthquakes increase GDP by triggering additional spending, whereas government funded initiatives to prevent and mitigate the effects of disasters are treated as non-productive costs (Stiglitz *et al.*, 2010). Finally, it also emphasises the power of productivity in creating wealth (Lewis, 2005) through greater genuine consumer spending power, an observation consistent with Dent's spending wave theory. Consequently, productivity is afforded central focus in this research, with the qualification that it must support stakeholder value rather than purely financial growth.

2.3.3 Challenges to GDP as a Growth Model

The key message in relation to GDP is that, as Raworth (2017) argues, the model is unsustainable as a result of two highly interrelated dynamics, inequality and ecological limits to growth, her proposed response being operation between sustainable tolerances.

Inequality

Concerning inequality, the shift in power from earners of income through employment to those attracting ‘rents’ through capital ownership is reflected in disproportionate wealth being accumulated by the latter at the expense of the former (Piketty, 2014; Reich, 2016) . Although Schwab *et al.* (2020, pp. 78-79) suggest that CIVID-19 may rebalance power between capital and employment, they also predict that inequalities between rich and poor will be exacerbated. There are two related causal mechanisms rendering inequality self-destructing: social misalignment and value containment. The former relates to conflict, crime, poor health and education emanating from wealth differential, the latter constriction in the flow of value because poorer citizens do not have the means to buy goods and services. The model is broken due to social incoherence and constraint in value flow.

Limits to Growth

Considering limits to growth, the capitalist market model demands continuous exponential growth in output to sustain sufficient increases in GDP to motivate investment and consumption to drive the economy (Raworth, 2017, p.39). This model assumes unlimited natural resources, which are consumed in powering the growth required to satisfy increasing demands of an expanding global population. As warned by Meadows *et al.* (1972), ecological limits of raw materials and capacity of the environment to absorb the wasted energy, such as CO2 omissions, render this assumption invalid. The model is broken because of ecological limits to growth.

Working within Tolerances

The interplay between inequality and limits to growth presents a brutal choice; face the socio-economic consequences of most people forced to live with less, or find ways to grow sustainably and equitably whist consuming fewer resources. The former option risks resentment and conflict, with consequential loss of social cohesion. Therefore, for capitalism to remain a viable economic and social model, it is necessary to operate within tolerances, supporting essential and equitably distributed growth whilst respecting ecological limits. This is the principle of ‘Doughnut Economics’ (Raworth, 2017), which can be combined with Value Productivity, defined in Section 2.4.6, as shown in Figure 2.2.

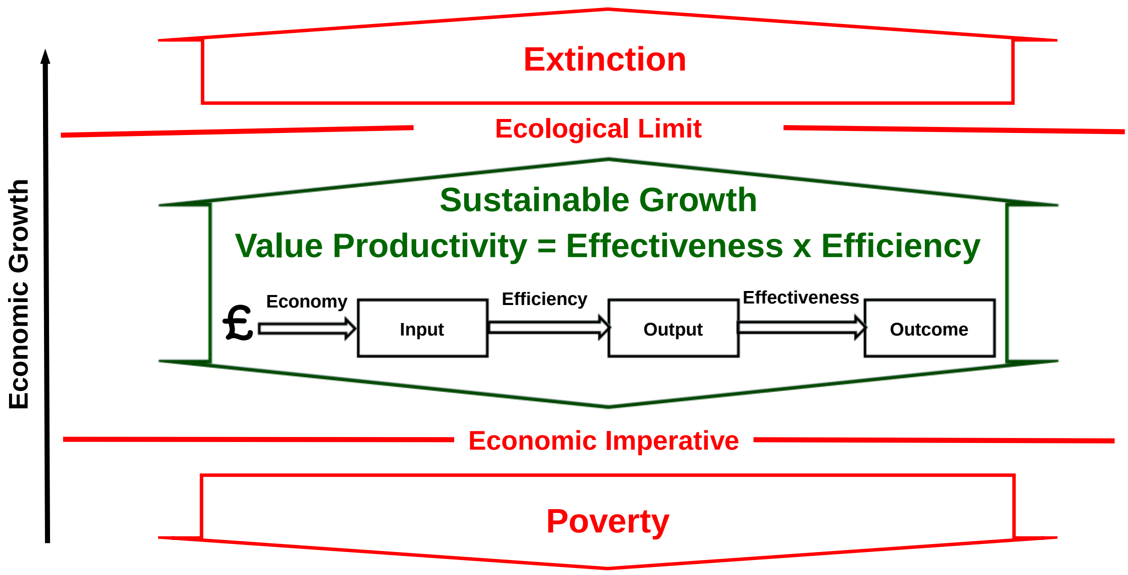

Figure 2.2: Doughnut Economics and Value Productivity

A key to achieving this balance lies in respecting the distinction between wealth and value. Wealth is an accumulation, stock, whilst value is a flow which increases or decreases wealth. It is critical for sustainable growth that the causal role of value is clearly defined, recognised and respected (Mazzucato, 2018b). In financial accounts, the Balance Sheet is accumulated value whilst the Profit and Loss Account and Cash Flow Statement capture flow. The physics analogy is potential and kinetic energy; head of water in a reservoir is necessary but only of value when flowing through a turbine to generate power. In Object Orientated Programming (OOP) the distinction between accumulation and flow is represented through state transition (Taylor, 1998; QA, 2013), which is also fundamental in dynamics modelling, the first OO language, Simula, written for this purpose.

2.3.4 Value as a Frame for Sustainability

There are essentially three elements to sustainability: demand side, supply side and change. The demand side concerns an imperative to meet human needs driven predominantly by increasing population. On the supply side, we are facing increased scarcity of essential natural resources to satisfy these needs. Change involves the transformation of resources into stakeholder outcomes to meet the needs. The imperative is to deliver equitable growth sustainability by respecting ecological limits. To this end, value provides a strong frame in two respects. A value perspective promotes growth within ecological limits and equitable distribution between stakeholders increases energy flows to create more value and reduces conflicts that constrain it. This leads to Value Productivity.

Key Conclusion: The current economic model is unsustainable and prerequisites for redress are creation of greater equitable value within sustainable ecological limits.

2.4 Value Productivity

2.4.1 Economic Context

There are generally three ways in which an economy is funded by government: austerity, borrowing and taxation which translate into consuming less, consuming now and paying later and self-funding consumption through redistribution respectively. Although detailed analysis is outside scope of this research, the key point is all these options are suboptimal, creating a combination of social, economic and ecological challenges. However, there is a fourth option, productivity; increasing the creation of more for less.

2.4.2 The Power of Productivity

Research by Lewis (2005, p. 11) shows that productivity, rather than education and capital normally purported, is the principal causal driver of wealth and holds the key for transition to first world economic status. Lewis concludes that wealth flourishes in a free, fair, economy, which protects intellectual property, with well-functioning markets supporting high productivity through competition. He also stresses the need to quantify the causal link between micro productivity, within sectors and industries, with macro productivity of the overall economy.

2.4.3 Political Recognition

The power of productivity is widely recognised at a political level. For the UK, low productivity is of particular concern, not least because it lags behind that of comparable, competitive economies. Humphrey (2017) chrysalises this theme using quotes from three eminent UK politicians:

> "In 2016, the Chancellor of the Exchequer Philip Hammond said it is "shocking" that "in the real world it takes a German worker four days to produce what we make in five". In 2015, his predecessor George Osborne described low productivity in the UK as the "challenge of our time," and said that unlocking the opportunity could add as much as £130bn to the economy. Last year the Secretary of State for Business Innovation and Skills said that if UK productivity matched the United States GDP would increase by 31% [over £600bn]".

Reframed, this means that the UK possesses potential economic headroom equating to nearly one third of GDP through productivity improvement. However, there are some fundamental limitations with this measure in its current form.

2.4.4 Limitations of Productivity as a Measure

Four limitations of productivity as currently measured are particularly relevant in context of the new value theory: delay in impact, disconnect between productivity and earnings, focus on outputs rather than outcomes and difficulty in measuring intangibles.

Delay in Impact

This challenge concerns the time and unpredictability of real impacts on economic performance. Infrastructure presents a particular problem in this respect; involving long timescales first to deliver, then for take-up of new capability to filter through to economic benefit, including green initiatives (Spatari *et al.*, 2011). Conversely, delivery of increased productivity with speed and certainty, as postulated by this research, would provide a powerful lever for short and medium term economic management. However, even if this condition is met the second challenge kicks in, disconnect between productivity and compensation for labour engaged in the value adding process.

Disconnect Between Productivity and Compensation

Another interpretation of value from an economist viewpoint is the price of different goods and services in a market (Rodrik, 2015, p. 117). Consequently, the Theory of Value in economics essentially concerns price formation, which is prohibitively narrow when considering all key stakeholders in the market as a value ecosystem. Concerning distribution, Mishel (2012) points out that across countries between 80% and 90% of differences in wage levels can be accounted for by variations in national labour productivity, measured as GDP divided by employment level.

However, in recent years within the US productivity is almost double labour compensation over the same period, implying unequitable distribution to a least one key stakeholder. In the US between 1973 and 2016 median compensation grew by only 11% in real terms, and production workers' compensation grew by only 12%, compared to a 75% increase in labour productivity (Stansbury *et al.*, 2017). Productivity, whilst essential, is insufficient in itself to ensure equitable and sustainable value across all stakeholders, which strongly relates to the next limitation, focus on output.

Focus on Output rather than Outcomes

The third limitation of productivity as currently measured is confinement to a relationship between input and output, without explicitly incorporating outcomes. There is evidence that happiness increases productivity (Proto, 2016; Bellet *et al.*, 2019). An implicit assumption concerning the converse is that intended outcomes are a natural consequence of growth delivered through improved productivity. This model is founded on the belief that a market is a natural, self-correcting process, whereas as Reich (2016, p. 4) points out, markets are man-made with inherent flaws, particularly relating to value. The linkage between output and intended outcomes is by no means assured, a challenge exacerbated by the fourth limitation, transition from physical to intangible assets.

Measuring Intangibles

The transition from physical to intangible assets in value creation (Lev, 2001) is linked to productivity through the increasingly serious issue for GDP as a measure of the economy comprising a reducing proportion of material items (Coyle, 2015, p. 130). It is much easier to measure physical output, such as cars, white goods and manufactured items than output of nurses, accountants and software designers. Output is a concept best suited to a product-dominated economy. Productivity as currently measured is problematic for services because it only reflects quality through price, a corollary of which is that value delivered outside priced transactions are omitted, or as Schwab *et al.* (2020, p. 81) put it, “We value least economically the individuals we need the most”.

2.4.5 Harnessing Capitalism

Zitelmann (2018) shows that capitalism is more successful at tackling poverty than aid; more market-oriented developing countries have a poverty rate of 2.7% compared to 41.5% in developing countries. Success is not through contrivance or design but by survival of the successful though imitation of what works best, an instance of the maximum power principle (Odum, 2007). Zitelmann emphasises the distinction between increasing the size of the pie, economic growth, and distribution of the pie, equitable distribution. This premise is corroborated by Rosling (2018) who demonstrates through ‘factfulness’ that not only has world poverty reduced dramatically over recent decades, largely through technology-enabled productivity, but that the ideal of eliminating extreme poverty is actually tantalisingly close.

The challenge is to find a way of harnessing advances in technology to increase productivity in equitable and sustainable value. To this end, Solow (1956) proposes modelling the economy as a dynamic system in which the apparently conflicting concepts of equilibrium and growth are reconciled through ‘Balanced Growth’. This approach, encapsulated in Doughnut Economics (Raworth, 2017), recognising the need for equitable distribution of sustainable growth, is driving increasing interest in Stakeholder Capitalism (Sundheim *et al.*, 2020). Two key prerequisites for harnessing capitalism to deliver equitable and sustainable stakeholder value warrant further consideration: the role of convergence, spillovers and synergies, and integration of private and public sectors.

Role of Convergence, Spillovers and Synergies

Convergence refers to the merging of economies, in which respect productivity and the distribution of consequential wealth creation are evident in globalisation, which has evolved through three stages of unbundling: trade, communications and face to face costs (Baldwin, 2006; Baldwin, 2016). Spillovers (Business Dictionary, 2019f) arise where one development leads to others, which can and often benefit other players, such as the iPhone (Haskel *et al.*, 2018, p. 73). Finally, synergies occur when a number of apparently unrelated factors come together at the right time to create value, for example, the invention of microwave ovens was the result of a synergy between magnetrons used for radar to heat food and white goods for domestic packaging.

Spillovers and synergies are critical in the emergence of what McWilliams (2015) refers to as the Flat White Economy (FWE), a region of high growth centred around digital enterprises in London's East End. He cites three factors which account for bringing the FWE to London: timing and adoption of digital technologies, rate at which the UK adopted online retailing and marketing and high level of creativity, London possessing the most creative labour force in the world (McWilliams, 2015, p. 33). Emergence of the FWE demonstrates two things critically important to the new value theory. First, with the appropriate convergence of technology, people, motivation and environment it is possible to create value through increased productivity very quickly; from 2008 to 2014, the FEW grew faster than the City of London, Singapore and Hong Kong. Secondly, extraordinary growth is possible with less and making use of existing resources, the FEW emerging in the aftermath of a global financial crash in a deprived area of London.

Integration of Private and Public Sectors

Conversely, it is important not to lose sight of the critical role of the state in enabling and funding innovation rendering such exponential growth through productivity possible. Mazzucato (2018a) exposes a myth that the private sector, motivated by profit, alone accounts for key innovation, evidencing that Internet and smartphone technologies were enabled by state funding. She advocates restructuring capitalism to take into account the true sources of wealth creation in which value is the critical frame (Mazzucato, 2018b), an argument shared by Reich (2016).

The requirement and opportunity is to integrate the public and private sectors through mutually supporting feedback. Public-Private Partnerships (PPP) intend collaboration but in practice come with a high cost for the public purse, an excessive level of risk for the public sector and consequential heavy burden for citizens (Salom, 2018). A stronger model involves complementing commercial efficiency with precisely targeted public investment to benefit all stakeholders. For example, Janet(UK) integrates commercially available network infrastructure with state funded, commercially unviable, additional bandwidth demanded by higher education and research, critical for UK plc. (Davies *et al.*, 2011, pp. 179-201).

Change programmes have a core role in achieving business models with mutually supporting purpose and intentions between stakeholders. The contention behind this research is that these aspects can be mutually reinforcing through the application of Meta level principles which respect the universal laws of cause and effect, encapsulated through Systems Thinking and quantified using dynamics modelling explored in Chapter 6.

2.4.6 Value as a Frame for Productivity

Productivity measured around outputs is a scalar value with magnitude only, with no explicit link to stakeholder outcome:

Productivity = Outputs / Inputs

In Section 2.2 it was proposed that value as a measure of the degree to which stakeholder needs and wants are satisfied in relation to resources consumed provides a strong frame for equitable and sustainable growth. This perspective provides the basis for a complementary measure of productivity as the product of effectiveness and efficiency, Value Productivity, defined as the relationship between outcomes and outputs, and efficiency, outputs per input:

Value Productivity = Effectiveness x Efficiency

= (Outcomes / Outputs) x (Outputs / Inputs)

= Outcomes / Inputs (2.6)

As productivity drives GDP, value productivity steers the value creation process to deliver equitable and sustainable growth by focusing on stakeholder specific outcomes enabled by output productivity. By injecting stakeholder direction, Value Productivity operates as a vector.

The incorporation of money into Value Productivity results in Value for Money (VfM) Outcomes and Benefits treated synonymously:

VfM = Outcome / Cost = Benefit / Cost (2.7)

The rate at which Value Productivity is delivered is energy per unit time and provides another complementary measure, Value Power:

Value Power = (Outcomes / Inputs) / Time (2.8)

These three value-centric measures are expanded in Chapter 4.

Key Conclusion: Productivity is an output–focused efficiency measure of more for less whilst Value Productivity also measures effectiveness, by incorporating outcomes, and includes direction through stakeholder specificity.

2.5 Value Potential

2.5.1 Elusive Productivity Gains

Technological innovation accounted for the increase in productivity and consequential growth through the industrial age (National Geographic, 2020) and there was an expectation that this trend would continue in the information era. However, apparent failure to realise expectations, particularly in IT, stubbornly remain. The term ‘Computer Paradox’ was coined by Brynjolfsson (1993) and encapsulated in the quip by Solow (1987), “ You can see the computer age everywhere but in productivity statistics". Strassmann (1990); (1997) devotes intensive inquiry to the problem of poor financial returns from computer technology, even exposing widespread negative correlation. Furthermore, since the global economic crash in 2008, productivity worldwide has slowed and in the UK fallen significantly behind comparable competitive economies; as previously eluded.

Concerning equality, Giridharadas (2019) evidences that despite advances in technology and free access to information and learning now made available through technology, inequality in America is increasing and reading standards declining. The same inverse relationship holds between medical advances and healthcare, manifested among other measures such as reduced life expectancy. During a decade of greatest need, the immense advances in technology over the same period have not translated into increased productivity or realised potential stakeholder outcomes.

2.5.2 Opportunity and Challenge

We are now undergoing a new era of technological advance, Fourth Industrial Revolution (Schwab, 2016), offering fresh potential for prosperity gains for which we must first utilise advances to increase productivity. Secondly, we must ensure that the increased productivity has 'direction' to realise equitable stakeholder outcomes, delivered within sustainable ecological limits. Critically, this second imperative includes social considerations, in particular, implications for people impacted by work undertaken or displaced altogether by technology, a trend accelerating as a result of COVID-19 (Schwab *et al.*, 2020). Value Productivity is proposed as a key measure in achieving these outcomes.

2.5.3 The Fourth Industrial Revolution

The Fourth Industrial Revolution is characterised by three elements: velocity, bread and depth and impact (Schwab, 2016, p. 3), which translates into pace, scope and complexity. Schwab and other commentators, for example Franklin (2017), categorise the advances into megatrends from which they make informed predictions concerning potential future scenarios. Whilst such predictions offer valuable insight concerning direction of flow, this doctorial research focuses on the mental and physical learning and change processes, which enable effective harnessing of capabilities provided by advances to deliver stakeholder value. To this end, two advances, Artificial Intelligence and Digital Twin, are deemed particularly relevant for creating value from change programmes because they offer Predictive Learning and Dynamic Performance Management respectively, which support the three key prerequisites defined in Chapter 4: Agile Learning, Causal Precision and Causal Certainty. The potential is underscored by Gartner (2017) and corroborated in subject expert interviews (Collins, 2018; Core *et al.*, 2018; Fletcher, 2018; Tracy, 2018) covered in Appendix A1.

Artificial Intelligence: Predictive Learning

Artificial Intelligence (AI), which includes Machine Learning, is of particular interest in two ways, learning and prediction. Concerning the former, AI has implications on the magnitude, quality and speed of learning. For example, Tracy (2018) points out that most dimensions of Learning Power, defined in Chapter 3 and applied in Chapter 8, fall within the capacity of machine learning. In this vein, an equivalent of the Turin Test, measuring computer intelligence, the Lovelace Test, is proposed by Du Sautoy (2019) to assess creativity.

Agrawal *et al.* (2018, p. 4) stress the criticality of AI decision-making by reducing the cost of prediction, analogous to how steam power rendered transport affordable and computer technologies cut the cost of information and communication. However, Agrawal *et al.* (2018, p. 13) argue that AI is fundamentally different in value creating potential by taking data that you have and transforming it into information you do not have. This attribute is critical for modelling complex systems, an ultimate example of which is Digital Twin, considered next.

Digital Twin: Dynamic Performance Management

Digital Twin uses digital information constructed about a physical system to create an entity on its own (Grieves *et al.*, 2017). A digital twin is a special type of simulation model achieved by combining current data from the subject with its simulation model (Anylogic, 2018). Until now largely confined to manufacturing (Tao *et al.*, 2017), adopting a Digital Twin is becoming easier as the cost of computation and communication continue to decrease, in parallel with advances in model building capabilities. The potential to provide real-time insight and prediction renders this technology powerful in context of value creation through Dynamic Performance Management. This capability offers to enhance business performance across industries, sectors and entire markets, the direction of travel for the Market Dynamics Model (MDM) covered in Chapter 8. Digital Twin is revisited in Chapter 11 in the context of Causal Architecture.

2.5.4 Value as a Frame for Value Potential

There are three fundamental requirements for harnessing technology to deliver stakeholder value: causal modelling, causal certainty and learning agility. First, network related characteristics, such as scalability and spillovers, require modelling techniques capable of quantifying patterns of causality in CAS over time. Secondly, the modelling must be supported by data of sufficient validity to enable pragmatically applicable results for the purpose of value generation, requiring integration of Big Data (Mayer-Schönberger *et al.*, 2013) and Predictive Analytics (Siegel, 2016) with abstracted ‘Fermi’ calculations (Hubbard, 2014, p. 17). Thirdly, the problem of sunk cost requires a shift in the investment cash flow profiles using Discounted Cash Flow (DCF) techniques, particularly Net Present Value (NPV) proposed by Hawawini *et al.* (2010, p. 196) as a measure of value creation. The familiar ‘J-curve’, characterising high early costs countered by later positive inflows attributable to the investment, is transformed to the self-funding investment. The imperative to increase the rate of value transformation involves agile learning and a proposed measure for this shift is Value Power, the rate at which stakeholder value is delivered, expanded in Chapter 4.

Key Conclusion: Technological advances provide an opportunity to increase productivity but the causal linkage must be viewed in the context of Complex Adaptive Systems.

2.6 Value Delivery

Projects, programmes and portfolios, for this research generically referred to as change programmes, are primary vehicles through which intentional shifts in organisational structure and culture, products, processes and behaviour are defined and implemented. In this capacity, they serve a critical role in improving productivity and consequential stakeholder value. This final section considers the scale and impact of change programme failure to deliver stakeholder value. Failure patterns are examined in Chapter 4.

2.6.1 Scale of Change Programme Failure

There are two aspects to this problem: scale and impact. Scale, the prominence and severity of change programme failure, is established by considering four categories of programme of particular relevance due to their direct and enabling impact on political, economic and societal value: infrastructure, defence, organisational and IT. Impact is covered in Section 2.6.2.

Infrastructure Programmes

Infrastructure programmes tend to be large and take many years to complete by which time the world has often moved on, rendering them vulnerable to failure in terms of intended purpose. Further, Flyvbjerg *et al.* (2003) states that virtually every mega construction project across the world is running over budget and overdue, for the UK corroborated by Dudman (2016) and Lowe (2017). Schneider (2017) lists a number of major programme failures under three broad categories: ecological shifts and civil reaction, changing government policy and cost overruns.

Defence Programmes

In addition to the stringent military standards of compliance, defence programmes are notoriously difficult to deliver. For example, a recent report for the MOD predicts a £7bn shortfall on budget during the early 2020s (NAO, 2018). The imperative for compliance renders defence programmes similar to safety critical infrastructure, such as nuclear, and drives another important distinction common with much infrastructure; all functionality must be delivered before any intended outcomes can be realised. For example, an aircraft carrier must be delivered as a completed vessel supplied with aircraft and fully supported logistically.

Organisational Change Programmes

Leading experts indicate that up to 70% of organisational change programmes fail to deliver intended value, a statistic Hughes (2011) attributes to five principal sources. The first instance is from Hammer *et al.* (1993, p.200) stating that 50 to 70 percent of organisations that undertake reengineering initiative do not achieve intended results. The second reference is from Beer *et al.* (2000, p. 87) asserting that 70% of all change initiatives fail, which they attribute to change management methods. Kotter (2008, pp. 12-13) provides the third instance affirming that based on his own study more that 70% of needed change is either not started, not completed or completed without delivering initial aspirations. Bain and Company offer the fourth instance of a 70% failure rate in change (Senturia *et al.*, 2008) and the fifth by McKinsey (Keller *et al.*, 2009). Corroboration is provided through survey-based research, such as PwC (2013) which states that 69% of top executives consider that their transformation programmes do not deliver expected benefits in the business.

IT Programmes

Standish Group provides data relating to IT programmes failure globally since 1994, through interviews, case studies and market research surveys. For the first 21 years, criteria were based on the Project Management Institute (PMI) definition of success, the 'iron triangle' of on target [compliance], on time, on budget. Based on traditional PMI criteria, the success rate of all IT programmes hardly shifted between 1994 and 2013, from 31% to 36%, and there was also little variation in the underlying specifics (Standish Group, 2014c).

Subsequently, additional measures were introduced to provide a perspective on value delivered; the resulting framework called Success versus Value Orthogonal (Standish Group, 2014a, p. 1). By all measures, there is a large variation between programme types, Standish Group reporting the highest outright failure rate in government initiatives at 24% against a success rate for retail of 46%. Programmes adopting reusable components are far more successful compared with those starting from scratch; 54% success versus 22% failure rates respectively. However, the greatest insight in the context of this research concerns consideration by value. Analysis of this data by Dunbar (2016) shows that when measured against value the success rate reduces to between 27% and 31%, which is consistent with the 70% failure rate attributed to organisational transformation programme. Data reflecting a shift from success of functional deliverables to value delivered provides significant insight concerning programme failure.

2.6.2 Economic Impact of Programme Failure

Failure impact comprises two cost elements: direct and opportunity. Direct cost concerns wasted resources, for example, overspends due to rework and nugatory expenditure. Direct cost of failure is generally known because it has been incurred and duly measured as part of conventional project management. However, the most significant element concerns opportunity cost of failure in delivering intended value to stakeholders, which because unrealised it is not measured and generally ignored in assessments. When this lost stakeholder value is taken into account, the cost of change programme failure takes an entirely new significance in relation to global economic growth and the welfare of citizens. For example, Sessions (2009) calculates the annual cost of IT programme failure in 2009 as $1,255bn and $200bn for the US and UK respectively; $6,180bn globally. This estimate, based on what Hubbard (2014) calls a ‘Fermi calculation’, provides generic, verifiable metrics:

Annual GDP spent on ICT 6.4%, corroborated Standish Group (2015b, p. 4) at 6%

43% or 2.75% GDP is spent specifically on hardware, software and services

66% of government spend on programmes is at risk

65% at risk programmes fail, estimated by Sessions but consistent with 70% failure cited previously

Opportunity cost [projected benefits] as a ratio of direct cost 7.5:1, estimated by Sessions

2.6.3 Failure Reframed as Opportunity

To place these magnitudes in perspective, for the UK this annual cost represents around 8% annual GDP and 40% of the entire £500bn bank rescue package in response to the 2008 financial crash (Swaine, 2008). In a similar vein, the 10-year investment for UK infrastructure is £466bn (HMT, 2014), which means that the cash equivalent of 28% improvement in IT programme value delivery equates to the entire annual average cost of infrastructure refresh. Further, the UK possesses potential economic headroom equating to 30% GDP, circa £600bn, through productivity improvement in relation to comparable economies. These macro perspectives demonstrate the size of opportunity in reclaiming prosperity lost through change programme failure. Chapter 3 examines common approaches to change programmes and Chapter 4 explores failure patterns.

Key Conclusion: Reversing change programme failure offers headroom around 8% GDP for enhancing stakeholder value based on IT initiatives alone.

2.7 Essence

In conclusion, the critical role of change programmes, magnitude of their failure and why it matters is viewed in the context of stakeholder value and macro perspective. Value is a measure of outcomes in relationship to associated resources consumed; more for less. The current economic model is unsustainable and prerequisites for redress are creation of more for less and equitable distribution. Productivity is an output–focused efficiency measure of more for less whilst Value Productivity also measures effectiveness, by incorporating outcomes, and injects direction through stakeholder specificity. Technological advances provide an opportunity to increase productivity but the causal linkage must be viewed in the context of Complex Adaptive Systems. Reversing change programme failure offers headroom around 8% GDP for enhancing stakeholder value. For the UK, headroom for improvement by addressing the productivity gap rises to 30% GDP.

3 State of the Art Review

3.1 Introduction

Chapter 2 set out an overview of the problem space, concluding that value provides a powerful frame for addressing the imperative to deliver equitable, sustainable growth within ecological limits. Potentially achievable through productivity improvement, by harnessing technological advances, new value-centric measures are proposed to counter limitations of existing growth and productivity indicators. However, change programmes are failing to realise this potential by a large margin. This raises the question whether failure is due to one or more programme disciplines or whether there are deeper relational factors at play.

This chapter explores the former possibility by researching state of the art thinking, models and tools for creating value from change programmes. Given the vastness of this domain, focus is directed to aspects most pertinent for this research through five perspectives as shown in Figure 3.1. These disciplines are structured across two dimensions, functional, for example, how strategic objectives are addressed explicitly within implementation plans, and temporal, how the objectives transcend into desired state over time. Whilst not exhaustive, the perspectives are selected on two grounds. First, in combination they cover most key functional links. Secondly, Strategy, Investment, Implementation and Performance map to common temporal stages, for example the Acquisition Cycle used in defence (MoD, 2002). Implementation covers design and manufacture, increasingly rendered concurrent under agile development. Change covers the increasing focus on human aspects.

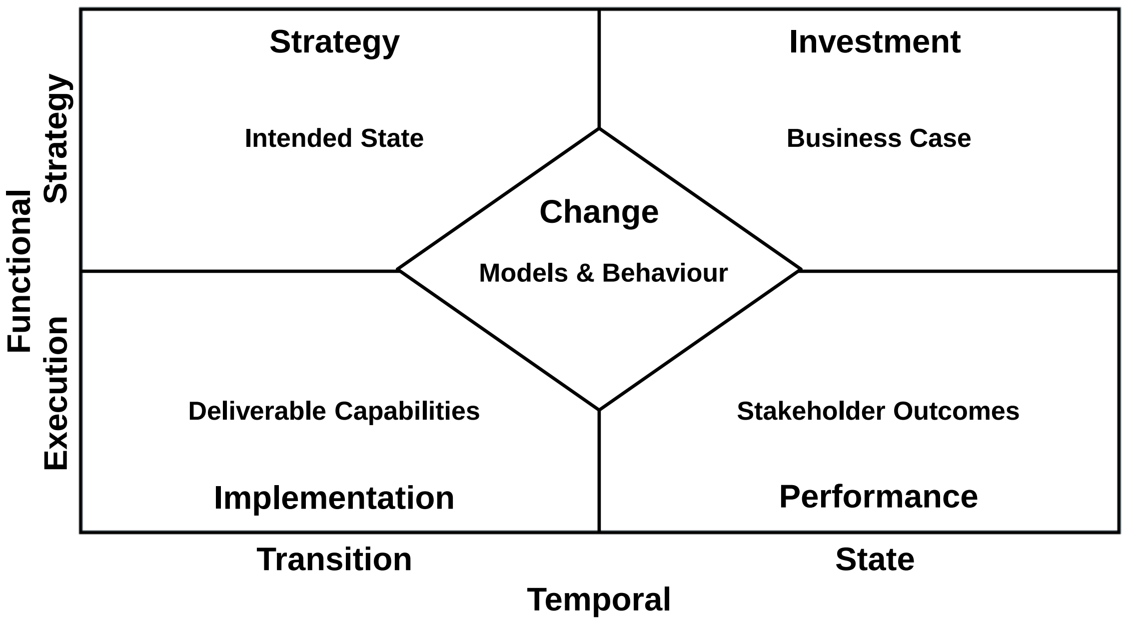

Figure 3.1: Focus Perspectives for State of the Art Review

3.2 Strategy Focus

3.2.1 Meaning of Strategy Focus

Strategy is a vast domain spanning at least ten major approaches (Mintzberg *et al.*, 1998) and numerous specific concepts associated with the different viewpoints. For example, value chain relates to a positioning frame (Porter, 1985; Porter *et al.*, 1985) while biases pertain to a cognition viewpoint (Makridakis *et al.*, 2008; Kahneman, 2011); offering fundamentally different approaches to strategy. The challenge is to extract the critical essence in relation to the purpose of this research.

Johnson *et al.* (1999, p. 10) define corporate strategy as direction and scope of an organisation over the long term which achieves advantage through configuration of resources within a changing environment to meet market needs and stakeholder expectations. Scholes *et al.* (2001, p. 5-6) stress critical distinctions for the public sector as providing not only private but shared social value by addressing legal frameworks, market failures and equity. Generically, Rumelt (2017, p. 241) frames strategy as a hypothesis of what does and does not work and implementation as an experiment. More specifically, Kaplan *et al.* (1996, p. 149) define strategy as a set of hypotheses about cause and effect which can be expressed as a sequence of if-then statements which translate into Strategy Maps (Kaplan *et al.*, 2004). These Meta-level definitions and associated techniques emphasising causality provide a basis for the new theory.

3.2.2 Key Terms

There are several key terms intended to crystallise strategy, which while not universally agreed across literature are contextually critical and this section provides clarification based on convergence between texts (Bowman, 1990; Kaplan *et al.*, 1996; Johnson *et al.*, 1999; Warren, 2008; Grundy, 2012; Kenny, 2014).

- **Mission** is the overarching purpose of a business, defining its guiding philosophy and reason for existence, typically including market served, services offered and values
- **Values** describe desired cultural habits to provide a behavioural compass and focus for purpose and motivation through their dominant importance in giving us meaning
- **Vision** is strategic intent, in terms of destination for the business at a given time; defining what success looks like and when it is to be achieved
- **Goals** are high level, often lofty generalisations of aspiration, designed to inspire ambition, endeavour and achievement; sometimes called BHAGs, big, hairy, audacious goals
- **Objectives** are specific outcomes which need to be accomplished in order for the goals to be achieved and vision realised, defined quantitatively through measures and targets

- **Core Competences** refer to resources, processes and skills; capabilities which provide competitive advantage achieved by, and enabling achievement of, defined Objectives

Chapter 4 concludes Part I by defining prerequisite core competencies and associated objectives for effective deployment of the proposed new value theory and framework, which determine the research methodology in Chapter 5, against which solutions are developed in Chapter 8 and implementation evaluated in Chapter 10.

3.2.3 Business Models

Closely allied with strategic positioning is choice of business model or design, defined as the instrument by which an enterprise intends to generate revenue and profit, with reference to strategy and implementation (Debelak, 2006, p. 3). Business models represent the architecture for creating stakeholder value from which a Target Operating Model (TOM) (Andersen *et al.*, 2012; Blenko *et al.*, 2014; Choo, 2017) is generated.

Business models are built around the Profit and Loss Account which acts as a fractal. Consequently, models tend to group under archetypal patterns. For example, Slywotzky *et al.* (1997) identify categories of ‘Profit Model’, examples being De Facto Standard Profit, such as Microsoft, and Blockbuster Profit typified in pharmaceutical and film industries. In all, Slywotzky *et al.* (1999) define thirty models, together with associated appropriate strategies with which to maximise value. These patterns can be used with systemic archetypes (Senge *et al.*, 1998) to diagnose problems then design and implement strategies. Whereas business models concern organisational structure, there are also archetypal patterns of human behaviour; addressed through values levels considered next.

3.2.4 Values Levels

The important role of human values in the context of value meaning was introduced in Section 2.2.2. Values levels provide archetypal containers defining human maturity in terms of how people relate to each other. This is deemed critical for strategy in the context of value creation by providing insight to, and predictability of, business cultural characteristics and associated behaviour for business model design. The theory is founded on the work of Graves (1970) and the principles are combined with meme theory (Dawkins, 1989) for incorporation within Spiral Dynamics (Beck *et al.*, 2014) for practical application. There are also some parallels with theory concerning levels of work which is applied in the context of organisational change (Kinston *et al.*, 1989; Kinston, 2007; Duschinsky, 2009).

Graves categorised seven values levels spanning basic survival to advanced human maturity, which exhibit some commonality with Maslow’s hierarchy of needs (Maslow, 1943) in the context of human motivation. The levels constitute bounds of conformity, which also renders strong parallels with ‘basins of attraction’ drawn from Chaos Theory for organisations (Wheatley, 2006, p. 118) and applied in non-linear dynamics (Thompson *et al.*, 1989). Shephard (2005c) argues that levels 4 to 7 are particularly relevant for practical business model design and outlined with names assigned by the Author.

- Level 4 Command and Control organisations, such as regimented corporations, armed services, government and formal religions, demand passive conformance of their members, employees and followers.
- Level 5 Entrepreneurial Growth results from rejection of constraints imposed by command and control, involving active willingness to grow under the guise of competition, at the expense of others if necessary.
- Level 6 Sacrificial Equality returns to passivity where members value belonging to something greater than themselves. Examples include idealistic socialism in which equality is a core governing value.
- Level 7 Responsible Growth involves a significant shift from all previous value levels, exhibiting four defining characteristics: ideologies and delusions are discarded for systemic grasp of reality, active growth for mutual benefit, flexibility to adopt any of the previous levels as required and ability to resume win-win cooperation, if and when other parties reciprocate.

The role of values levels in the new value theory is revisited in Chapter 6.

3.2.5 Search for a Successful Approach to Strategy

Many authors have sought to determine a formula behind sustainable business success by exploring what exceptional corporations ***do*** that is different, notably Peters *et al.* (1982) and Collins (2001); (2009). Whilst useful steers, Raynor *et al.* (2013c, pp. 35-36) caution that this approach injects bias and fails to separate signal from noise, instead researching how exceptional companies ***think***. Their conclusions, expanded in Chapter 6, boil down to two rules, a third being that there no others: Better before cheaper, Revenue before cost, which translates into prioritising effectiveness over efficiency.

In distinguishing between good and bad strategy, Rumelt (2017) defines four characteristics of poor strategy: vagueness such as wishful platitudes, failure to face problems, mistaking goals for strategy and lack of specificity in objectives. All are symptomatic of sacrificing causal precision for wishful thinking, for example, superficial use of templates and new age thinking in which positive thoughts are deemed to attract like outcomes without action (Byrne, 2008). In exposing these patterns, Rumelt (2017, p. 74) challenges a core tenet of Senge (1990), shared vision at all levels, which he argues neither accounts for, nor is necessary to achieve, success; whereas harnessing different perspectives is essential. This view is consistent with recent research on range and rebellious thinking (Epstein, 2019; Syed, 2019), expanded in Section 3.2.6.

Rumelt (2017, p. 77) proposes a Meta-level ‘kernel’ for good strategy comprising three elements: diagnosis, guiding policy and coherent actions:

- Diagnosis is precise specification of the problem and ***why*** it is important.
- Guiding policy defines broadly ***how*** the problem is approached
- Coherent actions are ***what*** specific actions are needed to drive the guiding policy.

This kernel translates into the why, how, what structure proposed by Sinek (2009).

The emphasis on quantitative precision is corroborated by Warren (2012) in challenging the fabric of strategy as taught in business schools, citing the flaw in maximising market share as an example. The generally accepted argument is that a given market has an overall value and that profit equates directly to share of the pie. Focus is duly directed to determining market potential and offering differential value propositions relative to competitors in order to win maximum share. Whilst sometimes viable for a commodity in an homogenous environment (Moffatt, 2018), this strategy is deeply flawed where there exists high variety in value across customers, products and channels. Warren (2008) argues that dynamic causal modelling is essential in formulating strategy. The role of diversity in dealing with today’s global, complex and volatile landscape is now explored.

3.2.6 Role of Diverse Thinking in Strategy

With increasing recognition that methods and tools which worked in the industrial age are now proving inadequate, recent research converges on the need to inject levels of diversity which reflect the pace, scope and complexity of today’s Volatile Uncertain Complex Ambiguous (VCUA) landscape of wicked problems (Watkins, 2014; Watkins *et al.*, 2015). Syed (2019, p. 15) proposes that we are now in an ‘age of diversity. The critical role of strategy in reflecting this shift lies in its early lifecycle position, shaping the entire change programme.

Six highly interrelated areas in the context of strategic thinking are expanded: range, creativity, prediction, team mix, mastery and scale, because they converge on the imperative for essential redundancy, under the Law of Requisite Variety (Ashby *et al.*, 2011), to facilitate diversity and creativity, where learning is key.

Range

Range concerns the diversity of sources from which knowledge is sought, a key insight being the imperative to shift from narrow specialism to multi-disciplinary breath with particular focus on connectedness between domains (Epstein, 2019, p. 109). How, rather than what, we think becomes critical, in which respect Epstein advocates Fermi calculations (Hubbard, 2014, p. 17) in quantifying seemingly incalculable measures with minimal information. This approach requires us to discard old tools, embrace ambiguity and explore multiple goals, together with paths to achieving them; requiring flexibility afforded through allowing for essential redundancy.

Creativity

Closely coupled to range is diversity in creative thought (Syed, 2015; Syed, 2019), the key insight being need for multiple perspectives in order to prevent collective blindness, attributed to intelligence failures leading to 9/11. It is also essential to avoid 'echo chambers', a form of group dynamic which not only promotes bias but actively exploits counter views to inoculate the bias from external challenge, evidenced through fake news. The financial case for diversity is reflected by research, for example 66% higher Return on Equity (ROE) attributed to diverse company boards (Syed, 2019, p. 23). Attributes most important to achieving creative diversity include active facilitation of, and trust enabling, cognitive dissent; questioning established beliefs involving a shift to outcome focus, the essence of reframing (Watzlawick *et al.*, 1974; Bandler *et al.*, 1982).

Prediction

Tetlock (2017) concludes that in wicked environments most 'expert' predictions compare with random guessing likened to "dart throwing chimpanzees" and uncovered key attributes needed for what he terms 'Superforecasting', predicting seemingly unpredictable measures with a pragmatic level of accuracy (Tetlock *et al.*, 2016). Primary among these attributes are ability to explore multiple perspectives, rather than focusing on and defending a single 'big idea', and preparedness for being wrong then using feedback for correction. Tetlock also places great weight on combining Fermi calculations with Bayesian probability, favouring poker-like quantification of odds refined as new information emerges, rather than imprecise qualitative terminology. The efficacy of this combination is corroborated by other proven experts in the field of prediction and measurement, for example (Silver, 2012; Hubbard, 2014).

Team Mix

Team mix refers to diversity of members of a group or team in terms of neurological characteristics driving learning interaction. Belbin (2004) and Margerison (1987) corroborate that composition significantly influences team learning and performance, both experts providing self-assessment measurement systems; Team Roles and Work Preferences respectively. A key insight is that balanced teams generally deliver the highest performance and, conversely, teams comprising individually top performers, termed 'Apollo' by Belbin, usually underperform against expectations. More specifically, selection by talent alone can lead to disastrous results through destructive competitive dynamics, largely attributed to the dramatic fall of Enron who recruited using a strong 'talent' culture (Gladwell, 2002). The criticality of team diversity to drive innovation and designing interventions for wicked problems is recognised by enterprises, such as Google, which harness this energy of difference to sustain critical competitive advantage (Coyle, 2018).

Mastery

Mastery concerns a level of expertise which enables excellent and extraordinary performance in a given field, the acquisition of which according to (Pink, 2011) involves mindset, persistence and continuous improvement. Recent research by Epstein (2019) and Syed (2019) indicate strong links with learning diversity, counterintuitively concluding that building expertise across a number of unrelated areas can result in mastery within a particular domain which outperforms specialising in the domain. Gladwell (2008) layers further counterintuitive insights relating to mastery. For example, cut off dates for education combines with flawed IQ-based selection methods with the result that potential high performing resources are eliminated.

Scale

Finally, research relating to consistency of systemic patterns across multiple domains provides a useful consolidation for diverse thinking in strategy. West (2017, p. 412) argues that existing strategies relating to sustainability, a wicked problem, fail to account for, ”pervasive interconnectedness and interdependency of energy, resources, and environmental, ecological, social and political systems.” West proffers that whereas ecological systems migrate towards equilibrium, socioeconomic systems, including infrastructure, cities and other CAS, require continuous adaptation requiring growth and attendant resource consumption, with two implications. First, a ‘finite singularity’ point will be reached through super exponential growth after which collapse into another level, basin of stability, with potentially devastating consequences is inevitable. Secondly, in order to postpone this point, it will be necessary to innovate at an accelerating rate. Jackson (2017) corroborates these conclusions in the context of supporting future prosperity without growth. As Henrich (2017) stresses, it is not individual smartness but willingness of many individuals to interact and share knowledge, trust strangers and be wrong which determines innovativeness of modern societies.

3.2.7 Role of Modelling in Strategy

Strategy proposes a route for transition to an intended future state which requires understanding of causal mechanisms for effective navigation, in which vein two advances are important: Strategy Maps and dynamics modelling.

Strategy Maps: Linking Strategy and Performance

From conception of their Balanced Scorecard (BSC), Kaplan *et al.* (1996, p. 152) framed this performance management framework in a strategic context by linking objectives in cause and effect threads, later called themes, to financial outcomes. This innovation developed into Strategy Maps (Kaplan *et al.*, 2001; Kaplan *et al.*, 2004), possessing three key attributes which connect the five focus perspectives proposed in Section 3.1. First, Strategy Maps provide a causal foundation, Kaplan *et al.* (2006) placing great weight on causal alignment between objectives and measures, thus connecting strategy and performance. Secondly, objectives are mapped explicitly to initiatives, thus connecting strategy with both investment and execution

(Kaplan *et al.*, 2008). Thirdly, the maps provide a degree of integration between hard and soft measures, thus supporting key aspects of change. For these strengths the technique is adopted for practical deployment and discussed further in Chapters 6 and 11.

Systemic Modelling: Causal Precision

The major limitation with Strategy Maps is that they assume unidirectional causality with no representation for feedback loops, a limitation which becomes particularly apparent in performance management and discussed further in Section 3.5. However, the maps provide a foundation for greater causal precision afforded by more rigorous systemic mapping and dynamics modelling. Qualitative support for Systems Thinking includes Loop Causal Loop Diagrams (CLD) (Sterman, 2000, p. 137) and quantitatively using dynamics modelling of which there are three key paradigms: Discrete Event (DE), System Dynamics (SD) and Agent-based Modelling (ABM) modelling, spanning various levels of abstraction allowing combination (Borshchev, 2013). SD is particularly suited for developing strategy (Warren, 2008). ABM can simulate emergent behaviour, an important capability in relation to CAS. DE is ideal for logistics, such as supply chains and batch manufacturing, where the Author was an early adaptor of the technique. SD and ABM are used extensively in this research.

3.3 Investment Focus

3.3.1 Meaning of Investment Focus

Whereas strategy provides a roadmap for transcending to an intended future state, investment focus concerns the viability of that state in terms of benefits to stakeholders in relation to resources consumed. For most practical purposes, this involves an investment appraisal, typically starting with and initial cash outflow, followed by inflows and outflows in later periods, normally years (Götze *et al.*, 2008). Financial appraisals are generally encapsulated with a business case which is a formal recommendation to enable the right decision, meet compliance requirements, secure funding, mobilise resources and provide a baseline for measuring and managing the programme (Gambles, 2009, pp. 3-9).

Hawawini *et al.* (2010, pp. 3-4) frame investment decisions as managing for value creation, stressing that value to shareholders and lenders is related to the way in which other stakeholders, such as customers, employees, suppliers and the community are treated. The imperative to deliver value to owners through collaborative alignment with other stakeholders holds the key to sound business model design and in this context expanded in Chapter 6.

In reality, the fate of proposed change programmes is determined through business cases on financial grounds by Economists and Accountants who focus on hard monetary criteria. Therefore, it is crucial to explore state of the art thinking and practice concerning this domain if programmes essential for non-financial wellbeing are to be considered seriously by key decision makers; the focus of this section.

3.3.2 Fundamental Finance Principle

Focus on cash underpins the fundamental finance principle, which states that business investment, such as a change programme, will create value if the present value of future net cash flows exceeds the initial outlay (Hawawini *et al.*, 2010, p. 5). This principle gives rise to two key terms in the context of the monetary appraisal of investments: cash flow and time value of money. Cash flows equate to magnitude and refer to inward and outward movements of real cash, meaning that there are no adjustments or manipulations, such as depreciation, applied to statutory accounts. Focus on cash stems from the importance of liquidity for business survival.

Cash also has a time value for two key reasons. First, cash sourced externally has a price, the cost of capital, and secondly, there is an opportunity cost of not investing the cash in either externally or other mutually exclusive internal programmes (Sizer, 1978, p. 181). The dominance of cash flow as a decision criteria warrants examination of common practice. This involves related challenges for public sector investment and non-financial measures and role of process and work categories, leading to a need for eliminating waste whilst respecting essential redundancy when assessing change programmes as investments.

3.3.3 Discounted Cash Flow

The general term for investment appraisal techniques which focus on cash and account for time value for money is Discounted Cash Flow (DCF), of which there are two fundamental variants in common use, Net Present Value (NPV) and Internal Rate of Return (IRR), which approach the problem from opposite directions as shown in Figure 3.2.

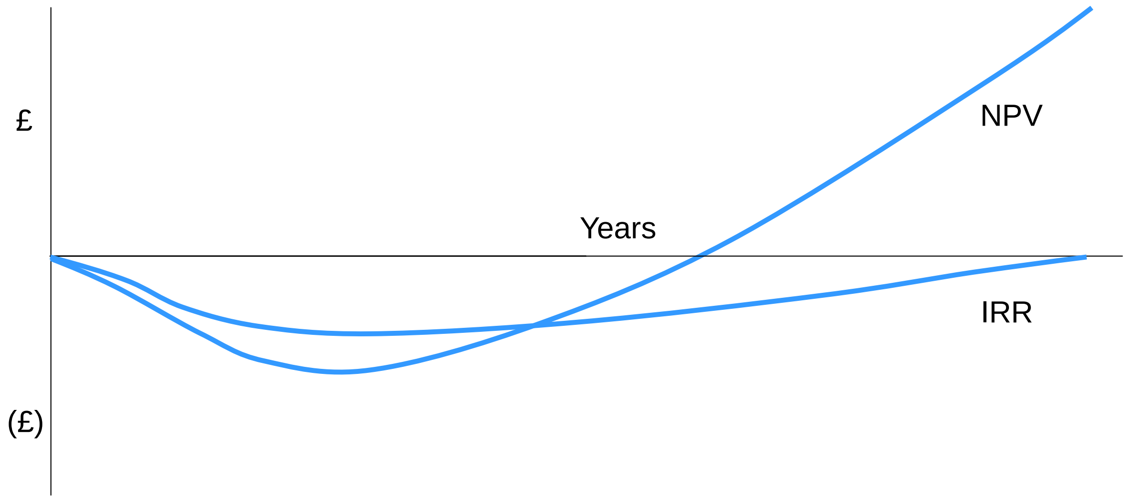

Figure 3.2: NPV and IRR for Single Investment

Net Present Value (NPV)

Net Present Value (NPV) is the absolute current monetary value of a programme of a defined life taking into account the time value of money by reducing cash flows for each year (n) by a discount factor calculated from a given rate of interest (r) using the formula given by Bull (1974, p. 203):

$$\text{Discount Factor} = 1 / (1+r)^n \tag{3.1}$$

NPV returns a monetary value for an investment and requires a specific interest rate, i.e. cost of capital, which can prove difficult and is often highly contentious around the cost of external and or internal funding. Consequently, interest rate is commonly built as a weighted cost of capital (Dixon, 1983, p. 111).

Internal Rate of Return

Internal Rate of Return (IRR), otherwise known as Yield, is the rate of interest which discounts future net cash flows of a programme of a defined life to render the NPV zero (Bull, 1974, p. 203) or required to ensure that the total NPV equals the total cost (Dyson, 1994, p. 385). IRR provides a comparison between competing investments and threshold criteria in the form of a single percentage. This is one reason why IRR is often favoured over NPV by accountants, another being that IRR tends to favour early cash flows and discounted payback, both implying less risk (Hawawini *et al.*, 2010).

Reconciling NPV and IRR

For a single investment opportunity both NPV and IRR will lead to the same conclusion because at interest rates below IRR the NPV will be positive and vice versa. However, for a more realistic situation comparing mutually exclusive programmes or selecting the top performers from a portfolio, NPV and IRR can give opposing results (Dixon, 1983, pp. 22-24). Figure 3.3 shows plots for two investments A and B where for interest rates below a given value A has greater NPV than B but above which the opposite is true. The point at which the plots intersect is called the Fisher's Intersection (Hawawini *et al.*, 2010, p. 235) and represents the point where investments agree on both NPV and IRR. The conundrum between NPV and IRR has injected argument concerning the best measure to use for investment decisions since Fisher *et al.* (1907) introduced it.

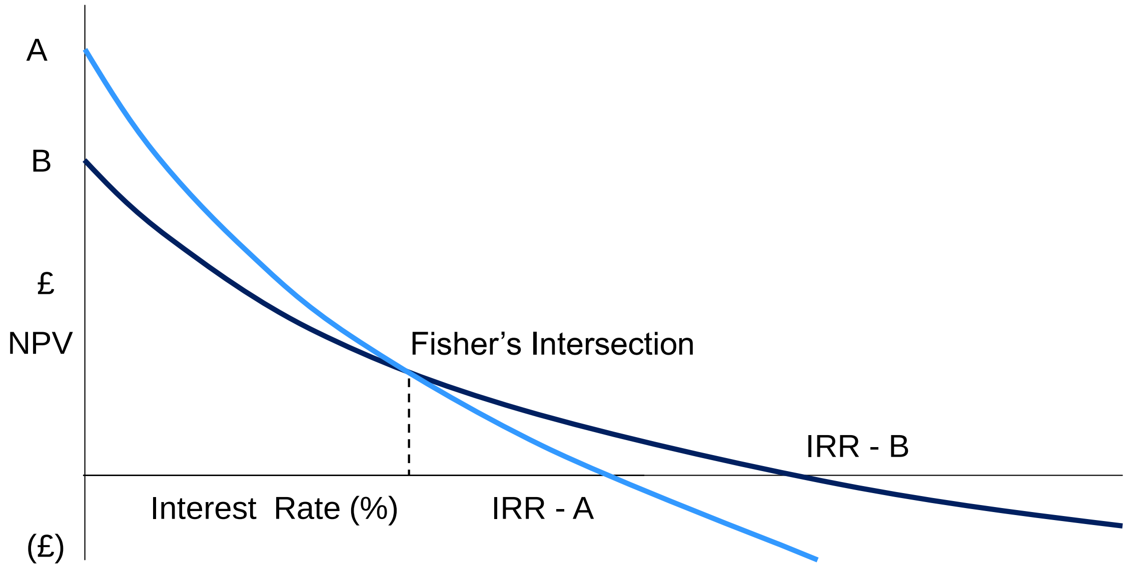

Figure 3.3: NPV and IRR for Mutually Exclusive Comparison

The importance has inspired research to determine sound criteria to choose between, and combine NPV and IRR, to provide greater certainty in capital appraisals, for example, (Osborne, 2010; Weber, 2014), both of whom express a preference for NPV as conclusions from their work. Hawawini *et al.* (2010, p. 236) corroborate the Author's experience, that managers generally prefer IRR because it is a single percentage not requiring cost of capital and tends to favour shorter return programmes. For practical purposes, the ideal situation is to combine maximum NPV whilst reducing risk by ensuring adequate early positive cash flows leading to rapid payback, resulting in optimal value power. However, in the event of conflict Hawawini *et al.* (2010, p. 237) also advise that NPV is more robust.

3.3.4 Investment Appraisal in the Public Sector

Investment in the public sector presents a number of critical distinctions from private enterprise initiatives, emanating from need to deliver social value, rather than profit. For example, Scholes *et al.* (2001, p. 5-6) argue that while commerce focuses on outputs measured in money as the relationship between revenue and cost, government services need to deliver social outcomes with no direct price component, the benefits of which are difficult to measure financially. There are calls to bring sectors closer through social responsibility by corporates (Windsor, 2006) and greater value for money from the public sector (OECD, 2012; NAO, 2017) However, attempts to combine private sector efficiency with societal outcome in the public sector proves problematic and often results in significant waste, such as ill-conceived Public-Private Partnerships (Salom, 2018) and ineffective use of Management Consultants (Craig, 2005; Craig *et al.*, 2006).

For the UK, public sector investment assessments follow the Green Book (HMT, 2011) which addresses distinctions through inclusion of multiple cases: Strategic, Economic, Commercial, Financial and Management. An interview with the author Lowe (2017) is covered in Appendix A1. Lowe confirms that emphasis on austerity and cost cutting has led to more programmes than can be managed effectively, containing poor specification of purpose and weak causal linkage with intended outcomes. Abundance of funds is no guarantee of effective government investment, vast sums being squandered during years of relative plenty (Elliott *et al.*, 2007; Craig, 2008). Conversely, Mazzucato (2018a) stresses the case for recognising the key role of the state in major innovations. The need is a shift from conflict to integration between public and private sectors, the common practical challenge being effective measurement and management of both hard financial and soft societal outcomes, which calls for greater attention to systemic causal thinking as advocated by Seddon (2008).

3.3.5 Search for a Successful Approach to Investment

Research corroborates the Author’s experience concerning factors determining investment appraisal efficacy. Gambles (2009) defines three categorises of poor business case: token, misleading and weak. Token refers to situations where bureaucracy trumps common sense. Weak cases include vagueness, ambiguity and omissions, for example interests of key stakeholders without financial ‘clout’. The opposite category is misleading business cases, the most dangerous example being where costs are understated, benefits exaggerated and risks either not considered or simply ignored, in order to meet designated approval thresholds. Jenner (2009) calls this out as fraud.

The focus on financial appraisal drives a tendency to express inherently non-financial benefits in money, often using surrogates. For example, the Green Book advocates assigning a financial value to citizen time saved (HMT, 2011, p. 59). This can be argued to some extent, but for sensitive societal outcomes often culminates as reductionist cost saving. Another general problem with business cases, driven by focus on financial criteria is short termism, where long term investments are favoured in preference to rapid returns (Hawawini *et al.*, 2010). In the public sector this is driven by austerity (Lowe, 2017) and in private enterprise share price, which Kaiser *et al.* (2013) call ‘Red Line Thinking’.

Quantifying Non-financial Benefits

Characteristics of best practice, corroborated through interviews in Appendix A1, converge on clear measurement of all benefits. However, instead of forcing financial value directly onto societal outcomes, non-financial factors should be quantified and resulting outcomes measured financially where appropriate (Gilb, 2017a; Jenner, 2017; Lowe, 2017). For example, time saved on commuting or less days lost to illness can be transformed at a macro level into increased productivity, leading to greater common prosperity in the long term.

A key conclusion from the research is that DCF principles can be adapted to deal with non-financial benefits using the concept of Value Power, rate at which value is realised. For example, reframing the question from, “What are non-financial benefits worth financially?” to “How can we deliver the optimum outcomes most quickly with least resources sustainably and equitably?” This necessitates more precise causal modelling, higher levels of abstraction and longer timescales, calling for agile learning, causal precision and causal certainty; core competences concluded from Part I and defined in Chapter 4.

3.3.6 Importance of Process and Lean Thinking for Investment

Ultimately, value creation involves process, which Harrington (1991, p. 9) defines as any activity or group of activities that takes input, adds value to it, and provides an output to an internal or external customer using resources to deliver definitive results. Therefore, process transforms investment into value, in other words, the means by which benefits are delivered and costs consumed. This renders it centre stage when considering investment focus, for example savings can be quantified through activity and cost driver analysis used for Activity-Based Cost Management (ABCM) (Kaplan, 1998).

The power of process is epitomised through Lean thinking which focuses on delivery of customer value by removal of Muda, the Japanese name for waste, from processes through five highly coupled concepts: clear specification of value, identification of value stream, flow, pull and perfection (Womack *et al.*, 2003): Although similar in some respects to Process Reengineering (Hammer, 1990; Hammer *et al.*, 1993), Lean broadens boundaries to include the entire value stream in order to ensure effectiveness as well as efficiency. Conversely, reengineering tends to default to optimising efficiency through cost saving and outsourcing at the expense of effectiveness (Appelbaum *et al.*, 1999).

Lean thinking is corroborated by the Theory of Constraints (TOC) which focuses on bottlenecks (Goldratt *et al.*, 1989; Goldratt, 1990). Lean reverses workflow into a pull process in which only materials requiring operation at a given time are in the system; accounting for the term ‘just in time’. The need for precise conformance is behind Six Sigma, promoted by Jack Walsh at General Electric (Pande *et al.*, 2000; Zinkgraf, 2006). Value is delivered by process which, whilst involving specialist departments, must be designed and operated to optimise stakeholder value, rather than functional efficiency in a silo effect (Tett, 2015). The process view also supports more accurate costing and performance measurement approaches, notably ABCM by mapping consumption causally to specific activities and associated resources (Turney, 2005; Kaplan, 1998; Cokins, 2001).

However, shifting focus from function to process is necessary but not sufficient when dealing with complex systems in which prerequisite levels of flexibility dictate the need for spare capacity to assure delivery of intended stakeholder value in accordance with the Law of Requisite Variety (Ashby, 1991). In this context, it is crucial that investment cases must differentiate between waste and essential redundancy, recognising the critical relationship between them in the real world. This causal reality is translated into a value principle in Section 6.5.

3.3.7 Categories of Work

There are three categories of work under Lean: adding value, necessary but not adding value and neither value adding nor needed, which are equally applicable for product and service industries (Womack *et al.*, 2003, p. 38). These categories translate into value added, essential redundancy and waste respectively, summarised below.

Value Added

Under Lean, value is added through a Value Stream comprising three value added (VA) activities: problem solving , physical transformation and information management (Womack *et al.*, 2003, pp. 19, 356). These definitions of value added (VA) activities are particularly powerful for the new value theory because they map to key organisational models, performance frameworks and the definition of value developed in this research, namely: doing the right things and doing things right, together with their causal coupling through information, which possesses high transformity in the energy hierarchy (Odum, 2007).

Essential Redundancy and Waste

The second category of work is called Type One Muda and the third Type Two Muda, which map to essential redundancy and waste respectively. Both Type One and Type Two Muda are non-value adding, but whereas Type Two can be eliminated immediately, Type One is essential redundancy and cannot be removed without damaging the value adding work, unless the underlying drivers are removed first. For example, inspection is Type One Muda and cannot be removed until rendered unnecessary, whereas pointless meetings, conflict and scrap are Type 2 Muda. Whilst key approaches to performance improvement, such as Lean, ABCM and quality focus centred on Deming’s work, can prove difficult to reconcile (Saukkoriipi, 2004) all definitions converge towards the three activity categories under Lean.

3.4 Implementation Focus

3.4.1 Meaning of Implementation

Strategy provides direction and a high level transition plan to an intended future state. Investment tests viability of the future state in terms of value, i.e. benefits in relation to cost of their realisation. Implementation refers to the actual transition to the intended state through execution. Contextually, strategy is doing the right things and implementation doing things right. Whilst the critical role of implementation is recognised, for example Kaplan *et al.* (2008) refer to the 'execution premium', a major issue is widespread failure to realise strategic intentions through implementation, which Coveney *et al.* (2003) call the 'Strategy Gap'. Nieto-Rodriguez (2012) partially explains this pattern by pointing to the massive bias in interest and status afforded to strategy by business schools and gurus, management consultancy and research papers. For example, in 2009 only two top 100 schools taught project management as a core subject on MBAs and most leading business theories neither refer to project management nor link strategy and execution.

However, there is an increasing shift in emphasis from business as usual (BAU) to change, in which respect, Nieto-Rodriguez (2012, p 32) recognises two types of business aim: operational and strategic. Operational objectives are generally short term targets needed to hone growth and profit, for example Total Quality Management (TQM) continuous improvement initiatives (Spenley, 1992; Hackman *et al.*, 1995; Oakland, 2014). Conversely, strategic objectives are aimed at transforming the business to significantly increase growth and profitability. These two views are generally referred to as 'Running the business' (RtB) and 'Changing the business' (CtB) respectively (OGC, 2008; OGC, 2010; Jenner, 2012). The key point, stressed by Nieto-Rodriguez, is that there is a continuing significant shift from the former to the latter, which demands greater focus on effective implementation. More specifically, transferral from BAU to strategic change increases the imperative for explicit causal coupling between strategy and execution, which is explored from three angles: structure, cost and benefit dynamics and dependence, after first defining key terms.

3.4.2 Key Terms

It is first essential to define key terms relating to state of the art concerning implementation.

Portfolio and Portfolio Management

A portfolio is the totality of an organisation's investment, or segment thereof, in the changes required to achieve its strategic objectives (OGC, 2008, p. 5) and portfolio management the coordinated collection of strategic processes and decisions that enable most effective balance of organisational change and business as usual (OGC, 2010, p. 1).

Programme and Programme Management

A programme is a temporary, flexible organisation created to coordinate, direct and oversee the implementation of a set of related projects and activities in order to deliver outcomes pertaining to the organisation's strategic objectives. Programme management is the action of carrying out the coordinated implementation of the programme to achieve outcomes and realise benefits of strategic importance to the business (OGC, 2007b, p. 4).

Project and Project Management

A project is a temporary organisation, typically shorter than a programme, created for the purpose of delivering one or more business outputs according to an agreed business case and project management of planning, delegating, monitoring and control of all project aspects to achieve the project objectives within expected performance targets for time, cost, quality, scope, benefits and risks (OGC, 2007b; Axelos, 2013).

Portfolio, Programme and Project Office (P3O)

P3O provides a decision-enabling delivery support model for all business change within an organisation with the aim of meeting business needs (OGC, 2008, p. 6). This combination recognises two key aspects of delivering initiatives, need to link intended change to strategic objectives and interdependence between initiatives, in achieving this outcome (OGC, 2008, pp. 5-6; Dolan, 2018, pp. 25-27).

Risk and Risk Management

Risk is the combination of probability and magnitude of a loss, disaster or other undesirable event and Risk Management the identification, assessment and prioritisation of risks followed by coordinated and economical application of resources to minimise, monitor and control the probability and impact of unfortunate events (OGC, 2007a; Hubbard, 2009).

Agile and Agile Management

Agile is a response to increased scope, pace and complexity of business and general economic landscapes for more effective business transformation. Agile project management is value driven and aims to deliver as much of targeted, prioritised requirements as possible within time and budget boxes using dynamic methods and tools, such as Lean and SCRUM (Atkinson *et al.*, 2005; Carroll, 2012; Purcell, 2016; McKinsey Agile Tribe, 2017).

Earned Value and Earned Value Management

Earned Value is a cost, not value, measure of what has actually been achieved in relation to the latest cost Estimate at Completion (EAC). Earned Value Management (EVM) is an advanced technique for programme management used extensively within the aerospace and defence sectors because it is particularly well suited to complex, high risk programmes (Fleming *et al.*, 2000; Webb, 2003; Anbari, 2003; Ziyash, 2018). The Author has also deployed EVM successfully in other applications across both private and public sectors. The technique is generic and can be used in combination with, and complements, PRINCE2® and other project management methodologies. EVM provides a means of measuring cost, schedule and compliance quantitatively using the cumulative cost curve as shown in Figure 3.4.

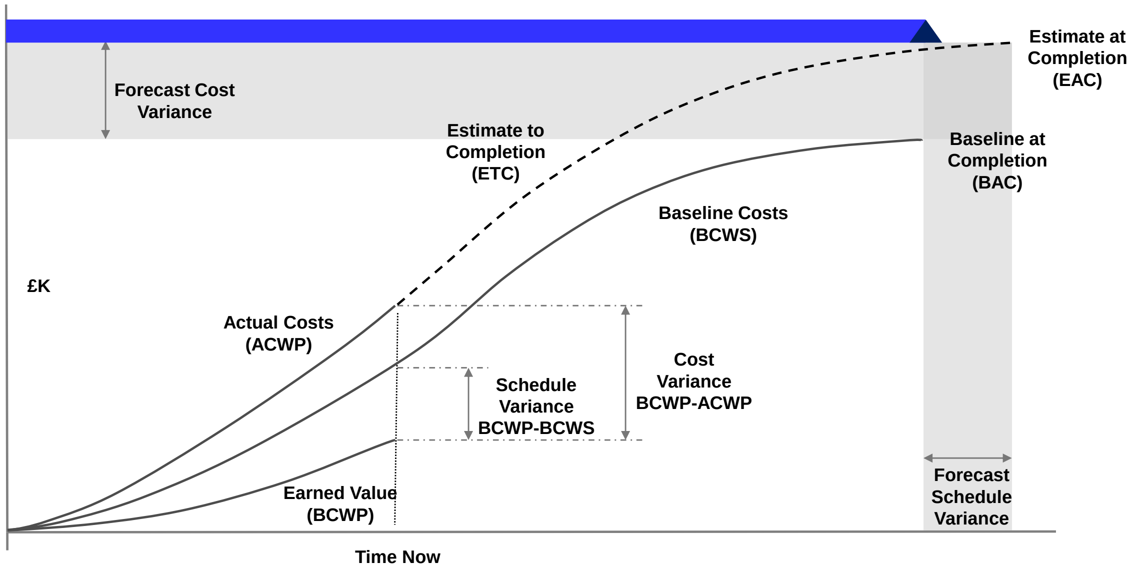

Figure 3.4: Earned Value Management

Governance

Another critical element of change programmes, particularly relevant for implementation is governance, defined by APM as a set of policies, regulations, functions, processes, procedures and responsibilities that define the establishment, management and control of projects, programmes and portfolios (APM, 2019). Matthiesen-Jones (2019) stresses alignment of programme goals and objectives with those of the overall enterprise. Weill *et al.* (2004, p. 27) cite six categories of asset in the context of corporate governance: human, financial, physical, intellectual property, information and IT, with which there is close mapping with the five capitals defined in the context of sustainability: manufactured, financial, social, human and natural (Forum for the Future, 2017). Criteria for good governance converge on a number of critical factors, notably: sponsorship, planning, reporting, stakeholder engagement, learning, responsibility and willingness to end initiatives which cease to deliver value (Harrin, 2016).

Benefits and Benefits Management

In the context of change programmes, (Dolan, 2018) uses the Association for Project Management (APM) definition of benefits as quantifiable and measurable improvements resulting from completion of deliverables perceived as positive by a stakeholder (APM, 2012). Jenner (2012, p. 15) adds contribution towards organisation objectives for benefits, and defines Benefits Management as the identification, definition, tracking, realisation and optimisation of benefits. Although included under implementation because it evolved from and is championed by the project and programme management fraternity, Benefits Management also relates to investment (Ward *et al.*, 2006; Bradley, 2010).

Value and Value Management

Institute of Value Management (2017) asserts that the concept of value is based on the relationship between satisfying needs and expectations and the resources required to achieve them whilst the aim of Value Management is to reconcile all stakeholders' views and to achieve the best balance between satisfied needs and resources. Jenner (2012, p. 19) stresses that benefits and value management are mutually supportive and most effective when integrated and because of commonality the Author treats these terms as synonymous.

Value Management encompasses all other terms because it captures the core tenet, directing the relationship between stakeholder outcomes and cost of realising them through consumption of resources, more specifically defined for this research:

Value Management is the mindset and process of delivering equitable and sustainable stakeholder value from change programmes

3.4.3 Change Programme Structure

Programme structure refers to the way in which resources are assigned and for what purpose.

Work Breakdown Structure

The purpose of a Work Breakdown Structure (WBS) is to divide the entire project into its component elements in order to establish a framework for effective management control of the project scope, schedule and budget (Devi *et al.*, 2012). The WBS forms a fundamental part of the planning process for most project management methodologies, such as PRINCE2® (Bentley, 2010; Axelos, 2013). Whilst a WBS is considered to be the taxonomy of a project and critical to design (Globerson, 1994), there is no explicit linkage to stakeholder value. An important dynamic of a WBS is that costs are aggregated through the levels and, typically, translate into a cost-centric plan, as shown in Figure 3.5, in which costs over time are depicted in red and assumed to be constant for ease of illustration.

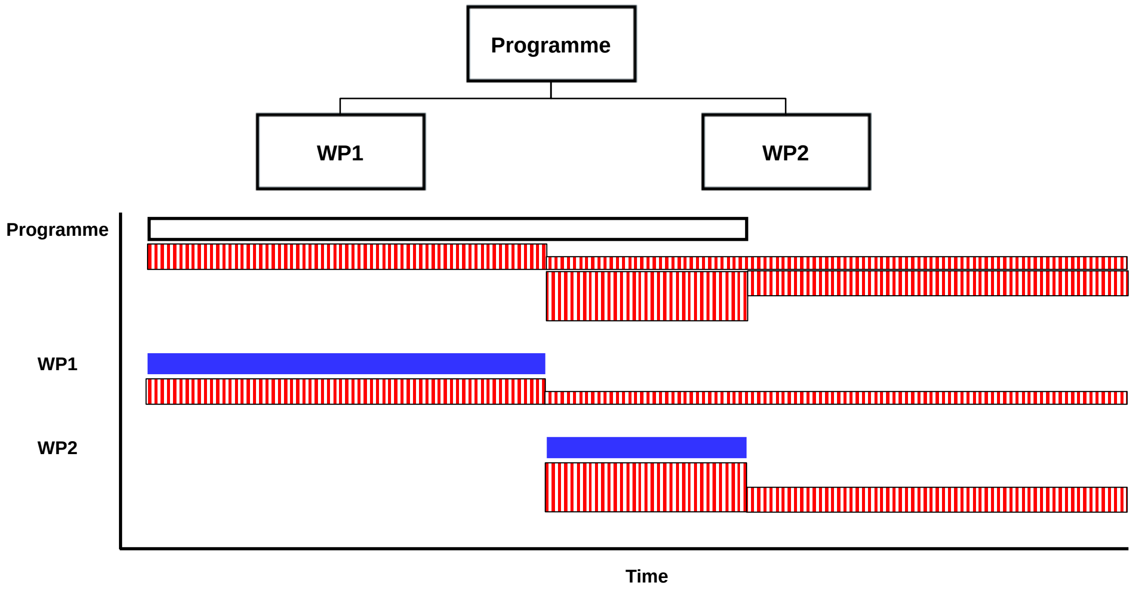

Figure 3.5: Work Breakdown Structure and Cost-centred Plan

Value Breakdown Structure

In recognising the limitations of a WBS in the context of value, Devaux (1999); (2015, pp. 112-118) introduces the concept of a Value Breakdown Structure (VBS), which lays out the value added contribution of each component and work package in a project or, importantly, projects within a programme or portfolio. A VBS translates into a value-centric plan as shown in Figure 3.6 in which benefits over time are depicted in green and assumed to be constant for ease of illustration.

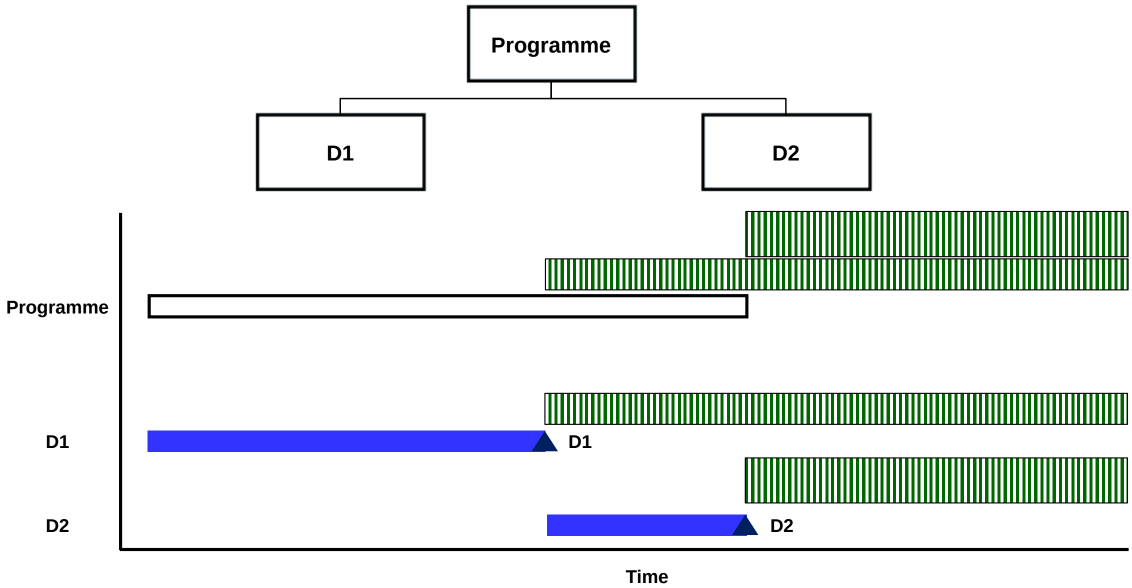

Figure 3.6: Value Breakdown Structure and Value-centred Plan

An important dynamic of a VBS is that unlike costs, benefits are conditional upon value dependence, which is expanded in the next section. Devaux further stresses that whilst very similar in structure, a VBS value cannot be simply aggregated from lower to higher levels due to the interaction between mandatory and optional work and critical path. For example, if work on delivery of an optional feature migrates to the critical path, any delay will result in what Devaux (2015, pp. 118-120) calls 'drag cost', which is the reduction in expected net value of the entire project of a delay in an item on the critical path. Both these observations are consistent with the TOC in relation to bottlenecks, where a delay caused by a bottleneck on the critical path of a process delays output of the entire product or service (Goldratt *et al.*, 1989; 1990). The integration of cost and value breakdown structures is covered in Chapter 6.

3.4.4 Programme Value Dynamics

The application of Value Power requires mastery of Programme Value Dynamics, cost and benefits behaviour over time, and demands precise causal linking of costs and benefits attributable to programme phases, as shown in Figure 3.7 simplified for clarity.

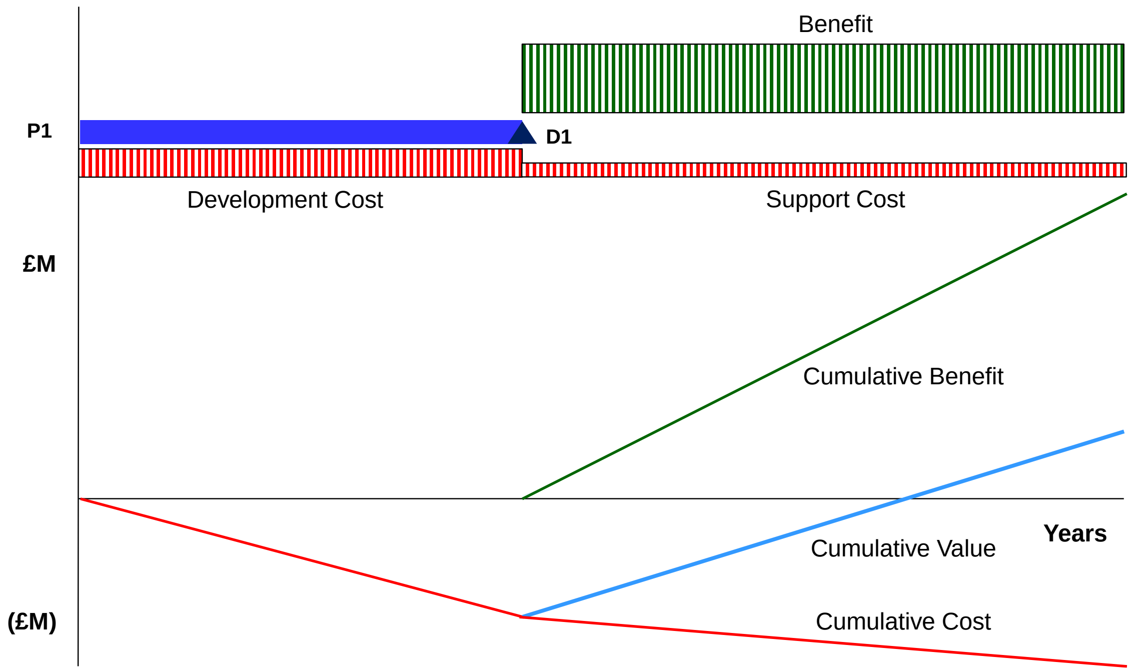

Figure 3.7: Programme Value Dynamics

Programme Cost Dynamics

There are essentially two categories of cost which influence value delivered by a programme: development and support. Development costs refer to all non-recurring expenditure and behave differently over time depending on contractual structure. For time and material arrangements, slip results in a 'marching army' effect where costs to the client continue to accumulate in proportion to the slip duration. Conversely, where fixed price contracts apply, cost remains the same for the client however long the slip; the burden falling on the provider. Support costs are items which recur on a periodical basis in order to sustain capability of the deliverable, for example annual system maintenance and ongoing recruitment and training.

Programme Benefit Dynamics

Benefits are stakeholder outcomes, in financial terms comprising reduced cost and increased income. There are four key behavioural features relating to outcomes. First, benefits can only be realised after the completion of deliverable capabilities which enable them. Secondly, unlike costs, realisation of benefits is not certain and achievement is dependent upon appropriate deployment of deliverable capabilities. Thirdly, potential benefits are not returned immediately on completion of new deliverable capabilities, but build up over time. Fourthly, cost savings are usually realised much more quickly than increased revenue.

3.5 Performance Focus

3.5.1 Meaning of Performance Focus

Performance focus centres on delivering stakeholder value through measurement frameworks.

Stakeholder Focus

Stakeholders are people, or living agents, with an interest in outcomes from and with which there is some form of energy exchange through the change programme and domain under change. There is increasing recognition for the need to manage business from a stakeholder management perspective which focuses on the importance of purpose (Freeman, 2010; Freeman *et al.*, 2010). There are four categories of stakeholder directly associated with a business: Owners, such as shareholders, investors and taxpayers, Customers, Employees and Suppliers. Also important are agents impacted by the transformation, intentionally or unintentionally, which include citizens and society as a whole. Importantly, this final category also includes the environment, as a living entity from which resources are consumed through energy exchange. In this research great weight is afforded to the need for, and means of achieving, mutually supporting and equitable value between stakeholders, balancing growth with ecological limits (Raworth, 2017; Schwab *et al.*, 2020). This 'win-win' approach is developed in Chapter 6.

Performance Management Frameworks

Most recent performance frameworks, notably the Balanced Scorecard (BSC) (Kaplan *et al.*, 1996), European Foundation for Quality Management (EFQM) model (Calvo-Mora *et al.*, 2005) Baldridge Performance Excellence Model (Evans *et al.*, 2003) and Business Canvas (Osterwalder *et al.*, 2010), are structured around these stakeholder perspectives. The frameworks also share strong causal foundation, recognising two types of measure: lead indicators, value drivers which are prerequisites for achieving stakeholder outcomes, lag indicators. There are generally several lead measures to every outcome lag measure. For example, prospects, contacts, conversion rate and margin per sale are leading measures in a chain of cause and effect resulting in profit, an outcome measure for owner stakeholders.

Two related causal measurement approaches are also particularly relevant to this research: Objectives and Key Results (OKRs) and Activity-Based Cost Management (ABCM). OKRs are designed to drive performance in fast moving, dynamic and highly innovative business, such as Google where they originated (Doerr, 2018). Conceived to address limitations of traditional absorption costing, Activity Based Costing (ABC) determines the true cost of products, customers and channels by linking causal drivers through activities which actually consume resources (Cooper *et al.*, 1988; Kaplan, 1998; Cokins, 2001; Turney, 2005). This 'cost assignment' view is complimented with a process management dimension, resulting in a causal cost performance framework referred to as the ABCM Cross. There are strong links between the BSC and ABCM (Maiga *et al.*, 2003), both developed in Harvard, particularly relating to causal linkage and dealing with intangibles; through Strategy Maps (Kaplan *et al.*, 2004) in the case of BSC, and the ABCM Cross (Cokins, 2001, p. 15; Turney, 2005, p. 94).

3.5.2 Convergence of Big Data and Dynamics Modelling in Performance

Performance is a key area where complimentary advances in Big Data and Dynamics Modelling are finding practical application.

Big Data

Big Data is a general term referring to the use of large datasets to derive knowledge and support decision making (Mayer-Schönberger *et al.*, 2013) through Decision Support Systems (Shim *et al.*, 2002) and Business Intelligence (BI) (Negash *et al.*, 2004), This technology has progressed into AI and Machine Learning to the point where any necessity for causal modelling is challenged (Anderson, 2008). This view that causal models are no longer needed is strongly contested by other leaders in the field, for example Fletcher (2018) interviewed for this research, Appendix A1, considers causal modelling, along with Metadata (Sen, 2004), to be essential for effective BI. In the context of performance, an important role for Big Data is prediction. In this respect, advances in BI include Predictive Analytics (Siegel, 2016) and Agrawal *et al.* (2018, p. 13) distinguish AI as creating value by rendering prediction inexpensive.

Dynamics Modelling

Literature makes reference to performance dynamics in three contexts: human resources, business structure and measurement systems. First, the term refers to relationship between shifts in job behaviour and results over time (Sturman, 2007; Sonnentag *et al.*, 2012). The second concerns impact on the dynamics of value relating to business structure, for example in considering the trade-off between short term efficiency gain of outsourcing versus longer term resilience of vertical integration (Novak *et al.*, 2008). Thirdly, (Bititci *et al.*, 2000) explore the development and feasibility of dynamic performance measurement systems (DPMS), which is the context most appropriate for this research. Subsequent advances in dynamic simulation, Big Data, Predictive Analytics and performance frameworks are converging towards Digital Twin introduced in Chapter 2, albeit currently focused on manufacturing (Uhlemann *et al.*, 2017; Tao *et al.*, 2017; Jones *et al.*, 2019).

3.5.3 Causal Modelling Context

Bhaskar (1998) asserts that we can never possess a complete picture of reality; ultimately we perceive the world through incomplete models. It follows that our capability to navigate and engage in co-creating reality to generate value is determined by the efficacy of our models, which translates into precision and certainty of causality. In the context of performance, Richmond (2001, p. 20) quips, “When improving performance is your aim, causation must be your game!” Causal modelling can be framed in two dimensions, model and structure, as illustrated indicatively in Figure 3.8.

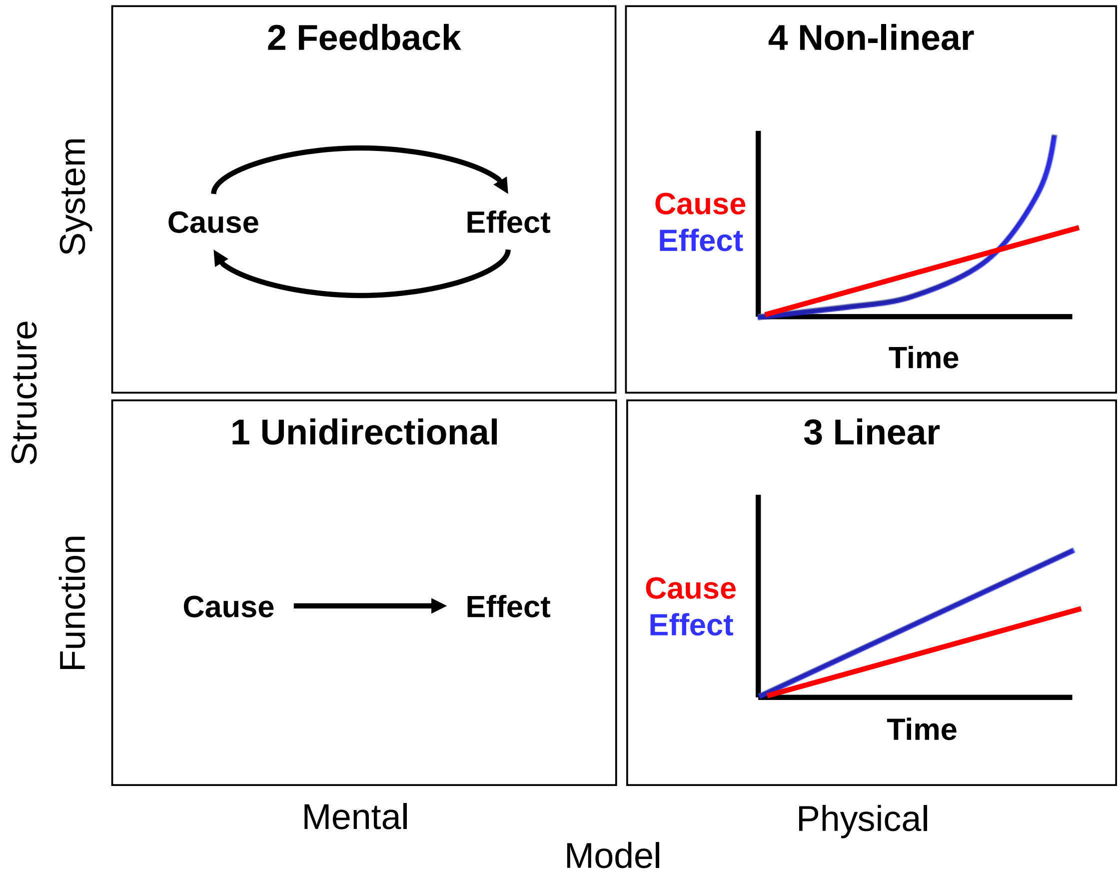

Figure 3.8: Causal Modelling Context

Structure concerns relational aspects of causality considered under function and system, which Beautement *et al.* (2011, p. 15) translate into closed and open systems perspectives respectively. The Model dimension refers to broad types of modelling categorised mental and physical. A mental model is defined by Hollins (2019, pp. 14-16) as a blueprint which draws attention to important elements of a problem in terms of context, background and direction, shaped by values, experiences and unique worldviews.

The key point is that physical models can either challenge and correct bias contained in mental models or deliberately or unconsciously reinforce them, together with any attributable flaws. For example, spreadsheets perpetuate mental models of linear, unidirectional causality, whilst System Dynamics simulates reality more precisely through non-linearity driven by feedback Causal Precision, which incorporates modelling, and Causal Certainty along with Agile Learning are defined in conclusion of Part I as prerequisite capabilities for effective deployment of the new theory and framework; discussed further in 3.6 Change Focus.

3.5.4 Hard and Soft Measure Integration

Finally, we need to explore the challenge of quantifying factors typically regarded as ‘soft’ or ‘intangible’, such as trust, motivation and values, which potentially influence system behaviour and, consequently, value outcomes in profound ways. As previously eluded, business cases often exclude intangibles but Richmond (2001, p. 195) argues that omitting soft measures injects a high risk of missing significant causal factors, which concurs with the Author’s experience. The challenge involves modelling causal precision and measurement to inject certainty.

Modelling Soft Measures

Soft measures and the manner in which they influence behaviour are subject to human frailties, notably biases and use of inappropriate heuristics. Sterman (2000, p. 26) draws upon bounded rationality (Simon, 1957) in proposing partial model testing by isolating each organisational element of the model from its environment until the environment and mental model that underlies the decision rule are consistent (Sterman, 2000, p. 605). This approach is facilitated by some dynamics modelling software through storytelling and partial simulation functionality (Impact Dynamics, 2018).

Richmond (2001, p. 201) provides four key guidelines for integrating soft variables with hard factors into dynamics models: use consistent scales, think operationally, i.e. causally, use hard data to calibrate soft variables, and conduct sensitivity analyses to determine the relative importance of specific values. Application of hard and soft measure integration is shown in Figure 3.9 by applying Systems Thinking and presented as a simple CLD developed by the Author within which relationships relating to soft measures are postulated, using staff burnout as an example. CLDs are constructed using two types of feedback loop. Reinforcing loops are designated ‘R’ with all ‘+’, denoting same causal directionality, or even number of ‘-‘ which denote inverse causality, and balancing loops are assigned ‘B’ containing one or an odd number of ‘-‘. R loops drive growth or decline, and B loops impose control or constraint.

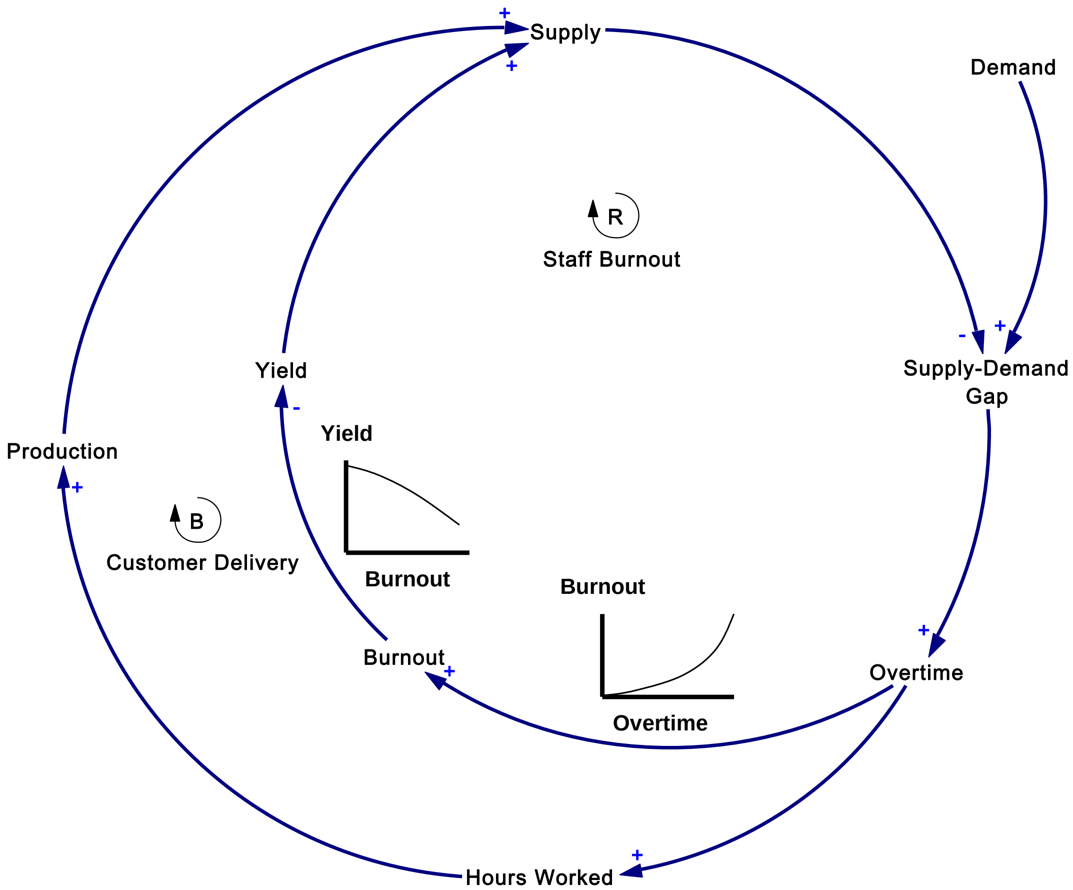

Figure 3.9: Hard and Soft Measure Integration Using Systems Thinking

CLDs provide a powerful means of capturing causal stories but have limitations. They are only qualitative and contain potential structural flaws, notably omitting accumulations, which are fundamental in understanding and quantifying state transition, and ambiguities concerning causal direction (Richardson, 1986). These limitations are addressed by translating the CLD into a dynamics model, such as System Dynamics (SD) as shown in Figure 3.10, also developed by the Author. Warren (2008) advocates translating causal interpretations of problems into SD models directly, on the grounds that the conversion process from CLDs can prove difficult and only adds confusion The Author disagrees; the Causal Tracing Document (Davies, 2018), built using CLDs, proved invaluable for developing the Bacs Market Dynamics Model (MDM), Chapter 8, which covered both SD and Agent-based Modelling (ABM) for which translation proved naturally intuitive.

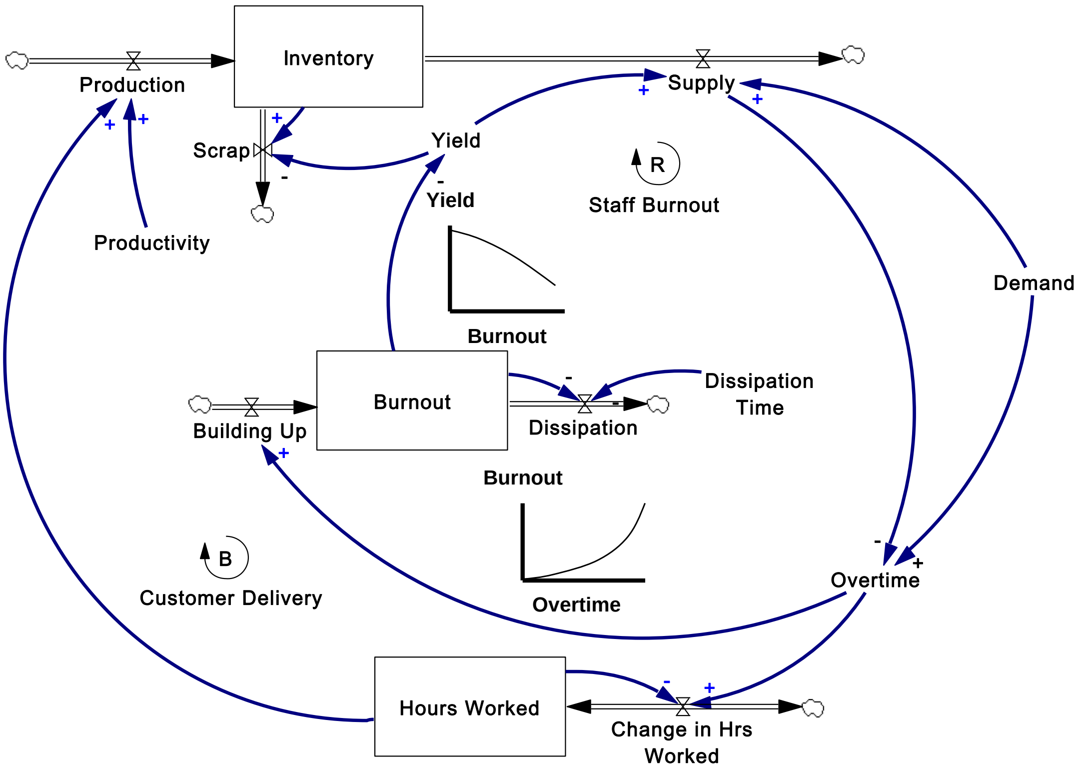

Figure 3.10: Hard and Soft Measure Integration Using System Dynamics

Measuring Soft Parameters

Hubbard (2014, p. 287) argues that all quality assessment problems are about human preferences with essentially two ways of measurement, stated and revealed. Stated preferences are what people say that they prefer, whilst revealed preferences are those displayed through actual behaviour. Measuring the former usually requires surveys, used extensively for real data used in the developmental case study for this research covered in Chapter 8. Revealed preferences can be captured through direct observation of behaviour, and the application of predictive analytics (Siegel, 2016) used by online companies such as Amazon.

Hubbard proposes a number of approaches for quantifying soft measures, including willingness to pay via trade-offs, risk tolerance and profit maximisation. Complementary to these methods, Richmond distinguishes between measurement, determining the magnitude, and quantification, assigning a numerical index, arguing that whereas measurement requires units, quantification only needs a relative scale (Richmond, 2001, p. 196). The Author advocates pursuing both determining units wherever possible and appropriate and applying quantitative scales when not, rather than omit important factors from the model. Unitless scales also provide a powerful means of integrating soft factors, which cannot be measured, with hard measures that can.

3.6 Change Focus

3.6.1 Meaning of Change Focus

Kotter (1995) attributes flawed human thinking and consequential behaviour to unsuccessful change and encapsulates the solution as a process comprising eight elements: urgency, coalition, vision, communication, empowerment, quick wins, consolidation and institutionalisation. Change draws on culture (Thompson, 2018; Coyle, 2018), providing insights concerning successful teams involved in change, and advances in neuroscience (Kahneman, 2011; Baars *et al.*, 2013; Shephard, 2017) the practical application of which enables rapid, radical change in individuals and groups. Kotter (1996, p. 175) concludes that successful change boils down to the learning organisation, a finding corroborated by Senge (1990). After providing definitions and considering the important aspect of levels, this sub-section explores learning as a process, together with ways to increase the rate of learning. Finally, the role of technology in learning is discussed.

3.6.2 Definitions of Learning

Of the numerous definitions for learning (Malamed, 2016), three themes provide the essence for this research: persisting capability, value creation and error correction. Gagné (1965) describes learning in terms of a change in human disposition or capability that persists over a period of time. Driscoll *et al.* (2005) place learning in the context of value creation as a persisting change in human performance or potential which must come about as a result of the learner's experience and interaction with the world. This perspective aligns with the Empirical layer of reality in Critical Realism covered in Chapter 5.

Argyris (1976) frames learning as the detection and correction of errors, and error as any feature of knowledge or of knowing that makes action ineffective. In this context, error is a mismatch which, together with matching, is a condition of learning; the detection and correction of error produces learning. This latter definition describes a balancing loop in systemic terms (Senge, 1990), which always involves correction, i.e. matching, towards a goal, and forms the basis of the Customer Journey used for the Market Dynamics Model (MDM) covered in Chapter 8.

3.6.3 Levels of Learning

Research suggests that learning occurs at three key levels: single, double and triple loop. Single and double loop learning are more generally understood (Argyris, 1976; Smith, 2013). Single loop learning occurs when the response to events involves existing capabilities, objectives, processes and assumptions. In other words single loop learning does not involve change in structure. Conversely, in double loop learning causal structures are challenged to determine potentially more effective ways to frame, analyse and address the problem. The difference can be summarised as: single loop learning concerns doing things right and double loop learning whether we are doing the right things (Romme *et al.*, 1999).

Although less clearly defined, research by Tosey *et al.* (2011) points to convergence on triple loop learning being a shift in mental model of the world, strongly associated with purpose. Sinek (2009, p. 37) stresses the importance of sequencing three key questions in the correct order: why?, how?, what?, which he refers to as the Golden Circle, and which can be related to triple, double and single loop learning respectively (Engelbart, 2012). For practical purposes the mapping extends to Real, Actual and Empirical layers of reality in Critical Realism (Bhaskar, 2008), applied in constructing the Value Power Framework in Chapter 7.

3.6.4 Learning as a Process

It follows from the definitions that in a systemic context, learning can be framed as a balancing feedback process closing the gap between intention and outcomes by co-creating desired reality in collaboration with universal laws of cause and effect. This process view is reflected in several frameworks, three of which are particularly relevant for the new theory: Deming Cycle, Accelerated Learning and Learning Journey.

Deming Cycle

Deming (1994, p. 132) defines a cycle for continuous improvement comprising four steps: Plan, Do, Study and Act (PDSA). Plan involves preparing a change aimed at improvement. Do refers to implementing the change, preferably on a small scale, Study, also called Check in which case the cycle is shortened to PDCA, concerns reviewing the results and Act either adopting the change, abandoning it or running through the cycle again. Interest in PDSA for the new theory is the generic nature of this structure, evidenced by the range of applications, albeit under different names and forms, in which it appears. For example, the TOTE Model, (Trigger, Operation, Test, Exit) is used in the context of neurological strategies, patterns of kinaesthetic, audial, visual or audial digital, or self-talk driving behaviour (Empowerment Partnership, 2020).

PDSA is also used under the SCRUM process in agile software development (Carroll, 2012, p. 68) and explicitly linked with the Theory of Constraints (Lepore *et al.*, 1999). Deakin Crick *et al.* (2017a) adopt a similar cycle for the platform to support Learning Journeys and Learning Power (Deakin Crick *et al.*, 2017b). Critically, the cycle can also be applied at different learning levels, for example, Plan can be abstracted to Purpose as well as relate to planning a specific change. This generic quality of the Deming Cycle is deployed in construction of the Value Power Framework and Value Journey covered in Chapters 7 and 11 respectively.

Accelerated Learning Cycle

Smith (1998) developed Accelerated Learning during the late 1990s to address the increasing gap between education and rapidly changing needs driving real world employment, encapsulated for the UK by Hutton (1996). This core tenet is arguably even more relevant in today's landscape with social media, 'gig' economy (Wilson, 2017), dominant Internet players and now COVID-19 added to the mix. Smith (1998, pp. 24-27) proposes the Accelerated Learning Cycle which can be mapped closely to PDSA, as shown in Figure 3.11.

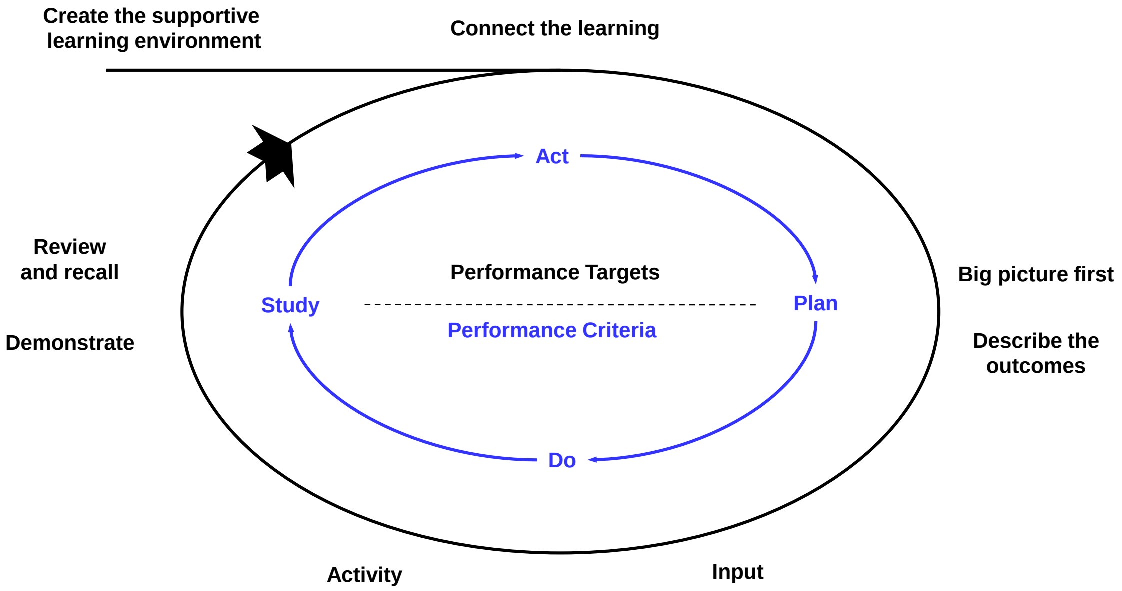

Figure 3.11: Accelerated Learning Cycle

Smith injects four key elements which represent significant enhancements to the basic Deming Cycle of particular relevance to the new theory concerning: learning environment, context and purpose, precise questions and neuroscience.

Learning Environment

A positive and supportive learning environment is characterised by high expectations combined with low anxiety, a state Scheele (2000, p. 18) calls 'relaxed alertness' and in NLP it is referred to as the 'learning state' (James *et al.*, 2001). This aspect also draws in the learning organisation brought into mainstream thinking by Senge (1990);

Context and Purpose

Further pre-framing describes the learning process in the context of subject or domain towards which learning is directed. This stage, Big picture first, is effectively part of planning, making explicit links between the expected learning with content and process by explaining 'what' and 'why' to encourage meta-cognition and learner self-knowledge. Focus on purpose is a key neurological driver in learning and a critical element of Photoreading (Scheele, 2000), an extreme form of subconsciously driven learning in which the Author is trained and applies, explicitly referenced by Smith (1998, p. 137).

Precise Questioning

Throughout the cycle, learners are encouraged to ask questions as a 'right hemisphere' creative process, using structured templates, to promote outcome thinking. Importantly, this inquiry not only refers to the subject matter but includes questions concerning the performance criteria and targets for success based on precisely specified outcomes, a discipline synonymous with Test Driven Development in software (Beck, 2003) used for the MDM (Harding, 2018) and incorporated within the Value Power Framework constructed in Chapter 7. In NLP, greater emphasis is placed on questions than answers (Shephard, 2005a) and precision is used to eliminate flawed heuristics in the form of distortions, generalisations and deletions through the Meta Model (Bandler *et al.*, 1976).

Neuroscience

(Smith, 1998, p. 19) also incorporates advances in neuroscience, notably four insights. First, it is crucial to use the entire brain in the learning process. Secondly, learning can be enhanced by matching content and delivery with visual, audial and kinaesthetic (VAK) neurological preferences; discussed in Section 3.6.5. Thirdly, motivation through setting of precise goals is a critical learning and performance driver, also concluded by Pink (2011). Fourthly, an essential element in closing the gap between intention and outcome is feedback. The power of integrating strong starting conditions, in the form of precise intention setting, and correction through perpetual feedback is corroborated by complexity theory, which Gribbin (2005, p. 3) crystallises as starting conditions and feedback; applied for this research in Section 6.8.

Learning Journey

Recent research suggests a view of learning as a relational process through which we regulate the flow of energy and information over time in order to achieve a particular purpose (Deakin Crick *et al.*, 2017a). In other words, learning involves energy transformation in causally coupling purpose and performance. Deakin Crick refers to this process as a Learning Journey and the energy driving the process Learning Power; the latter subsequently expanded in this section. A Learning Journey comprises four measureable sequential sub-processes: Forming Identity and Purpose, Generating Learning Power, Knowledge Structuring and Producing Value (Crick, 2017; Deakin Crick *et al.*, 2017b). Importantly, the Learning Journey frame is applicable at single, double and triple loop levels of learning, designated Just doing it, Learn to improve and Learning the transforms respectively.

Learning Journey as a Cycle

Tracy (2018) argues that Learning Power is essentially a dispositional measure which applies to all sub-processes and, consequently, reconfigures the Learning Journey as a cycle with Learning Power in the centre both influencing and being influenced by the entire process. More recently, Crick also restructured the Learning Journey for the Learning Journey Platform (Deakin Crick *et al.*, 2017a) into a four step cycle: Chose purpose, Diagnose and plan, Do the job, Measure and evaluate, which maps more closely to both the Deming and Accelerated Learning cycles. The combination of Learning Journey as a PDSA cycle and applicability at all levels of learning provides a core foundation for the Value Power Framework constructed in Chapter 7.

Internal and External Learning Journeys

Learning Journey and Learning Power research originally focused on student transition from self-selected purpose to performance in the context of education (Deakin Crick *et al.*, 2012; Deakin Crick *et al.*, 2014). In this case, the process is principally an internal Learning Journey, in terms of personal growth. However, typically this leads to an intended personal outcome, such as recognised qualification, which has implications on external outcomes, for example employment. In the case of a change programme, team members are undergoing their own internal Learning Journeys, which may lead to qualification and job progression, both influencing and influenced by the programme which has external intended outcomes.

Tracy (2018) is uncomfortable with hard categorisation into internal and external because the dimensions are so integrated. This is a strong argument because intentions and outcomes for internal and external Learning Journeys must be aligned in order to optimise value creation and delivery across stakeholders. Consequently, this integration is incorporated within the Value Power Framework in Chapter 7.

3.6.5 Powering the Learning Process

The efficacy of a process in the transition from purpose to performance is influenced by four key factors: problem typing, active engagement, learning enhancement and learning diversity.

Problem Typing

Typing refers to Meta characteristics of a problem, as opposed to specific content which is addressed using similar principles but at a lower level of abstraction. Watzlawick *et al.* (1974) provide a broad categorisation; whether we are dealing with evolution, in which a change is needed within the same structure, or revolution involving a structural shift. These authors designate the former as first-order and the latter second-order change, with which they draw a mathematical analogy with Group Theory and the Theory of Logical Types respectively, and reference the cybernetics of Ashby (1956). Similarly, this distinction is a key purpose of the Structural Differential in Non-Aristotelian systems theory (Korzybski, 1994, p. 397).

Snowden *et al.* (2007) proposes the Cynefin framework, which maps combinations of knowns and unknowns to four quadrants relating to degree of complexity. (Jackson, 2019, p. 162) points to limitations in the Cynefin framework, notably the absence of human aspects such as values and intentions, and proposes a problem context grid comprising two axes, complexity, similar to Cynefin, and stakeholders.

Active Engagement

The next factor in determining effectiveness concerns the degree of physical separation which a learner has with the real world problem, the point of power to create value in which two methods are of particular relevance: Action Learning and Informal Learning.

Action Learning

Action Learning, originally developed by Reg Revans to improve UK productivity after WW II, focuses on helping managers and is encapsulated by the Learning Equation: L = P + Q (Revans, 2011, p. 3). P refers to programme learning and Q to questioning insight gained through Action Learning. Revans' core argument is that programme learning is insufficient unless supported by deep questioning through action, critically, within an unfamiliar environment and unfamiliar application in order to inject ambiguity and invoke intense inquiry. Consequently, Action Learning is a reflective process which other practitioners, for example (Marquardt *et al.*, 1999; McGill *et al.*, 2003), have developed, drawing on work concerning self-reflection (Schön, 2017). The Author adapts Action Learning for Value Breakthroughs described in Chapter 11.

Informal Learning

Strongly linked to learning through doing is informal learning (Eraut, 2004). Cross (2011, p. 17) coins the term 'Spending-Learning Paradox' to denote that 80% of learning in organisations is informal whilst 80% of training budgets are spent on formal learning, arguing that this renders traditional planning obsolete. Cross also distinguishes training as something pushed onto you and learning as something you choose to do, pulling in response to a need. This frame has strong parallels to Lean (Womack *et al.*, 2003) and Learning Journeys (Deakin Crick *et al.*, 2017b) and suits the unpredictable nature of business which can render planning less effective than the flexibility to respond to change rapidly through innovation (Hagel *et al.*, 2005).

Learning Enhancement

Claxton (2002, p. 14) proposes three practical approaches in which we can enhance learning. First, we can help learners to learn more easily, for example, improving quality of learning materials. Secondly, we can help people to learn better, taking into account preferred neurological learning style and targeting material accordingly. Thirdly, we can help people become better learners, developing the dispositions and skills enabling them to learn well under any conditions. Claxton refers to this third option as building Learning Power, of which he is a founder.

Quality of Learning Content

In addition to content, quality includes use of multiple media. As organisations place ever greater responsibility for learning on employees (Wagner *et al.*, 2004) and physical co-location constrained by COVID-19, online delivery of learning is becoming increasingly essential. It is also set to disrupt education models through what Seldon (2018) coins the Fourth Education

Revolution, due to the potential for delivering cost effective best in class teaching without need for physical co-location of teacher and leaner.

Learning Preference Matching

Learning can be rendered more effective with reference to insights concerning neurological preferences through which we cognate information and learn: kinaesthetic, audial and visual, shortened to KAV (Smith, 1998). Recent research refute that learning styles are fixed at birth or focusing on a preference correlates with performance (Husmann *et al.*, 2019; Nancekivell *et al.*, 2019). However, other practitioners advocate ensuring all styles are encompassed. For example, the 4-MAT structure proposed by McCarthy *et al.* (2005) ensures that all styles are covered by spanning questions matching preferences: why?, what?, how? and what-if? These 'quadrants' also map onto the learner focus,' I', 'they', 'it' and 'we' respectively (McCarthy *et al.*, 2005, p. 17). 4-MAT also provides a powerful framework for presentation (James *et al.*, 2001) and Shephard (2017) maps the four preferences to Jungian archetypes used to profile personality types (Keirsey, 1998).

Learning Power

Learning Power concerns the capacity to learn to learn (Crick *et al.*, 2014), a Meta level process comprising seven dimensions: Creativity, Curiosity, Sense-making, Hope and optimism, Mindful agency, Collaboration and Belonging, which are combined to provide an overall disposition score, Openness to Learning (Deakin Crick *et al.*, 2015). Learning Power facilitates three key capabilities which are of most value for this research. First, it enables self-assessment measurement of overall learning capability. Secondly, the decomposition into dimensions enables the identification of archetypal profiles which exhibit predictable behaviour patterns with specific contexts. For example, Learning Power archetypes developed by Tracy (2018) are deployed as a second level of customer segmentation for the Market Dynamics Model (MDM) covered in Chapter 8. Thirdly, precision afforded through dimensions also enables precise targeting of interventions under a coaching process to match the needs of the learner for a given context. For example, if a learner working in a highly interactive innovation environment scores high on creativity but low for collaboration, coaching can be most effectively directed to improve human relational aspects.

Learning Diversity

Learning diversity relates to the six highly interrelated areas, covered under Section 3.2.6, which corroborate the need for essential redundancy in strategic change: range, creativity, prediction, team mix, mastery and scale.

3.6.6 Role of Learning Technologies

Four aspects of learning technology are of particular interest from a value perspective: analytics, creativity, complexity and diversity.

Analytics

Learning Journeys and Learning Power are integrated through the emerging field of learning analytics, which Crick (2017) defines as the use of digital data for analysis and feedback that generates actionable insights to improve learning. Learning analytics refers to the ways in which computational support for capturing digital data can help to inform decision making for the processes and outcomes of learning (Crick, 2016). Key to this is the rapid feedback of data to users at all levels of the system and the capability of technology to represent complex data visually. To this end, Deakin Crick *et al.* (2017a) developed a Learning Journey Platform incorporating analytics and reporting, designed to support the learning process. Importantly for this research, this application frames Learning Journey very closely to a Deming Cycle, a commonality corroborated through the subject expert interviews (Tracy, 2018; Huang, 2018a).

Creativity

The Turing Test determines intelligence of a machine in relation to it being mistaken for a human. Du Sautoy (2019, p. 6) proposes the Lovelace Test as an equivalent for measuring machine creativity. To pass, a machine must produce output which is truly creative, of value and repeatable using algorithms that cannot be explained by the programmer. Du Sautoy concludes that we are rapidly approaching this situation and Ferrucci *et al.* (2017) explore deployment of AI's storytelling capabilities to literary application. It is also important to recognise that many of the Learning Power dimensions, notably creativity, curiosity, sense-making, collaboration, and now creativity, apply to machine learning (Tracy, 2018). From a value creation perspective, technology synergises rate of learning with cost effective prediction.

Complexity

Technology promises to replace many complex investigative tasks, hitherto dependent on human learning, with profound implications on productivity and value creation. In particular, AI offers two major advantages over the human brain in context of learning and decision making. First, computers can outperform even experts in relational complexity where rules determine all possible scenarios; a prominent example being chess. Secondly and more subtly, machines can eliminate bias. However, in the foreseeable future, human minds will be able to outperform machines where complexity is emergent, such as with CAS. Tetlock *et al.* (2016, p. 23) refer to AI expertise (Ferrucci *et al.*, 2012; Ferrucci *et al.*, 2017) in arguing the case for human expert paired with a computer to overcome cognitive limitation and biases. It follows that the sweet spot for learning lies in combining the cognitive power of pattern recognition and bias elimination provided by computers with intuitive mastery of the human brain.

Diversity

Just as diversity is critical for human creativity and problem solving, it is also becoming increasingly important for learning technology. For example, AI encompasses learning diversity through the combination of different algorithms. Domingos (2015) envisages a 'master algorithm' combining the strengths of algorithms derived from neuroscience, evolution, physics, statistical probability and computer science. The same applies to models. For example, Universal Modelling Language (UML) for object orientated (OO) software development deploys many different models spanning key perspectives of the problem space, such as Use Case for user interface, Activity Diagram for process flow and State Machine to capture transition events (Fowler *et al.*, 2000; Scott, 2002). The critical capability is integrating the models into a coherent architecture from which software code can be generated automatically; computer tools now being able to support this. The same applies to business, where model architectures, software system design and dynamics modelling are converging through technological advances, and their application is discussed in the context of Causal Architecture in Chapter 11.

3.7 Modelling Complex Adaptive Systems

A dominant theme permeating this review is that delivering value demands causal capability to run the business (RtB) efficiently and change the business (CtB) effectively in the context of a Complex Adaptive System (CAS), shown in simplified form as a Causal Loop Diagram (CLD) developed by the Author in Figure 3.12. The CLD is designed to portray the story of business as a CAS through compound relational feedback loops.

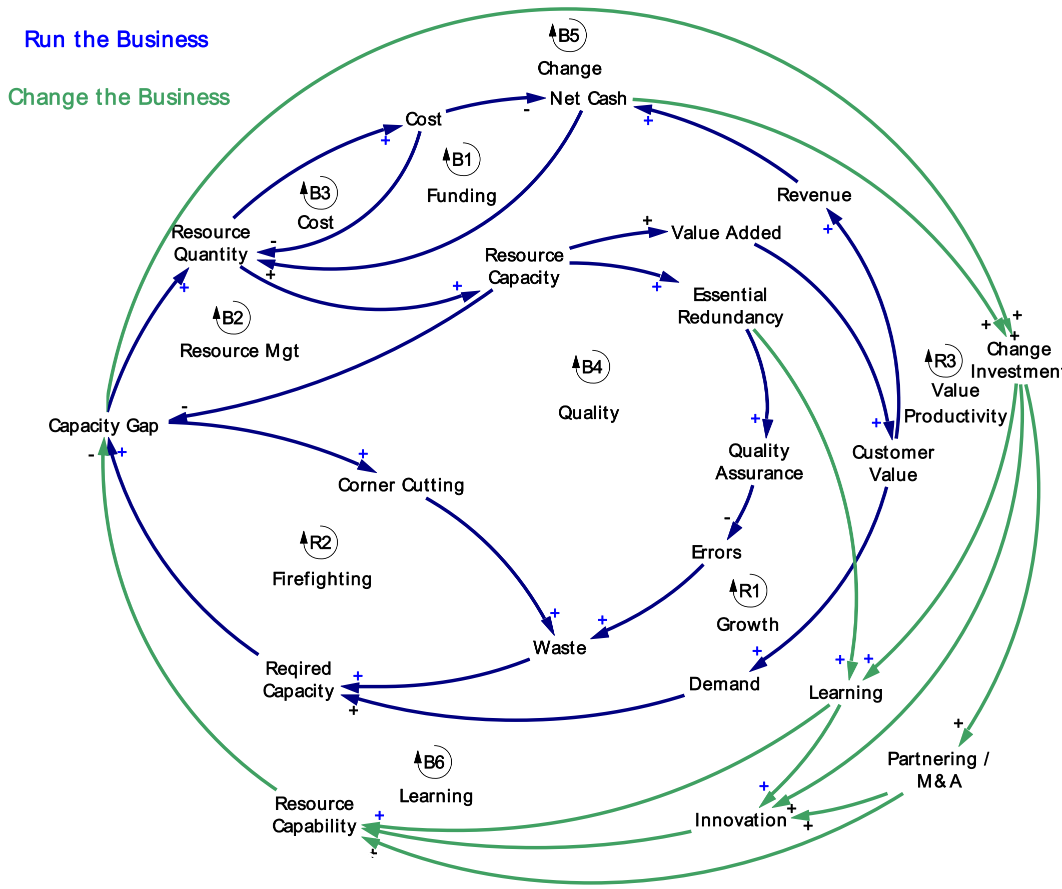

Figure 3.12: Run and Change the Business as a CAS

Run the Business (RtB) concerns growth, a reinforcing loop R1 which continues as long as customers are willing and able to pay for perceived value added output, until constrained through poor management of funding, resources, cost and quality, balancing loops B1 to B4, or external factors, such as competition and market saturation (not shown). Critically, growth is countered through firefighting, R2, where a resource gap encourages corner cutting forming a 'waste creates waste' loop, revisited in Chapter 6. Change the Business B6 shifts the causal structure by enhancing resource capabilities with the aim of increasing capacity for delivering intended value, the goal for this loop. This can be achieved by reducing consumption and cost or increasing customer value, thus increasing revenue, or acceptance to contribute through charges, taxes etc., in the case of public services.

There are two critical crossovers between RtB and CtB. First, B6 is conscious learning, such as Action and Informal Learning, through BAU activities directed to value creation. This involves double loop learning, for example continuous process improvement, and is only possible if facilitated through essential redundancy, i.e. spare capacity. Conversely, constant firefighting generally constrains all but single loop learning. Secondly, R3 concerns reinvestment in change from reduced consumption and cost, by eliminating waste whilst maintaining value delivery standards, to deliver greater value. R3 is Value Productivity and, critically for this research, is a self-sustaining reinforcing loop involving triple loop learning, such as business model transformation and cultural shifts. This only works if net positive cash from eliminating waste is reinvested into further capability to deliver value across all stakeholders in the ecosystem.

Three critical capabilities were identified from literature research and interviews concerning state of the art: rapid learning and translation of insights into value, designated agile learning, causal precision modelling of CAS and certainty through quantification of hard and soft measures and relationships.

3.8 Essence

This chapter explored state of the art thinking and practice relating to five focus perspectives encompassing the entire transformation process: Strategy, Investment, Implementation, Performance and Change. These perspectives reflect both temporal stages of, and specialist disciplines engaged in, change programmes. Significant innovations in each discipline, of direct relevance to value creation, are already being widely applied and continually under development. For example, Strategy Mapping, process thinking for investment appraisal, professionalisation and standards for project and programme management, performance management frameworks and recognition of the critical role for purposeful, diverse learning.

However, despite these advances, change programmes continue to fail in delivering intended stakeholder value, as evidenced in Chapter 2. This points to the problem lying not with specific disciplines in their own right but flaws in the causal coupling between them, in which respect two points are evidenced:

- Disciplines are generally conducted independently and causally uncoupled functionally
- Disciplines are generally conducted sequentially and causally uncoupled temporally

Value Productivity offers potential for delivering self-sustaining, equitable stakeholder value. To this end, Chapter 4 explores Meta-level failure patterns, which map to interfaces, with the aim of releasing Value Productivity by correcting the disconnections through functional and temporal integration.

4 Failure Patterns

4.1 Introduction

The Author's experience of persistent change programme failure to deliver stakeholder value across sectors, applications and countries is corroborated by primary research (Standish Group, 2015a) and observations by leading experts cited in Chapter 2. Standish Group (2014b, pp. 8-9) concluded that the most significant drivers of IT project failure converge under five categories corroborated by other experts, for example (Alami, 2016; Al Neimat, 2005), which map closely to change programme disciplines defined in Chapter 3 as shown in Figure 4.1.

- Unclear objectives and specification (Strategy)
- Unrealistic expectations (Investment)
- Weak programme management (Implementation)
- Failure to manage uncertainty and risk (Performance)
- Lack of senior commitment and user engagement (Change)

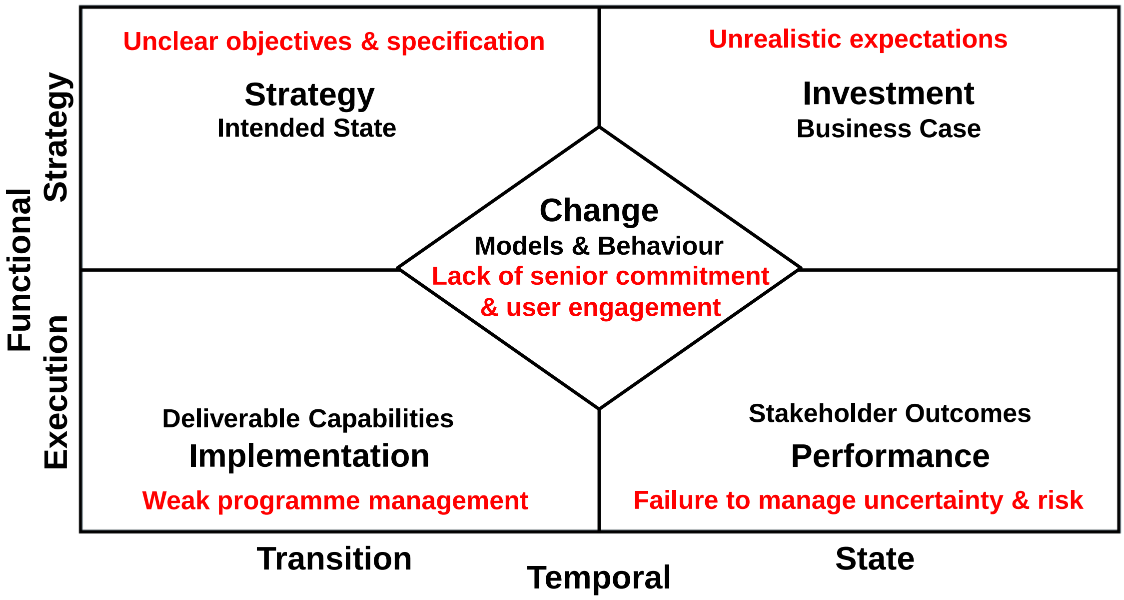

Figure 4.1: Reasons for Failure Mapped to Disciplines

However, the Author has direct experience of many programmes which met all these criteria yet still failed to deliver value, whilst others furnished transformational value despite performing poorly against the same measures. This chapter defines seven patterns defined through the Author's experiential observation which explain how this failure is a manifestation of fundamental flaws in causal thinking and behaviour. The failure patterns decouple strategy from execution in both function and time. They cover all interfaces between the focus disciplinary viewpoints covered in Chapter 3, as proposed and named by the Author below and shown in Figure 4.2.

- Pattern 1 Value Inversion: Solution before purpose
- Pattern 2 Value Imbalance: Conflict of intention
- Pattern 3 Value Mismatch: Event without a cause
- Pattern 4 Value Uncoupling: Cause without capability
- Pattern 5 Value Fragility: Function over value
- Pattern 6 Value Exposure: Assured to fail
- Pattern 7 Value Erosion: Lost in transition

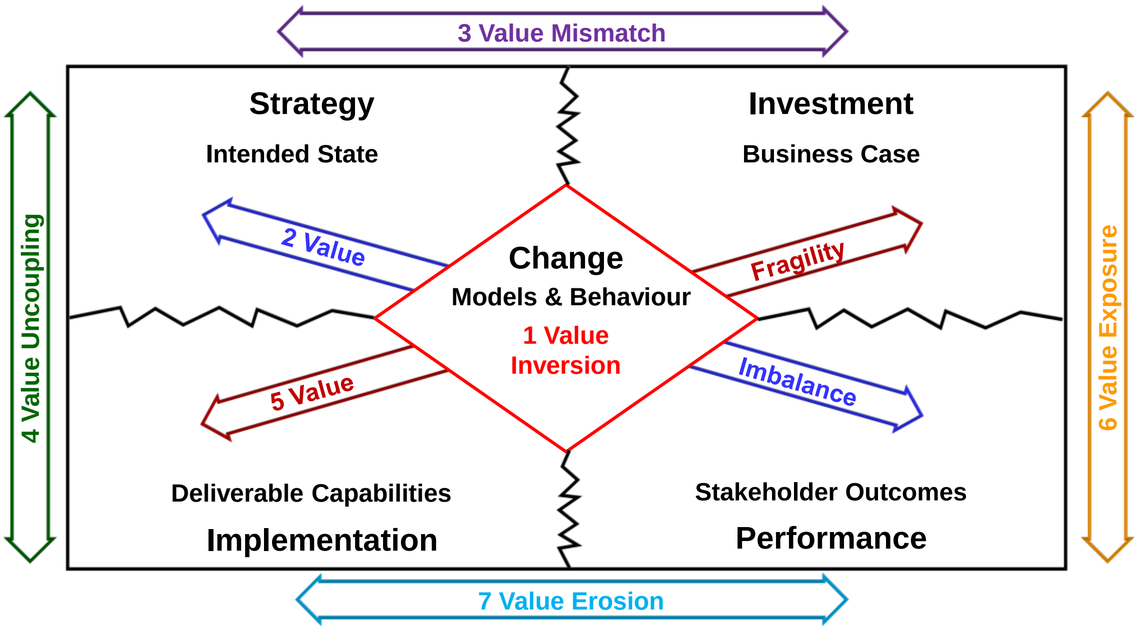

Figure 4.2: Failure Patterns Mapping to Change Perspective Interfaces

These archetypal patterns operate at a deep level of systemic causality, whereas the generally perceived reasons are surface level factors; important and often critical but only in the context of the systemic failure patterns. For example, no end of executive buy-in will substitute for flawed causal thinking which results in decoupling between deliverable functionality and changes in performance drivers essential to realise purpose

This chapter explores experiential and theoretical explanations for these Meta failure patterns and proposes imperative corrective capabilities. It is shown that these patterns emanate from flawed understanding and application of universal causal principles encapsulated within systemic thinking .The following sections define each of the archetypal patterns in turn, illustrated through case studies, mostly from the Authors experience, and explores their formation and manifestation. Although discussed individually the patterns overlap significantly, as do the disciplines to when they refer.

4.2 Pattern 1 Value Inversion: Solution before purpose

An assumed solution is chosen and implemented without adequate specification of, or causal linkage to, intended stakeholder purpose

Many change programmes start with an assumed solution and focus on functional execution without specifying either precise stakeholder(s) purpose or how the solution will cause outcomes which manifest that purpose. The consequence of this pattern is that even if compliant functional outputs are delivered efficiently on time and to budget, stakeholder outcomes often remain ineffective and intended value unrealised.

4.2.1 Real World Case: Welfare Delivery Automation

In the mid-1990s, UK government Benefits Agency (BA) embarked on an initiative to automate social welfare services, the largest IT programme in Europe at that time. With the sole purpose of reducing service provision cost, effort was directed on Business Process Reengineering (BPR); the current management fad with an efficiency focus. Welfare benefits were delivered through approximately 70 individual streams, called ‘chimneys’ managed as silos (Tett, 2015) but which involved key interfaces between them. For example, Housing Benefit was linked to Employment Benefit so that when the latter ceased so should the former, a trigger which relied on notification from the recipient. In reality, many claimants continued to receive payments incorrectly with most money permanently lost, in what BA called ‘leakage’.

The automation programme was run diligently under PRINCE2® (Axelos, 2013) yet no one questioned the narrow cost saving purpose. With Business Case responsibility, the Author calculated, using causal modelling, £20 million annual efficiency savings. However, leakage and fraud accounted for over £1 Billion each year. The programme was shown to be unviable under cost efficiencies alone and was shelved; saving further direct loss but missing the opportunity for much greater benefits through investment in effective fraud management, potentially requiring increased process investment (Davies *et al.*, 2011, p. 12).

4.2.2 Pattern Analysis: Why, How and What

First, it is necessary to define three terms which encapsulate the mental frame within which this pattern thrives: why, how and what. ‘Why’ refers to the intended purpose for change (Mirriam-Webster Dictionary, 2019d) and is dependent upon the specific stakeholder perspective. For example, purpose typically includes financial return, utility and salary for shareholders, customers and employees respectively. In the case study, ‘why’ concerns cost saving.

The definition for 'how' presents an ambiguity because it can refer either to the manner in which something causes a change or how something works or is implemented (Mirriam-Webster Dictionary, 2019b). In this context, 'how' refers to the former, i.e. causal process, through the question, "How must causal drivers change in order that the intended benefit is realised?" In the case study, the 'how' question would be answered with the causal linkage between changes in the process and cost saving.

'What' defines the characteristics of something (Lexico Oxford, 2019c). In this context, the 'something' is a deliverable, whilst characteristics are capabilities of the deliverable necessary for effecting changes in causal factors to realise intended stakeholder outcomes, i.e. benefits. In the case study, 'what' concerns the specific change to process Therefore, why, how and what can also be interpreted as benefit, driver and deliverable respectively. A key experiential observation, supported by research (Kotter, 1995; Drucker, 2006; Ackoff *et al.*, 2007), is that most change programmes are conducted with copious definition of functional deliverables but without a precise specification of purpose and associated stakeholder outcomes. This accounts for compliance with process and specified functional output but absence of causal coupling to intended benefits.

In Value Inversion, change programmes are conceived, designed, implemented and operated in the order: what, how, why; a frame corroborated by Engelbart (2003); (2012). For example, in this case study the surface presenting problem was articulated as, "Welfare services cost too much so we need to apply BPR", after which the programme was directed on how to conduct the reengineering. The 'how' question focuses on implementation of the assumed solution, not the causal linkage between the solution and realisation of intended purpose for the services.

Neither the real stakeholder purpose nor the causal means of realising the purpose are adequately defined or quantified. Typically, purpose is addressed through a business case, but only after the solution is decided and often manipulated for financial approval, a practice which Jenner (2009) describes as fraud. Almost all programmes in the Author's experience exhibit value inversion to some extent; especially in the consultancy arena which is commercially structured to promote fads, such as BPR, and perpetuated by government engagement of big players who peddle them (Craig, 2005; Craig *et al.*, 2006; Craig, 2008).

4.2.3 Resolution: Do the right things then do things right

The proposed correction of this flawed approach comprises three elements. First, purpose is specified in terms of precise intended outcomes behind which all stakeholders own a 'failure is not an option' commitment. Second, changes in causal drivers in the organisation and environment needed to realise intended benefits are defined. Thirdly, an intervention is designed which most effectively causes changes in these factors. This frame, encapsulated through the question order, why, how and what, is deployed in the principles and framework, Chapters 6 and 7 respectively, then validated using case studies covered in Chapter 9.

4.3 Pattern 2 Value Imbalance: Conflict of intention

Stakeholder intentions conflict and change programmes favour one or more stakeholder interests at the expense of others

Potential and realised value from change programmes is often perceived by stakeholders to be distributed unfairly between them, for example imbalance between shareholders and employees (Adam Cobb, 2016) reflected in disparity between productivity and earnings discussed in Chapter 2 (Stansbury *et al.*, 2017). Cost cutting to maximise financial returns for shareholders (Kaiser *et al.*, 2013) is often at the expense of stress on staff and suppliers, along with poor quality for customers. The consequence is suboptimal creation or destruction of value due to behavioural conflict resulting from misalignment of values, i.e. what is most important to each stakeholder. In the context of value, this problem relates to stakeholder purpose and intended outcomes, operating as triple loop learning (Tosey *et al.*, 2011) and the solution involves a shift in mental and business model from profit to purpose maximisation.

4.3.1 Real World Case: Procurement Policy

As one of the largest UK electronics companies, Plessey supplied state of the art command and control systems to civil and defence markets worldwide. Bought-in components accounted for over 70% of the cost base. The procurement policy reflected this high proportion by adopting an openly declared policy of lowest price from three separate vendor quotes, as a means to impose competitive pressure on suppliers. This made financial sense in the traditional cost-plus defence contracts where inefficiencies and risks were covered by the UK Government. As Chief Mechanical Engineer, the Author conceived, designed and managed a Computer Integrated Management (CIM) programme with the purpose of building necessary resilience needed to remain viable in the new competitive market, most notably involving shifts from cost-plus to fixed price and risk from customer to the provider (Davies, 1989).

The CIM initiative exposed a major flaw in the procurement policy. Procurement ‘success’ by minimising bought-in costs, came at the expense of suppliers who cut corners to claw back squeezed margins and Operations dealing with poor delivery timing and quality, in missing and sub-standard parts. This manifested in ‘Progress Chasers’, called ‘Expeditors’ in the US, manipulating component packs designated for batch assembly by Manufacturing Resource Planning (MRP II). The management overhead, representing waste in Lean terms, was borne by the customer under cost-plus, but far outweighed any savings in procurement in the new fixed price landscape.

4.3.2 Pattern Analysis: Conflict of stakeholder intended outcomes

A fundamental challenge in aligning stakeholder value is conflict between sustainable desired outcomes and short term financial imperatives. For example, shareholder motivation centres on financial return, maximised by increasing revenue through price and reducing quality in order to contain cost; revenue minus cost being the value equation for business. Conversely, the value equation for customers is utility to meet values, achieved through quality, minus price; diametrically opposite to shareholders. Conventional economic wisdom assumes that people act rationally and that these conflicts are balanced naturally (Smith, 1776, p. 445). However, as discussed in Chapter 2 many economists, such as Stiglitz (2012); Reich (2016); Raworth (2017), now challenge the validity of this rational view of human behaviour, as does neuroscience research (Kahneman, 2011). Their contention is evidenced by increasing imbalance in wealth between stakeholders caused by ineffective operation of markets and unsustainability of the GDP model of growth.

Categories of stakeholder form the basis of most performance management frameworks, notably Balanced Scorecard (Kaplan *et al.*, 1996) and Business Model Canvas (Osterwalder *et al.*, 2010) covered in Chapter 3. Key stakeholders are owners, such as shareholders, customers, staff and suppliers. From a purely financial transaction perspective, desired components of value between stakeholders are in conflict. For example, shareholders seek return on investment (ROI), which ultimately translates into the business generating profit distributed as dividends or capital gain through retained earnings. Profit is most obviously maximised by minimising cost of employees and purchases from suppliers and maximising price for a given demand from customers.

These conflicts can manifest as power struggles between different stakeholders, as shown in Figure 4.3, which default to lose-lose, lose-win or win-lose outcomes revisited in Chapter 6. This business model supports shareholder value supremacy, centred on continuous reinforcing growth of share price and earnings per share (EPS), fed through short term profit maximisation in order to satisfy perceived market sentiment; red line thinking (Kaiser *et al.*, 2013). Customer value then focuses on market share, balancing price with volume, which Warren (2008) shows to be false systemically. Staff resources are viewed as a cost which must be contained along with suppliers through negotiation on price minimisation. Critically, the relationships with customer, staff and supplier stakeholders are balancing towards sub-optimal value creation within the entire business ecosystem.

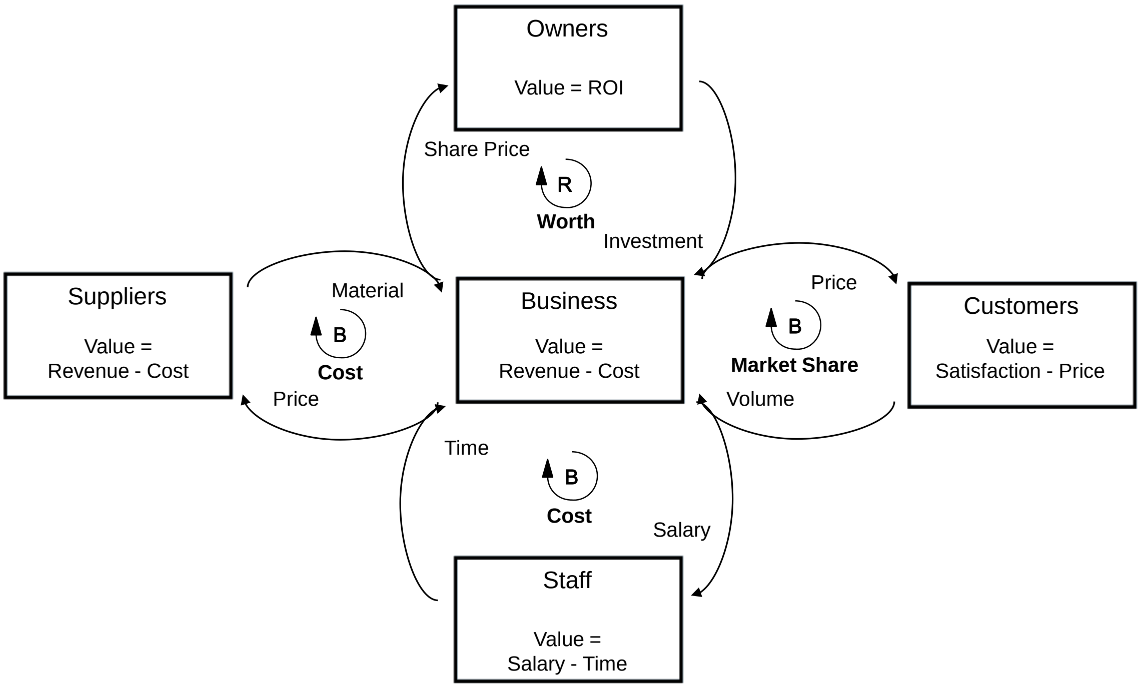

Figure 4.3: Transactional Value Equation for Key Stakeholders

4.3.3 Resolution: Specify mutual stakeholder intentions

The challenge is to determine how respective stakeholder value equations would need to be constructed in order to design a business system which defaults to collaboration, win-win. This is explored through research covering value relationships between key business stakeholders in the context of long-term sustainability of business performance and consequential stakeholder value. More specifically, mutual value linkage between the business and each stakeholder is examined in Chapter 6.

4.4 Pattern 3 Value Mismatch: Event without a cause

Change programmes focus on surface level problems and events rather than underlying patterns of cause and effect

In Chapter 2, it was shown that value is constructed from three building blocks, inputs, outputs and outcomes, together with the relationships between them. However, in change programmes attention is often focused on only one of these components at the expense of other elements. Examples include: maximising efficiency through cost cutting but in doing so reducing effectiveness of outputs to deliver intended outcomes (input focus), rewarding performance on outputs which fail to provide intended outcomes (output focus) or 'gaming' the system to deliver unsustainable short-term outcomes (outcome focus). These patterns, closely related to Pattern 1, result in misalignment of causality between components and consequential destruction of value through suboptimal energy transformation of inputs into outcomes. In the context of value creation, this problem concerns the causal misalignment between drivers of performance and stakeholder outcomes, operating at double loop learning (Smith, 2013)

4.4.1 Real World Cases: Misaligned Targets

The mental model behind what Pink (2011) calls Motivation 2.0 is founded on the premise that rewarding behaviour produces more and punishing it results in less; the thinking behind most performance targets. This mental model is both intuitively compelling and deeply ingrained within politics, society, economics and business; but flawed. For example, high levels of waste and failure in the UK government have been attributed to performance targets under command and control regimes (Seddon, 2003; Seddon, 2008), three extreme examples of which are presented below.

Case 1: Stafford Hospital

As many as 1,200 people died needlessly at Stafford Hospital between 2005 and 2008 as managers cut costs and slashed nursing numbers in a bid to meet government targets and win foundation status (Daily Telegraph, 2013). The subsequent public enquiry cited a culture focused on "doing the system's business rather than that of the patients" as a primary cause of the disaster (Francis, 2013, p. 4).

Case 2: Baby P

On 3rd August 2007, 17 month old Peter Connelly, 'Baby P', died with fifty injuries after eight months of abuse by his mother's boyfriend, despite involvement by numerous local agencies conducting reviews and over fifty visits by Social Services. LSCB Haringey (2009, p. 22) reported that at no point did it occur to anyone that the injuries were caused by someone else apart from the mother, who they concluded was unlikely to have inflicted them. This pattern is explicitly modelled using Systems Thinking and System Dynamics by Lane *et al.* (2016) in relation to child protection (Munro, 2011), citing three unintended vicious circles resulting from 'compliance addiction. First, low morale and consequential high staff turnover and absenteeism. Secondly, inability to apply the necessary level of flexibility, i.e. requisite variety, to meet precise needs of specific cases. Thirdly, failure to learn.

Case 3: Knife Crime

Under stress to demonstrate success in tackling knife crime, a previous Home Secretary pressurised officials to release figures which appeared to suggest that knife crime was down in ten hotspot areas. Some police forces involved later revealed that knife crime had actually risen for certain offences. Sir Michael Scholar, head of the UK Statistics Authority, said officials had asked the government not to release "unchecked" and "selective" figures, an intervention that forced the Home Secretary to apologise publically (Daily Telegraph, 2008).

4.4.2 Problem Analysis: Systems Thinking

Surface Events versus Deep Causes

Misaligned targets expose the distinction between visible surface level problems and underlying causes which are often obscured. Recognition of reality beyond our immediate perception is expressed across many religions, notably Buddhism (Causton, 1995, p. 182) and reflected in Systems Thinking (Senge, 1990, p. 52) where it is often represented by the Iceberg Model (Goodman, 1997). Equivalent depictions are NLP Logical Levels by Dilts (1990, p 56) and Integrated Performance (Watkins, 2014, p. 3; Watkins, 2016, p. 82) for change and performance respectively. Simplified versions are mapped in Figure 4.4. Ackoff (1978, p. 113) also reinforces relational importance in causality and the need for awareness of multiple reality levels for this research led to Critical Realism (Bhaskar, 2008) as the philosophical framework, covered in Chapter 5.

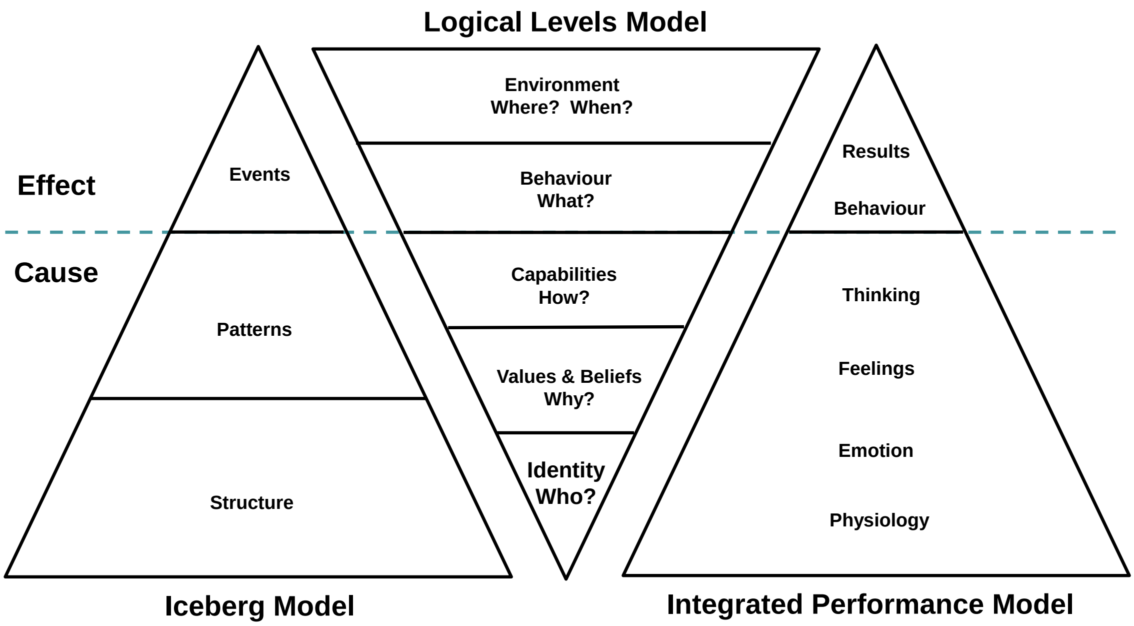

Figure 4.4: Iceberg – Logical Levels – Integrated Performance Models Mapping

Input, Output and Outcome Focus

Closely related to levels of reality is direction of focus, categorised under input, output and outcome and subsequently used to build universal value-related equations in Sections 4.5 and 4.6.

Input Focus

Input focus dominates where economy, i.e. cost in relation to inputs, is prioritised above both outputs and outcomes. The first case (Stafford Hospital) is a typical example of input focus where cost containment becomes the primary consideration and performance is measured in relation to cost minimisation and budgetary control. Input focus is also rife in commercial business manifested as cost cutting to increase short-term profitability in order to increase share price, red line strategy, but only at the cost of sustainable financial health (Kaiser *et al.*, 2013).

Output Focus

Emphasis on outputs in relation to inputs forms the basis of virtually all productivity measures. In the second case (Baby P) Social Service reviews and visits are the outputs of a process intended to protect children from abuse. The process itself was reviewed on the basis of performance targets, number of visits, and deemed to be excellent, upon which grounds a court ruled in favour of the Head of Social Services, previously dismissed on direction from the Home Secretary (The Guardian, 2014). However, in this example of output focus, purpose was not realised because the core outputs, visits, were ineffective in achieving the intended outcome, safe children.

Outcome Focus

Whilst input and output focus are not necessarily related to outcomes in any simple way, the third starts with outcomes, the premise being that this will automatically drive necessary behaviour. However, the problem concerns gaming of the system (Rieley, 2001) and bias (Kahneman, 2011). Reduction in knife crime is clearly an outcome because of the direct impact on stakeholders, i.e. victims and people living in danger directly or fear of it. However, this is an example of what frequently occurs with outcome focus where reporting is biased to present a desired reality; a form of manipulated reframing otherwise known as spin (Longman, 2020).

System Archetypes

Input, output and outcome focus all violate principles of Systems Thinking by injecting conflict which cause unintended consequences (White, 2012), often through one or more system archetypes (Senge, 1990; O'Connor *et al.*, 1997; Wolstenholme, 2004). Systems archetypes comprise structures of reinforcing and balancing loops. Wolstenholme (2003) consolidates the pairings into a small number of generic causal structures, emphasising the importance of boundaries between the system and environment, a focus consistent with other systems thinkers (Beer, 1984; Checkland, 2000).

The example of input focus is a subtle instance of 'shifting the burden' archetype, where favouring one part of the system transfers stress to other parts, and also 'success to the successful', in this case reward in the form of foundation status perpetuates flawed behaviour. Output focus often results in a 'fix that fails' archetype where action is incorrectly equated with outcome. Outcome focus encourages 'eroding goals' where either the actual outcome is knowingly exaggerated, as in this case, or standards are lowered, for example examination marking; both elevating perceived results above actual achievement.

4.4.3 Resolution: Align value causality

Inputs are resources needed to produce outputs. In the context of change programmes inputs translate into deliverable capabilities which involve and consume resources to enable outputs. For example, the capability to perform medical operations involves doctors and consumes disposables and money. Outputs, such as medical operations, social visits and arrests for knife possession, are the means by which deliverables provide intended stakeholder outcomes through effective utilisation of outputs; well patients, cared for children and safe citizens. This generic logic is reinforced using the following examples:

- A new hospital (deliverable) provides the capability for more operations (output) which is of value to patients (stakeholder) only if their wellbeing (outcome) is improved
- A new university campus (deliverable) provides capability to increase the (output) of qualified students (stakeholder) who create value (outcome) only if the qualification and learning enable realisation of their potential.
- A new police command and control system (deliverable) increases capability for more arrests (outputs) of value only if citizens (stakeholder) experience reduced crime and fear (outcomes)
- New social welfare policy funds (input) support visits (outputs) to problem families (Stakeholder) of value to recipient families and society (stakeholders) only if delinquent behaviour is eliminated (outcome)
- A new high-speed railway (deliverable) increases capacity for journeys (output) of value to passengers (stakeholder) only if intended purpose (outcome) of a journey is met reliably, comfortably, economically and on time.

Two key observations are evident from the examples. First, inputs do not assure intended outputs, and intended outputs do not guarantee stakeholder outcomes. Inputs and outputs are necessary but not sufficient and no matter how efficiently inputs produce outputs, stakeholder value will not be realised unless the outputs are effective in enabling intended outcomes. The key is aligning transformation of inputs, manifested as deliverable capabilities, into outputs and outputs into outcomes. Secondly, whereas inputs and outputs are neutral, outcomes are stakeholder specific; value needs direction as well as magnitude; requiring shift from a scalar to vector quantity.

4.5 Pattern 4 Value Uncoupling: Cause without capability

Change programme deliverables are not linked causally to changes in drivers needed to realise intended stakeholder outcomes

Functional deliverables from change programmes often have weak or no influence on effectiveness and efficiency essential for creating sustainable value. Typically a consequence of value inversion, the result of this decoupling is direct waste in resources and associated cost, together with loss of intended stakeholder benefits. In the context of value creation, this problem refers to a failure of programme deliverables to cause changes in performance drivers needed to deliver intended stakeholder outcomes, operating at single loop learning (Argyris, 1976).

4.5.1 Real World Case: Call Centre Capacity

Eurostar operates high speed trains between London and key European cities. Soon after opening, the company became a victim of its own success with the volume of enquiries exceeding handling capacity of their Ashford contact centre. This resulted in lost calls, which not only squandered immediate sales but also, more significantly, led to permanent customer attrition to competitors, such as low cost airlines. The solution to increase capacity seemed obvious; reduce call times and get a bigger automated answering switch to stack more calls; simple operation and technology challenges.

However, the Contact Centre Manager was not convinced that the resolution was so simple and commissioned a business case. His challenge was proved wise as the value-based analysis revealed a far more complex picture. Although there was a capacity problem for call handling, this was not due to volume alone but the increasingly involved nature of customer requirements, as Eurostar now cross-sold car hire, hotel accommodation and theatre tickets, in order to enhance overall customer experience and attract new revenue streams. The key to this value-add strategy lay in facilitating the skills mix and specialist call routing needed to manage the predicted increase in call volume and mix within, and between, business and leisure segments. Effectiveness in matching customer need had far greater leverage on sustainable profitability than operational efficiency gains through minimising call times. Also, a badly handled call generated repeat calls; waste.

4.5.2 Pattern Analysis: Construction of Universal Value Equations

Change programmes must succeed on two fronts. Most obviously, they must be efficient in how they develop functional capabilities, deliverables, in terms of compliance, cost and timing. This is the focus of project management reflected in methods such as PRINCE2® (Bentley, 2010; Axelos, 2013). Critically however, those capabilities must deliver effective stakeholder outcomes. Consequently, it is deemed insufficient to focus solely on the former; it is also essential to consider how programmes ensure that intended outcomes are realised by stakeholders. Although programme and portfolio management (OGC, 2007b; OGC, 2008; OGC, 2010) are intended to focus on delivering benefits, Chapter 2 evidenced that this intention is not being realised.

Effectiveness and Efficiency

At the core of this failure pattern is a misunderstanding of, and relationship between, effectiveness and efficiency, which Drucker (2006, pp. 1-2) relates to doing the right things and doing things right respectively. He also associates leadership and management with effectiveness and efficiency (Drucker, 2001); expressed in a similar vein by Ackoff *et al.* (2007, p. 75) in his f-law, “Administration, management and leadership are not the same thing”. From a value perspective, it is shown that effectiveness is the degree to which outputs enable outcomes, whereas efficiency is a measure of output produced for a given input. It follows that effectiveness is the degree to which purpose, expressed as outcomes, is realised through outputs.

It is now possible to derive three key universal equations relating to value using the energy transformity frame proposed by Odum (2007, p. 272) introduced in Chapter 2 and reshown in Figure 4.5.

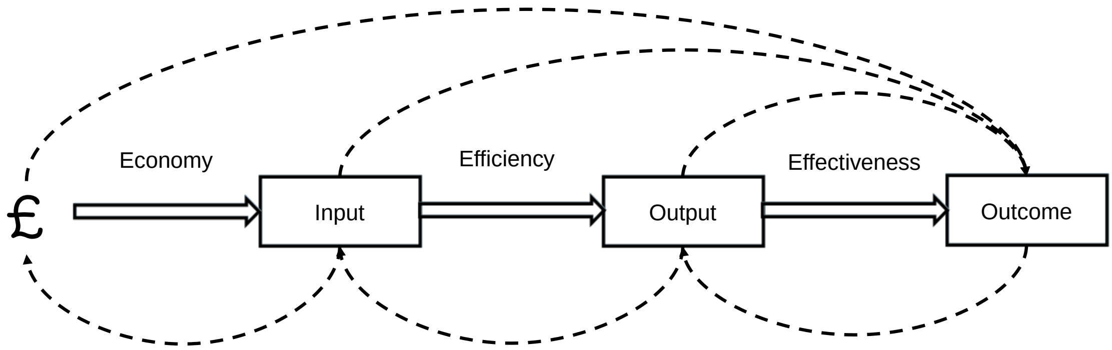

Figure 4.5: Value Transformity

Value Equation

Absolute

In absolute terms Value is the difference between an outcome and the input needed to realise that outcome. This is also consistent with the equation proposed by Fifield (2018), which includes risk and price. For practical purposes, outcome is synonymous with benefit and input with cost. Therefore, it follows that:

$$\text{Value} = \text{Outcome} - \text{Input} = \text{Benefit} - \text{Cost} \tag{4.1}$$

Quotient

This absolute definition of value requires input and outcome to be in the same units; ideal when dealing with commercial business, e.g. income - cost. However, where benefits are non-financial, it is necessary to reconcile different units. This can be achieved by expressing the

Value Equation as a ratio of outcomes to inputs (University of Utah Health, 2018); for a given monetary unit.

$$\text{Value} = \text{Outcome} / \text{Input} = \text{Benefit} / \text{Cost} \tag{4.2}$$

Value Productivity

Productivity is typically defined as output per resource consumed in the transformation process, i.e. output per input (Business Dictionary, 2016b). However, this excludes effectiveness. Value Productivity is a complementary measure which returns to the quotient definition of value. Davies *et al.* (2011, p. 32) define effectiveness as outcome for a given output and efficiency i.e. output per input independent of monetary unit, which is consistent with Odum's transformity and leads to:

$$\begin{aligned} \text{Value Productivity} &= \text{Outcome} / \text{Input} = (\text{Outcome} / \text{Output}) \times (\text{Output} / \text{Input}) \\ &= \text{Effectiveness} \times \text{Efficiency} \end{aligned} \tag{4.3}$$

Value for Money

Value for Money (VfM) is defined as the balance between Economy, Efficiency and Effectiveness (OECD, 2012; NAO, 2017) which can be expressed mathematically. Further, the product of these relationships provides a practical financial value performance measure, outcome per unit of cost, returning to value as a quotient using benefit and cost.

$$\begin{aligned} \text{VfM} &= (\text{Input} / \text{Cost}) \times (\text{Output} / \text{Input}) \times (\text{Outcome} / \text{Output}) \\ &= \text{Economy} \times \text{Efficiency} \times \text{Effectiveness} \\ &= \text{Outcome} / \text{Cost} = \text{Benefit} / \text{Cost} \end{aligned} \tag{4.4}$$

4.5.3 Resolution: Eliminate waste and respect essential redundancy

Decomposing value into three elements enables a precise means of diagnosing problems and targeting interventions which integrate efficiency and effectiveness. A common approach is to minimise staff cost, evidenced as the 'gig' economy (Wilson, 2017), rather than remove waste and invest in greater effectiveness. However, considering transformities between inputs, outputs and outcomes from all stakeholder perspectives makes it possible to build more sustainable interventions which eliminate waste, not only to reduce cost but also increase capacity, essential redundancy, to enhance effectiveness in value creation.

4.6 Pattern 5 Value Fragility: Function over value

Change programmes are structured to optimise delivery of functional efficiency rather than resilience to ensure stakeholder value outcomes

Even if solutions are potentially effective, change programmes tend to focus on functional efficacy of, and dependence between, deliverables rather than optimising potential stakeholder value through their capabilities. This failure pattern is manifested in two opposite ways. First, all technical aspects of an intervention are assumed to be necessary before use and duly implemented. However, with causal alignment, value can often be created safely and sustainably after partial completion. Conversely, under pressure to meet targets, essential functionality is completed but with errors (Howick *et al.*, 2001). The result in both cases is sub-optimisation and poor resilience of energy transformation into value. This is a problem of misalignment between inputs, outputs and outcomes operating at all, single, double and triple, learning levels.

4.6.1 Real World Example: New Banking Product

At the time, Barclays owned the largest high street network and retail market share. However, the company had a comparatively smaller proportion of business banking and was undertaking an urgent transformation to become one of the top five players within an ambitious timescale. An important element of the strategy involved cross-selling existing products by exploiting their network and retail market dominance. The most important of these services was Invoice Discounting, involving supplier invoice management on behalf of clients, mainly small and medium-sized enterprises (SME).

The programme was configured to deliver three core capabilities: service automation using an electronic network, essential process changes and product sales skills within branches, sequentially and prior to live operation. Although the initial business case, for which the Author was responsible (Davies *et al.*, 2011, p. 129), returned a positive NPV, analysis of the causal dynamics exposed three weaknesses in the context of value optimisation. First, the minimal concurrent working between deliverable phases imposed inherently long duration before positive cash flows. Secondly, no positive cash flows were projected until completion of the all three phases. Thirdly, by implementing electronic automation first, this injected both highest cost and risk early in the programme.

4.6.2 Pattern Analysis: Magnitude and Timing Dimensions of Value

Value is created from magnitude, size of outcome, and timing, when outcomes are realised by stakeholders. Under this frame, units are again of prime significance. When both costs and benefits are the same units, as is the case with money, both absolute and quotient expressions of value are straight forward. However, for this research it is crucial to measure value when benefits are non-financial, for example, well patients, safe citizens, housed people, timely and safely journeyed passengers and appropriately employed graduates, where the absolute representation of value is problematic due to incompatibility of units.

Value of Time

What none of the equations constructed in 4.5.2 makes explicit is that time has a value in its own right because value delivered earlier in a programme is generally worth more than the same value delivered later. The time value of money has long been recognised by the financial fraternity and for investment decisions reflected in Discounted Cash Flow (DCF) techniques covered under Chapter 3. However, time is often critical for non-financial benefits. For example, housing homeless people, reducing violent crime or protecting people through a COVID-19 vaccine in the first year, are patently of greater value than the same number of people benefiting later. The importance of timing for non-financial benefits is accommodated using the proposed concept of Value Power, rate at which stakeholder value is realised.

Value Power

In physics power is defined as the rate at which work is done. Work and energy have identical units, so power is also the rate at which energy is transformed. By framing value as transformation of energy (Odum *et al.*, 2000; Odum, 2007), Value Power can be defined as the rate at which value is created per unit time. Therefore, by incorporating time the three equations in Section 4.5.2 can be translated into equivalent value power relationships:

Value Power = Value / Time = (Benefit – Cost) / Time (4.5)

Value Productivity Power = (Output / Input) / Time (4.6)

Value for Money (VfM) Power = VfM / Time = (Benefit / Cost) / Time (4.7)

Equation 4.5 uses value as an absolute quantity and is applicable where the benefit and cost components of value are in the same units, normally money. Equations 4.6 and 4.7 are also applicable if the numerator and denominator are in different units.

Value Journey

Value creation can also be framed as a form of Learning Journey; the transformation of purpose into performance (Crick, 2017). Whether internal, for example increasing the capacity to learn through increased Learning Power, or external, such as the physical manifestation of outcomes through application of learning, journeys involve the transformation of energy to create value. In Chapter 11 it is proposed that a change programme is an instance of Learning Journey called ‘Value Journey’.

4.6.3 Resolution: Optimise value resilience in magnitude and time

The concept of Value Power can be applied to measure the status of change programmes, in the context of a Value Journey, as the rate at which learning is translated into manifested stakeholder outcomes. Rate comprises magnitude and time. Therefore, Value Power provides a means to optimise both magnitude and time of stakeholder value delivery. The equivalent value power equations for a programme are:

Programme Value Power = Value / Time = (Benefit – Cost) / Time (4.8)

Programme Value Productivity Power = (Output / Input) / Time (4.9)

Programme VfM Power = VfM / Time = (Benefit / Cost) / Time (4.10)

A challenge is accounting for the time value of non-financial outcomes, one approach being to discount benefits using the same principle as time value of money, ensuring that any disproportionate importance relative to money, for example saving lives, is respected; raising ethical issues outside scope of this research. Another is aligning values (Sierra *et al.*, 2019).

4.7 Pattern 6 Value Exposure: Assured to fail

Change programme costs are missed or understated, benefits misattributed or exaggerated and risks unaccounted for or underestimated

This pattern most often manifests through a combination of pressure to justify the business case against defined acceptance criteria, which Jenner (2009) calls out as fraud, and various forms of human bias expanded in Section 4.7.2 and defined in Appendix D. The problem is exacerbated through poor specification of criteria by which value and risk are assessed, together with inadequate provision for prevention and mitigation (OGC, 2007a; Hubbard, 2009). The consequence is excessive risk exposure, which when manifested results in value destruction.

4.7.1 Real World Case: Mission Critical Outsourcing

Federal Commonwealth Law Enforcement Board (CLEB) of Australia is responsible for countering fraud, such as money laundering. CLEB was reaching a final decision concerning options for the future management of their operational IT services. A major driver behind the decision to change was cost and CLEB commissioned a business case with which to compare the financial alternatives. The essential choice boiled down to continuing to manage IT in-house or outsource the services to a third party. The mission critical nature of the services meant that it was particularly important to factor risks into the investment appraisal. Consequently, the cost-benefit case was overlaid with a causal risk analysis which quantified the financial effects of key threats on both IT suppliers and users assuming that the current service level was maintained.

The specific effect of risk was quantified in terms of cost, incorporated into the DCF Analysis and displayed as an overlay on the NPV plot (Davies *et al.*, 2011, p. 151). The initial DCF Analysis of Costs, which excluded the effects of risk, appeared to render the decision to outsource easy. However, once risks were quantified and overlaid onto the DCF a very different picture was revealed, in which the comparative analysis was reversed. Examples of risk that accounted for such a marked difference included: configuration management, business continuity, security and capacity management, specialist expertise and disaster recovery, all examples of essential redundancy (Cambridge Dictionary, 2019e). The facility stayed in-house on the strength of this analysis.

4.7.2 Pattern Analysis: The Neurology of Value

Successful value creation requires two critical elements: predictive capability upon which good decisions can be made and sound decision making between alternatives. Both are driven by mental models, together with the physical models and data which support them. Therefore, it is crucial to account for the neurological processes and patterns involved in value creation. Some of the most insightful advances in neuroscience concern how humans deal with decisions under predicted probability of risk, encapsulated in Prospect Theory (Kahneman *et al.*, 1979; Tversky *et al.*, 1992). The most pertinent concepts for the new value theory further developed by Kahneman (2011) are:

- Characters: Systems 1 and 2
- Species: Econs and Humans
- Selves: Experiencing Self and Remembering Self
- Law of Least Effort
- Heuristics and Biases

Characters: Systems 1 and 2

System 1 includes intuition, which Kahneman (2011, p. 11) attributes Simon (1992) for defining as recognition. System 1 naturally seeks cause and effect, often from patterns, which it generally does well, but is also lazy and fallible, particularly under stress. Gladwell (2005) defines slicing as the ability of our unconscious to recognise patterns (Wheatley, 2006, p. 130). System 2 is slow, conscious and deliberate but critical for moderating the excesses of, and challenging overconfidence in, System 1. However, analysis requires effort and is the result of much shorter human evolution. We also tend to categorise the world into ‘black and white’, inserting a gap between extremes which does not exist and severely limits the validity of our mental models of reality, demanding ‘factfulness’ to correct (Rosling, 2018). Systems 1 and 2 are closely associated with right and left brain hemispheres (Ornstein, 1997), relating to unconscious and conscious functions respectively, and specific brain regions (Baars *et al.*, 2013, p. 26).

Species: Econs and Humans

Kahneman also defines two types of species, the fictitious Econs who live in theory and Humans who inhabit the real world. The key distinction between Econs and Humans is rationality; Econs are rational, and not prone to heuristics or biases. Conversely, research provides overwhelming evidence that Humans, whilst possessing the capacity, are consistently not rational (Kahneman, 2011, p. 411). This finding presents a fundamental challenge to conventional economic theory, which treats Humans as completely rational Econs (Orrell, 2010; Chang, 2011; Rodrik, 2015; Orrell, 2017). It also relates to the core tenet behind this research, that no matter how advanced the technical functionality delivered from change programmes, intended stakeholder value will only be realised if Human aspects of implementation are accounted for effectively, taking into account real characteristics and frailties.

Selves: Experiencing Self and Remembering Self

The two selves concern how we actually experience life in the moment and how we hold memories of experience, an insight emerging from recent advances in neuroscience (Baars *et al.*, 2013). Memories of our history as told through 'stories' are inaccurate, notably through the interaction of two rules: peak-end and duration neglect; our biology has evolved to keep score of an average of peak and final experiences rather than duration (Kahneman, 2011, p. 380). Secondly, memories profoundly affect how we experience the present and associated behaviour, particularly decision making. Peak-end and duration neglect mean that we decide on longer periods of pain and shorter spells of pleasure than is rational in the context of real experience. Saved memories, used to keep score using System 2, are distorted and flawed due to biology relating to System 1. This finding is important when considering stakeholder outcomes and is applied to the Bacs Market Dynamics Model (MDM), detailed in Chapter 8 (Davies, 2018, pp. 32-35).

Law of Least Effort

If there is more than one course of action available to achieve the same outcome, people will gravitate to the route involving least effort for cogitative as well as physical exertion (Kahneman, 2011, p. 35). This evolutionary preference conserves energy by minimising consumption; laziness is built into our nature. This law provides an explanation for the human tendency to cut corners or convince ourselves that outcomes can still be achieved without adequate resources or by shifting the burden onto other resources, both examples of prioritising efficiency over effectiveness. Countering this tendency generally requires willpower. However, the process of 'flow', the state of effortless concentration (Csikszentmihalyi, 1990), provides an optimal experience for problem solving and value creation (Kahneman, 2011, p. 41).

Heuristics and Biases

Heuristics are simple procedures that help find adequate, though often imperfect, answers to difficult questions (Kahneman, 2011, p. 98), an example being anchoring in which suggestions hold greater influence than logically justified. Biases are largely unconscious simplifications which reflect our values and beliefs, built into our mental models and manifested through profoundly influencing our behaviour. A critical example for this research is Confirmation Bias (Kahneman, 2011, p. 81) which provides a scientific explanation for the Law of Attraction, often attributed to unproven metaphysical phenomena (Losier, 2007), such as we manifest what we focus on. Heuristics and biases are covered more comprehensively in Appendix D.

4.7.3 Resolution: Integrate intuition and analysis

Both neuroscience and real world experience confirm the intuitive energy of System 1 and analytical balance of System 2. The key is shifting from an 'or' mindset of competing one with another to an 'and' mentality of assimilating the positive attributes and counterbalancing the vulnerabilities; bias in the former and paralysis by analysis in the latter. The practical means of achieving integration is causal stories using precise questioning which translate into Fermi calculations (Hubbard, 2014). Just as creating value requires integration of intuition and analysis, so does assurance of certainty by identifying and mitigating risk of value destruction.

4.8 Pattern 7 Value Erosion: Lost in transition

Benefits are not tracked and neither adverse variance corrected nor positive opportunities exploited during or after implementation

In the Author's experience, corroborated by experts (Ward *et al.*, 2006; Bradley, 2010; Jenner, 2012), value realisation, which concerns manifestation of stakeholder value through performance, is a particularly poorly addressed aspect of change management. In most programmes, actual value is neither tracked nor variances in projected value against business cases corrected. The implicit assumption is that by managing programme deliverables to specification, time and budget, intended stakeholder value will inevitably be realised. However, changes to circumstances in the external environment, internal programme issues and poor causal linkage, conspire to ensure that potential value is eroded over time in the absence of continuous correction.

4.8.1 Real World Case: Defence Programme Reporting

A major UK Defence company (Defence) supplied advanced military technology to the British Ministry of Defence and friendly governments around the world, attracting the best people and delivering leading products. Programme values ran into hundreds of millions of pounds. The avionics technology was cutting edge, highly complex and carried significant risk. Consequently, strong Programme Management and tight reporting were critical and this was reflected in the monthly reports which comprised over twenty pages. These reports, far more complex than those typically used for PRINCE2® (Bentley, 2010; Axelos, 2013), covered all aspects of the programme and sections were linked in order to account for the complex interdependences. There was one page, however, which dominated focus for the monthly Programme Board Meetings; the financials.

Each programme was structured around delivery of a target margin to the company and, because programmes were fixed price, any escalation in cost eroded the client margin. Programme cost was managed using Earned Value Management EVM) (Fleming *et al.*, 2000; Webb, 2003; Ziyash, 2018). In order to cover the risk, several layers of contingency were used, technical, programme and management, requiring increasingly higher levels of authority to deploy.

Despite the sophistication of this reporting process, careers, reputation, bonuses and survival ultimately depended on delivering the margin and considerable pain was associated with reporting negative variances in this key measure. Consequently, the monthly reporting cycle became a process for ‘protecting’ the margin; outcome focus. It was generally recognised that it was no more painful to report reduced margin later in the programme, than immediately after it was known. In fact, the later in the programme bad news was declared, the greater the opportunity for excuses, such as other functions caused the issue. This situation created a pattern of problems being obscured in the reporting process for as long as possible, with the result that when they were exposed it was much more difficult to correct them and regain lost margin, if possible at all.

4.8.2 Pattern Analysis and Resolution: Harnessing Complexity

Recent advances in complexity and chaos theories (Waldrop, 1994; Mitchell, 2009) have attracted significant interest across social sciences and business in the context of navigating the new CAS landscape (Wheatley, 2006; Johnson, 2007; Miller *et al.*, 2007; Boulton *et al.*, 2015). There are two prominent lessons for change programmes: causal level and combining right first time with correction.

Causal Level

One consequence within business of neural biases, covered in Section 4.7.2, is a tendency to associate problem and organisational grade; the bigger the problem, the longer it takes to correct and higher the grade needed to address it. For example, if we need to resolve a major issue built up of a long period, we assume that this will take a proportionately large effort and long time, implemented at senior level. In stable linear situations, this is often the case because control structures reflect both work decomposition and span of influence. In other words, the organisational level coincides with both causal source and authority to deal with it. However, in a CAS this link is broken because not only are cause and effect separated in space and time but, as complexity also tell us, small causes can have large disproportionate effects due to interconnected relationships; a phenomenon known as ‘leverage’ (Senge, 1990, pp. 114-126).

Causal level refers to what the Author calls ‘point(s) of power’ in a system where and when the greatest impact is caused through leverage. For example, substandard quality in small components or lines of computer code, originating at an operational level, can cause catastrophic failure of an entire system, as evidenced by Boeing 737 Max crashes (Campbell, 2019). As with this case, the root cause usually conspires at multiple levels, for example Board level pressure to deliver against competition, inadequate tactical management of quality control and operational staff incompetence. Therefore, although the point of power is independent of organisational status, the system structure causes behaviour through which the problem emanates (Meadows *et al.*, 1972; Senge, 1990, p. 42; Meadows, 2009)

Starting Conditions and Feedback

Gribbin (2005, p. 3) crystallises the essence of Complexity Theory as comprising two simple ideas; the sensitivity of a system to its starting conditions and feedback. Combined, these properties create the 'butterfly effect', first postulated by Lorenz (Lewin, 1993; Gleick, 1997), in which very small causes can result in massively disproportionate effects. In a stable environment with relatively high predictive certainty, it makes sense to adopt a Right First Time (RFT) strategy involving fixed specifications and implementation plans.

RFT is clearly reflected in sequential 'waterfall' software development, in which each phase is completed and frozen before commencing the next. The penalties are cost, speed and lack of flexibility to change, to which a response is Agile (McCormick, 2012; Carroll, 2012) incorporating iterative processes, notably Scrum (Purcell, 2016), which is similar to a Deming Cycle (Deming, 1994, p. 131). However, as Pontin (2017) attests, practice often conflates tolerating errors with agility, malfunctioning applications being the result, a flaw which can be corrected through Test Driven Development (TDD) (Beck, 2003; Harding, 2018).

4.8.3 Resolution: Combine right first time with correction

Both interventions and change programmes implementing initiatives are instances of CAS, in which it is not possible to 'plan out' all risk due to the inability to predict emergent behaviour precisely. Conversely, errors injected into a CAS can easily infect other parts of the system, amplifying their impact. The optimum approach, as demonstrated through modelling the programme dynamics for this real world case (Impact Dynamics, 2018), is to build in sufficient resilience into initial preparation and reduce risk through sound planning, then detect and eliminate residual errors as early as possible. As this case shows, it is critical to undertake this process in context of the entire system in order to account for interdependence across functions.

4.9 Essence

Part I needed to establish five things: the problem, why it matters, how it is being caused, redress for the causes and key prerequisite capabilities for deployment if the redress is to be effective. Chapter 2 evidenced that change programmes are failing to deliver intended stakeholder value and associated impact, equating to around 8% annual GDP, and leaving untapped headroom for the UK of up to 30% GDP through productivity differential with comparable economies. This raises the question whether deficiency lies in existence and effectiveness of programme disciplines and their deployment, or flawed integration.

To this end, Chapter 3 explored state of the art spanning key aspects of change, concluding that disciplines, together with associated methods and tools, are generally advanced, effective and widely deployed. However, the scrutiny exposed fractures between disciplines in both function and time. Chapter 4 examined this uncoupling through seven archetypal failure patterns, derived through the Author's experience which map to the interfaces. Proposed remedies for each pattern are subsequently translated into Value Principles in Chapter 6 and phases of the Value Power Framework in Chapter 7.

The overarching conclusion is that both environments targeted for change and programmes effecting change constitute CAS, characterised by vast scope, fast pace and relational complexity. Combined, these attributes are manifested in ambiguity and uncertainty. Three prerequisite capabilities for addressing the failure patterns within today's CAS landscape are identified from the literature research and subject expert interviews. First, under conditions of uncertainty and ambiguity agile learning, involving rapid transformation of insights into value, becomes essential. Secondly, learning informs and is directed by causal precision of our models of reality. Thirdly, causal certainty is injected into models through correct measure specification and quantification.
Each capability, assigned C#, requires achievement of objectives, designated O#.#, shown in the form of a simple systemic map comprising three interconnected reinforcing feedback loops in Figure 4.6.

- **R1 Value Transformation**: Translating purpose into performance
- **R2 Purpose**: Specifying and remaining on purpose
- **R3 Performance**: Specifying and remaining on performance to achieve purpose

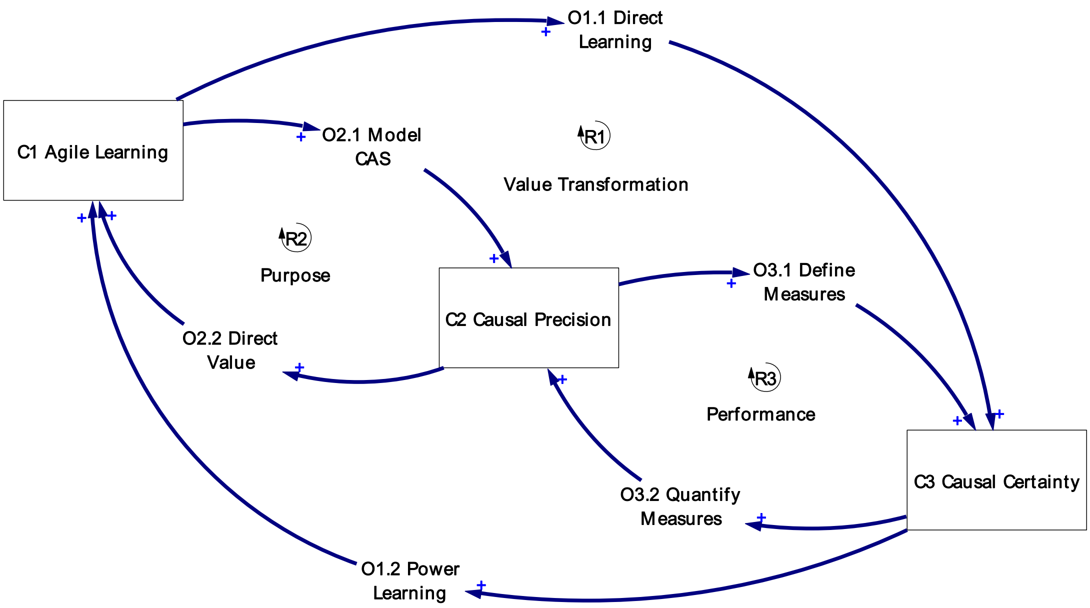

Figure 4.6: Prerequisite Capabilities and Objectives

The prerequisite capabilities and associated objectives are now expanded in Table 4.1.

Table 4.1: Prerequisite Capabilities and Objectives

Prerequisite and Objective	Rationale
C1 Agile Learning: Capability to specify purpose and translate into performance with speed and certainty	Agility is the capability to respond quickly and effectively to changes at three causal levels, structure, relationships and data, to assure resilient delivery of stakeholder value. For CAS where behaviour is shifting and unpredictable, continuous learning, rather than static rote training, becomes critical. The challenge is designing a generic process and means of increasing the rate of value transformation.

Prerequisite and Objective	Rationale
O1.1 Direct Learning: Structure value creation as a Learning Journey	A Learning Journey is a continuous cycle for translating purpose into performance, integrating learning and value adding processes. For change programmes, stakeholders operate as partners in which their internal journeys support external value delivery from the programme, named Value Journey.
O1.2 Power Learning: Measure and apply means to increase value creative learning	Learning Power is Meta-level learning to learn; comprising attributes which drive the rate of effective learning and translation into both internal and external stakeholder value. Learning Power both enhances the Learning Journey and is increased by the process. Scope is expanded to include complementary means for increasing rate of learning, such as neurological preference and perspective range.
C2 Causal Precision: Capability to model the causal translation of purpose into performance	The speed and certainty with which we can deliver stakeholder delivery is determined by our mastery of cause and effect. For CAS causation is imbedded in dynamic complex interactions between hard natural laws and soft behavioural factors. The challenge in modelling is capturing the causal dynamics explicitly, together with means to apply insights to direct value creation.
O2.1 Model CAS: Model all relevant causal relationships within a CAS	Change programmes must be viewed in the context of CAS containing wicked problems, which call for emergent multiple interventions, demanding a shift in mental and physical models from surface level events to underlying patterns of cause and effect.
O2.2 Direct Value : Apply model to support value specification and realisation	Dynamics models are inherently complex and difficult to follow. For practical value creation in CAS, the essential causal dynamics must be presented in such a way as to facilitate traceability from surface presenting problem events to root cause and from intervention to manifested effect to support decision making.

Prerequisite and Objective	Rationale
C3 Causal Certainty: Capability to define, source, transform, validate and apply measures to reduce uncertainty in causal translation of purpose into performance	Ultimately, certainty is injected by populating measures contained in causal models with adequate, valid values for which data is rarely available in either quantity or form needed. The challenge is to define parameters precisely then populate them with quantitative data which is sufficiently accurate to realise purpose.
O3.1 Define Measure: Define Meta-data for all value driver and outcome measures	Measures are defined using metadata comprising structural specification of parameter construction, together with precise units of measure. It is essential to ensure mathematical integrity through the discipline of unit consistency between measures throughout the entire dynamics model.
O3.2 Quantify Measures: Populate model with all input measure values	The focus in populating model parameters with values is sourcing valid data which enables realisation of purpose to within acceptable tolerances and level of certainty. It is far more critical to be about right than exactly wrong, to which end Fermi calculations are deployed, together with numerical scales for intangibles.

The Objectives determine the methodology for this research, discussed in Chapter 5, which encompasses Critical Realism as the philosophical framework, and combines Action Research and Case Studies using rapid prototype modelling for design. Means of achieving the objectives are developed and tested in a longitudinal developmental case study, Chapter 8, and validated across contexts in Chapter 9.

PART II RESEARCH PHILOSOPHY AND DESIGN

Having established the context, core problem, impact, redress and prerequisite capabilities in Part I, the research objectives and methodology for developing, testing and validating the new theory and framework are covered in Part II.

5 Research Objectives and Methodology

5.1 Introduction

This chapter describes the objectives, selection, application and design configuration of the overall methodology, together with specific methods and success criteria adopted for this work. Research objectives and success criteria are initially defined in relation to the core research question and real world outcome objectives and a statement of the Author's position provided. The methodology is then navigated across philosophies, approaches, strategies, choices and data comprising the methodology. More specifically, mapping of key aspects to Critical Realism as the philosophical foundation is explained. The research design is discussed in terms of six interconnected elements: problem patterns, literature review, developmental case study, subject expert interviews, theory and framework and validation case studies.

5.2 Research Objectives and Success Criteria

The core research question (RQ) provides overall direction for this work:

How can we improve delivery of stakeholder value from change programmes by integrating learning frameworks and systems thinking within value management frameworks?

Definitions of theory place great weight on understanding of cause and effect relationships in order to explain, predict and positively influence outcomes across different contexts (Sutton *et al.*, 1995; Gill *et al.*, 2002). The central theme of this research is value transformation through causal coupling of purpose and performance by change programmes across applications, demanding three prerequisite capabilities through achievement of associated objectives as concluded in Chapter 4 and shown in Figure 5.1.

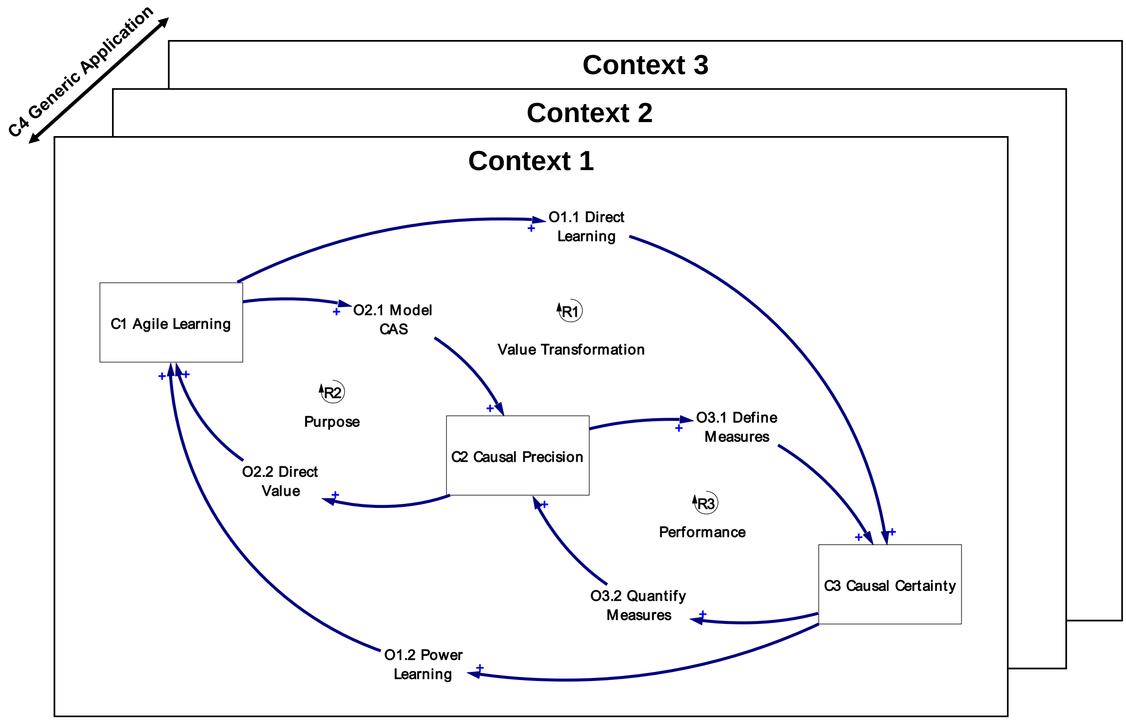

Figure 5.1: Prerequisite Capabilities and Objectives Cross Context

As the RQ is looking for a transferable theory, these prerequisite capabilities, now including C4 Generic Application, are realised through achievement of objectives as defined in Table 4.1. Solutions to Objectives O1.1 - O3.2 developed through the longitudinal case study in Chapter 8 are assessed against success criteria and evidence as defined in Table 5.1, then validated across contexts, O4.1, exercising the entire Value Power Framework in Chapter 9.

Table 5.1: Research Objectives and Success Criteria

Research Objective	Success Criteria	Evidence
C1 Agile Learning: Capability to specify purpose and translate into performance with speed and certainty		
O1.1 Direct Learning: Structure value creation as a Learning Journey	Stakeholder value creation can be modelled as a generic Learning Journey process	Stakeholder Learning Journey simulated dynamically
O1.2 Power Learning: Measure and apply means to increase value creative learning	Learning Power is incorporated within the Learning Journey	Learning Power modelled within stakeholder Learning Journey

Research Objective	Success Criteria	Evidence
C2 Causal Precision: Capability to model the causal translation of purpose into performance		
O2.1 Model CAS: Model all relevant causal relationships within a CAS	CAS can be modelled dynamically	Dynamic value causality within a CAS traced and interpreted
O2.2 Direct Value: Apply model to support value specification and realisation	Sufficient accuracy of calibration and prediction to facilitate intended value creation within a CAS	Dynamics model applied to inform decision making
C3 Causal Certainty: Capability to define, source, transform, validate and apply measures to reduce uncertainty in causal translation of purpose into performance		
O3.1 Define Measures: Define Metadata for all value driver and outcome measures	Hard and soft measures are specified precisely	Hard and soft factors simulated interactively
O3.2 Quantify Measures: Populate model with all input measure values	Data is sourced, transformed, validated and applied in the causal model to create value	Hard and soft measure values and relationships proved valid
C4 Generic Application: Capability of Value Power Framework to support intended stakeholder value across different contexts		
O4.1 Span Contexts Validation: Evidence of successful use across sectors, industries and applications	Efficacy of the Value Power Framework is proven across diverse real case studies	Free, full and unchanged general and specific before and after client feedback

5.3 Statement of Researcher Position

This section defines the Author's position from three perspectives: background, dominant logics and mindset, the relevance of which is threefold. First, the Author's experience provides many potential insights but also injects potential bias, for which transparency is important and is addressed in Section 5.12. Secondly, the failure patterns, which constitute a foundation for this work, were postulated from the Author's experience. Thirdly, the Author underwent a personal paradigm shift, without which much of the drive behind this research would not exist. The statement of position is revisited in Section 5.12 in considering impact of researcher's experience on the research process. Chapter 11 includes reflection on how the research itself has influenced the Author's position.

5.3.1 Background

The Author brings over forty years direct business experience to this research, being awarded a first degree in Mechanical Engineering in 1977 after completing a four year graduate apprenticeship within industry. Seeking to maximise experience across a number of industries, early post-graduate assignments included design and evaluation of automation programmes, including one of the first UK robotic deployments.

Credibility demonstrated in investment appraisal led to specialist roles reporting to Board level and opportunities for post-graduate qualifications; a Diploma in Management Studies (DMS) in 1979 and Masters in Business Administration (MBA) in 1988. The DMS involved development of a Target Costing process for new product introduction within mass production, which was presented across, and adopted as standard within, the company. Award of an MBA demanded the conception, design and measurable successful implementation of a Computer Integrated Manufacturing (CIM) system within Defence Electronics, in the dual capacities of Chief Mechanical Engineer in line management and Programme Manager for the CIM initiative. This work included embryonic development of Value Management and supporting computer tools.

In 1990, the Author switched career direction to IT and Management Consultancy, spanning diverse assignments over twelve years across private and public sectors in roughly equal measure. Founding Impact Dynamics Limited in 2002, focus on Value Management culminated in development and licencing of the Value Management Toolset™, covered in Chapter 11, and co-authoring a book (Davies *et al.*, 2011.). All assignments under IDL are were, and are fixed price, won through unique value propositions with payment conditional upon success; a combination demanding perpetual innovation under contractual delivery pressure. To this end, the doctorial research commenced in 2014 with the aim of building academic rigour and injecting latest thinking across academia and industry.

5.3.2 Dominant Logics

From the earliest immersion in transformation change programmes, it became clear that credibility rested on mastery of two capabilities: financial language and analysis, notably investment appraisal using Discounted Cash Flow (DCF), and causal quantification of benefits, such as cost savings and new revenue streams, attributable to transformational change programmes. The former was provided by the industry-focused degree course and readily honed through subsequent study. Causal attribution proved a different matter. Investment appraisal textbooks confined examples to simple payback of initial investment with reduced manual labour cost savings through automation. Standard Costing practice 'absorbed' overheads into hourly labour costs rates. If used unchallenged, labour savings derived from these cost rates were wildly exaggerated because not only did the ‘fixed’ component persist after implementation but was also significantly increased in in the form of support. Skill-based direct labour was being replaced with technology demanding ongoing support and more expensive knowledge workers, cost objects obscured in overhead ‘buckets’.

Although earning credibility by isolating and including only directly attributable costs, there remained significant gaps in thinking and practice across industry generally from which to draw. However, while undertaking the CIM programme, the Author integrated three convergent process-centred breakthroughs with DCF techniques to address causal attribution of financial impact. First, IDEF0 facilitated process modelling, identifying underlying activities (IDEF, 2021). Secondly Activity-Based Cost Management (ABCM) explicitly addressed the problem of misattribution by assigning expenditure to specific activities consuming resources, using causal Cost Drivers (Kaplan, 1998; Cokins, 2001). Thirdly, Discrete Event Simulation (DES) enabled dynamic simulation of process flow, particularly suited to complex routing present in batch manufacturing and supply chain logistics (Borshchev, 2013; Brailsford *et al.*, 2014).

Whilst providing elegant solutions for tangible costs and defined processes, these advances fell short of dealing with ‘soft’ human factors, such as motivation, engagement, creativity and collaboration, not readily translated into monetary outcomes yet increasingly critical to financial success in the transition from industrial to knowledge eras. The Author adopted the performance management innovations of Kaplan *et al.* (1996); Balanced Scorecard (BSC) for defining non-financial measures and Strategy Maps for linking measures causally, albeit at an abstracted level. Also adapted was parallel thinking in Benefits Management (Ward *et al.*, 2006; Bradley, 2010; Jenner, 2012), which includes causal linkage of drivers to outcomes, in addition to Business Intelligence (BI), which indicates potential causality through correlation using Big Data, the latter through 10 years working with Fletcher (2018), a UK leader in the BI space.

All these approaches to causal attribution of value share a fundamental limitation; they largely assume single direction causality and linear relationships. Further breakthroughs, majored in this research, came with Systems Thinking (ST) and System Dynamics (SD) (Senge, 1990; Sterman, 2000) providing practical analysis of feedback loops and non-linear characteristics. Of particular relevance is the work of Wolstenholme (2003), who trained the Author in SD, on systemic archetypes, followed by Complexity Theory (Mitchell, 2009) and Agent-based Modelling (ABM) (Hamill *et al.*, 2016) for emergent behaviour of Complex Adaptive Systems (CAS) (Miller *et al.*, 2007), such as markets. Practical insights from the research in the context of causality also included Causal Inference (Pearl *et al.*, 2018), Bayesian probability (Lambert, 2018), including Bayes Rule (Stone, 2013) and use of small data (Lindstrom, 2016), high level Fermi calculations (Hubbard, 2014) and contextual ‘factfulness’ (Rosling, 2018).

5.3.3 Mindset

The mindset with which the Author completed university and directed the first 18 years of post-graduate career comprised seven beliefs in relation to change, strongly influenced by the Engineering background:

- For a given situation there is one correct decision requiring complete information which is always obtainable with sufficient effort; similarly, opinions are either right or wrong
- It follows that there is only success and failure; therefore it is necessary to avoid risk to prevent the latter and be exhaustive in pursuing the former
- People, and by inference, organisations behave rationally and the key to influence and change is logic; emotion cannot be trusted and should be avoided
- Character and potential for success is largely determined through birth and upbringing; change is driven by external circumstances which impose a fixed natural limit to achievement
- Problems and characteristics, both for individuals and organisations, are imbedded as steady state over time and change is inherently modest, slow, difficult and limited
- The market is a natural phenomenon in which reward is linked to value delivered; fairness is built in naturally through self-interest; Adam Smith's invisible hand
- Persistence and contribution will be and reflected in advancement because organisations must recognise and reward ability to keep it; success is related to learning and qualifications

This belief system appeared to be validated by experience. A combination of ambition, driven perpetual learning and training, advanced qualifications and persistence rendered a Chief Engineering post in a major company which sponsored an MBA by early 30s. However, expected promotion to Board level did not materialise and the shift to Management Consulting also failed to meet aspirations, apart from a significant salary increase. Frustrated and directionless, the Author burned out with a failed marriage and two young children at 41 years.

This personal trauma forced recognition of how mindset beliefs and associated behaviour contributed to the situation. Ceasing all medication, alcohol and excuses, the decision was made to do whatever it took to find answers. The period of deep reflection, searching and learning which followed led to immersion in three convergent advances in human development: ST and complexity, neuroscience and archetypal pattern recognition.

ST shifted awareness to a world which is not fair but causal, cause and effect operating in feedback loops creating complex behaviour through interaction of natural physical laws and human emotional behaviour. Rather than seeing things in terms of right and wrong, success and failure, wisdom lies in recognising and harnessing the energy of difference to create value, requiring flexibility, intense learning and readiness to be wrong. Complexity Theory provided further insight into reality, notably emergent behaviour of CAS and recognition that intended outcomes are realised more effectively through working with deep causal structures than control of surface level events.

Neuroscience included training to Master Practitioner level in Neuro-linguistic Programming (NLP), the most important insight being the capacity for people and organisations to undergo massive change very quickly given sufficient convergence of urgency, purpose and capacity to learn. The 'Breakthrough' process for achieving paradigm shifts can be defined, learned and repeated, reversing conventional practice of ongoing therapy dispensed in hourly slots over many months, to a single session, normally one day, demanding total commitment and a 'failure is not an option' mindset. Critically, the process is founded on the presupposition that we co-create our own causes through focused action, necessitating a shift in values to achieve; triple loop learning. In delivering Breakthroughs to individuals, it became evident that the identical process was applicable to creating stakeholder value through business transformation; these Value Breakthroughs are discussed in Chapter 11.

A key insight from ST and neuroscience was the existence of archetypal patterns spanning the natural world and human behaviour, together with the degree to which they converge across domains and contexts. For example, system archetypes, such as 'Fixes that Fail' and 'Escalation' apply equally across human relationships and physical environment. Further, these patterns can be mapped to models of human interaction and organisational structure, observations covered in Chapter 6. Whilst not always applicable, patterns often provide reliable rapid diagnosis of problems. Further, a corollary of Complexity Theory is that, whilst it is not possible to forecast outcomes from a CAS exactly, patterns often provide sufficient predictability to reduce uncertainty to within acceptable tolerances. The seven failure patterns covered in Chapter 7 were defined using this insight.

5.4 Research Roadmap

There is an important distinction between research method and methodology. The former is a technique for collecting and analysing data, whilst the latter refers to an approach to the process of research encompassing a body of methods (Collis *et al.*, 2009, p. 73). The 'Research Onion' shown in Figure 5.2 based on Saunders *et al.* (2006, p. 132) is used to map the methodology for this research. The two outer-most levels cover research philosophies and three inner layers specific data collection and analysis methods.

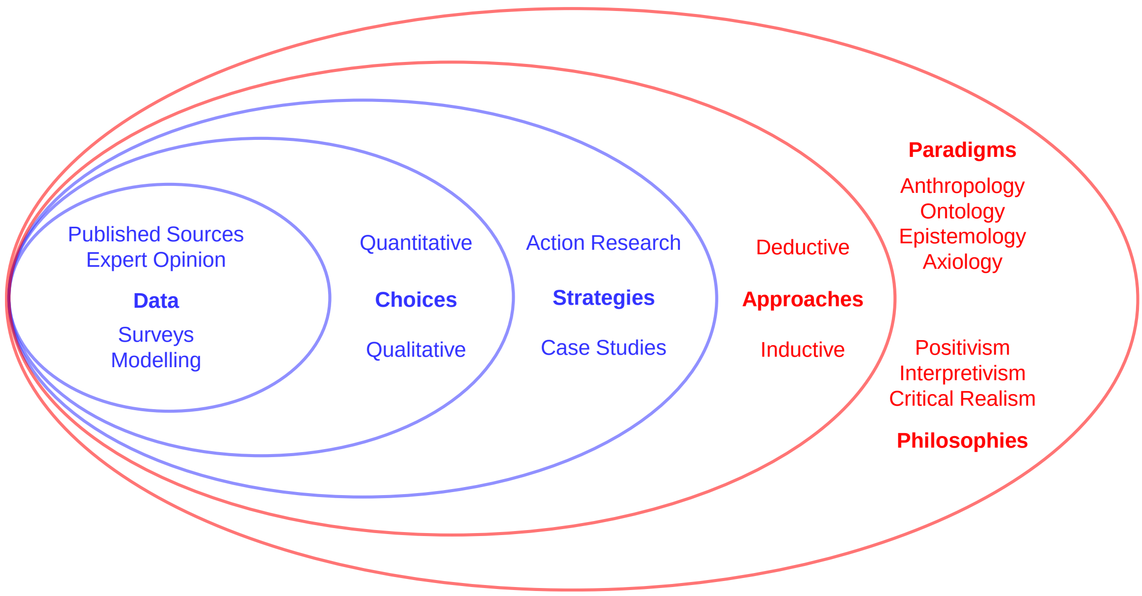

Figure 5.2: Research Roadmap

5.5 Paradigms

Paradigms and philosophies are inextricably linked and can be regarded as part of the same model, for example Collis *et al.* (2009, p. 57) frame paradigms as a continuum of assumptions about the world and nature between two extremes, positivism and interpretivism, which Saunders *et al.* (2006, pp. 103-107) refers to as philosophies. Lyon (2017) positions paradigms as assumptions within philosophies and these terms are defined separately with appropriate cross-reference, starting with four relevant paradigms.

5.5.1 Anthropology

Anthropology concerns what it means to be human and refers to the study of people as individuals and relationships with others and the environment. This work draws on Bateson (1972) in the context of learning levels, together with cultures and neurological systems. Values, beliefs and behaviour shared as habits between people become cultures which operate systemically as environmental attractors and have a profound bearing on ability to deliver intended outcomes from programmes where change necessitates a break from entrenched positions (Wheatley, 2006). Consequently, it is deemed critical to design programmes which account for and support cultural change; requiring triple loop learning, involving shifts in mental models and purpose.

A key insight from recent research is the evolutionary development of two neurological systems which can be mapped precisely to physical parts of the brain. Peters uses the metaphor of chimp and human to portray the distinction, which includes the focus on survival for the former and purpose for the latter (Peters, 2012, p. 71). The significance of survival instinct is manifested across the living world as show of dominance, even for lobsters (Peterson, 2018), which has a critical bearing on positional relationships, win-lose, lose-win, lose-lose and win-win, in business model design (Covey, 1992). As discussed in Chapter 3, Kahneman (2011) defines two systems. System 1, evolved for survival, is fast, intuitive and driven by a need to connect cause and effect, whilst System 2 is slow, analytical requiring greater energy and evolved later in response to social, technical and economic developments. Each system is subject to fundamental errors but when integrated offer great potential for value creation, again demanding triple loop learning.

The Author's anthropological position is harnessing energy of different beliefs and values causally aligned through common highest purpose to create sustainable and equitable stakeholder value

5.5.2 Ontology

Ontology refers to the nature of reality (Collis *et al.*, 2009, p. 59), how it works, and includes two aspects, objectivism and subjectivism (Saunders *et al.*, 2006, p. 108). The former views reality as externally created, independent of the agents, such as people, whilst the latter argues social phenomena are generated from the perceptions and consequent action of agents. The requirement to integrate hard and soft factors and causal relationships necessitates respect for different perspectives of reality, which steers towards selection of Critical Realism (Bhaskar, 2008) as the philosophical foundation for this research.

In a similar vein, Popper defines three worlds (Magee, 1973, p. 60). World 1 is a world of material things which is objective. World 2 is subjective and comprises the domain of minds. The third, world 3, comprises objective structures produced either intentionally or otherwise by minds but once produced exists independently of their creators, for example, ideas, art, science and institutions. Popper's world 3 can be likened to every book in every library (Blockley *et al.*, 2000, p. 89). A caution, however, is that the objective structures of world 3 are no guarantee of truth.

It is also critical to recognise that multiple interpretations of the same reality are possible and potentially valid, as implied through the concept of plurality, Morin (2007, p. 9) emphasising the importance of contextualisation. In referencing Korzybski (1994), Falconar (2000, p. 18) cites Plato's Cave as a metaphor for the limitations of language which he attributes to most misunderstandings and conflicts between people. The power of context is also cited by Gladwell (2000) as one of the three key components in driving the viral nature of change.

The Author's ontological position is harnessing energy of multiple perspectives causally aligned through mutually supporting intentions to create sustainable and equitable stakeholder value

5.5.3 Epistemology

Epistemology covers what constitutes acceptable knowledge in the field of study (Collis *et al.*, 2009, p. 59) and is closely coupled with two opposing philosophical views: positivism and interpretivism (Saunders *et al.*, 2006, p. 102). Positivist epistemology is the stance of a natural scientist in which knowledge is acquired through observations which can be translated into law-like generalisations. Conversely, an interpretivist epistemological position advocates a critical role for the human mind in acquisition of knowledge, rendering strong argument for this view in organisational change.

As with ontology, this research necessitates a combination of epistemological positions. Hard measures are necessary for acquiring knowledge for aspects of change, the validity of which is independent of participants' feelings. Examples include the occurrence of events in the physical world, such as encounters between customers and providers, critical for the developmental case study covered in Chapter 8. However, customer outcomes are determined by behaviour in response to these contacts. This is driven by how a customer actually experiences the event, which is directed by the customer's internal representation of the encounter within a specific context. It follows that value creation requires the combination of 'hard' factors, governed by natural laws, together with 'soft' emotional dispositions and mental cognition within a given context.

The Author's epistemological position is causal integration of hard natural laws with soft behavioural dispositions in the transformation process of creating sustainable and equitable stakeholder value

5.5.4 Axiology

Axiology concerns the role of, and judgements about, values in research (Saunders *et al.*, 2006, p. 110). Shephard (2005b) defines values as those things most important to us, motivate us, and to which we devote greatest time and attention. Values provide the guiding reason for all human action (Heron, 1996). A positivist philosophy considers the process of research to be value-free and researchers aim to be detached and independent from what they are researching (Collis *et al.*, 2009, p. 59). Interpretivists accept that a researcher possess values, even if not made explicit.

As with other paradigms, this research requires elements of both these axiological positions, concerning hard and soft measures. Considering the latter, there is a critical link between values, how we think the world should be, and beliefs, how we think the world actually is, which operate interactively in one to many relationships (Shephard, 2005b). Heron (1996) proposes writing a statement of personal values in relation to the research topic; for this work encapsulated in the concept of win-win where stakeholders benefit equitably. This value is supported by the belief that value can be created equitably, not necessarily equally, by designing change programmes which create business models and markets which drive this outcome through appropriate alignment of systemic causally.

The Author's axiological position is to recognise, respect and harness differences in values aligned causally through common commitment to highest purpose and mutually supportive intentions in creation of sustainable and equitable stakeholder value

5.6 Philosophies

Philosophies relate to the development of knowledge, together with the nature of that knowledge and consequently the philosophy adopted contains important assumptions about the way in which a researcher views the world (Saunders *et al.*, 2006, p. 101), opposite extremes being positivism and interpretivism (Yearworth, 2013).

5.6.1 Positivism

Positivism rests on the assumption that reality is singular and objective and is not affected by the act of investigating. This often involves a deductive approach whereby a defined theory is applied to the problem, which is often applicable across different contexts (Collis *et al.*, 2009, p. 56). The positivist position is most commonly associated with natural science where the researcher remains separate from the subject of research. This provides great objectivity and is ideal where precise, often single solutions are deducted through clear laws, as is usually the case in physics and many, even highly complicated, mechanical systems. Positivism is closely associated with Direct Realism which says that what we experience through our senses is the truth and that any deficiency in cognation of this truth is down to insufficient information (Saunders *et al.*, 2006, p. 105).

5.6.2 Interpretivism

Interpretivism, also referred to as phenomenology, developed as a response to criticisms of positivism in explaining human behaviour and is founded on the assumption that reality is in our minds, is multiple and subjective and, very importantly, is influenced by the act of investigating within a specific context. An inductive approach is typically applied through which system behaviour is interpreted within a specific context (Collis *et al.*, 2009, pp. 57-62). Interpretivism tends to use small samples and rich qualitative data, generate theories inductively and allow findings to be generalised across different settings.

5.6.3 Need to Integrate Positivism and Interpretivism

Much of this research is dealing with 'wicked' problems (Rittel *et al.*, 1973a; Rittel *et al.*, 1973b; Watkins *et al.*, 2015) within Complex Adaptive Systems (CAS) (Lewin, 1993; Miller *et al.*, 2007) presenting wide interconnectivity, complex ambiguity and rapid pace. Although not conducive to single, total solutions, wicked problems can be addressed effectively through interventions, which require integration of natural and social sciences. It follows that this research necessarily combines positivist and interpretivist positions and the critical interface between these apparently opposing philosophies concerns causality, which leads to selection of Critical Realism as the underlying philosophy.

5.6.4 Critical Realism

Critical Realism (CR) is a response by Bhaskar (2008), similar to Popper's three worlds (Magee, 1973), to the limitations of focusing on one or other philosophical extremes when dealing with complex systems by providing a strong causal frame, integrating positivist and interpretivist perspectives. Bhaskar argues that although an absolute reality exists, an essentially positivist stance, we cannot fully cognate it due to sensory limitations and that our behaviour in response to this partial view co-creates true reality with natural laws, an insight recognised by Interpretivists. Positivist and interpretivist views map to 'hard' and 'soft' measures respectively. His approach to reconciling these views is by stratifying reality into three layers: Real, Actual and Empirical, as shown in Figure 5.3 and articulated below, drawing on explanation by Foster (2013b).

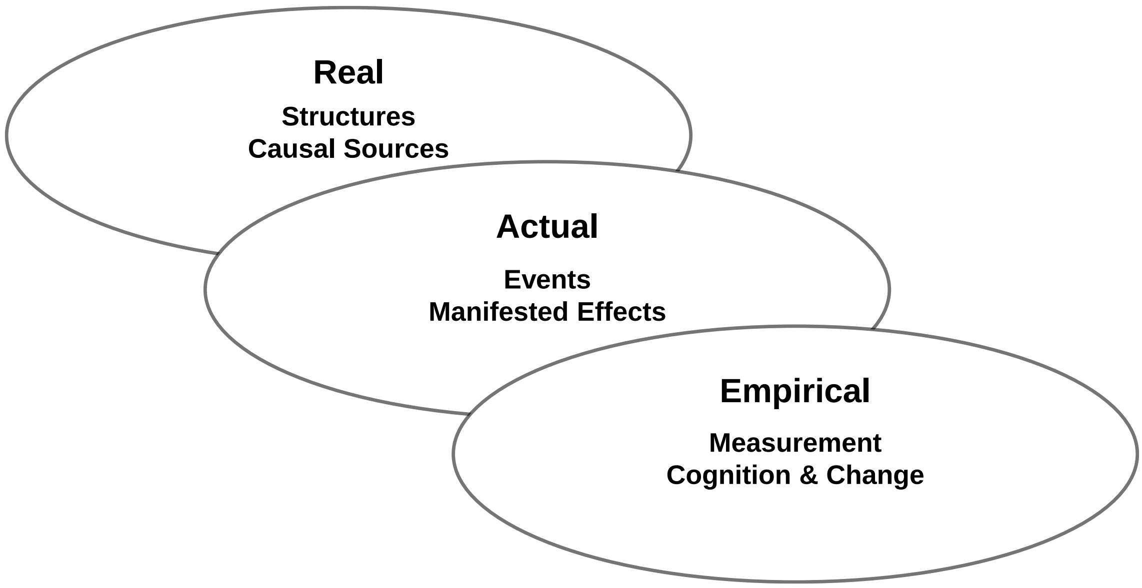

Figure 5.3: Critical Realism Layers of Reality

Real

Real contains causal structures which we cannot see but account for behaviour that we can. For example, we cannot observe gravity directly but we can see that something we call gravity causes items to fall. In this respect, gravity is a speculation of reality; albeit one that has endured the test of time. Real is the domain of causal relationships, comprising natural laws and human behaviour. Although not directly observable, causal structures contained in Real dictate events manifested in Actual and influence how we measure reality then design and execute change initiatives in the Empirical layer. As Fleetwood (2013) states, “Anything is real if it has a causal effect.”

Actual

Actual refers to events, of which we may or may not be consciously aware, resulting from causal structures in the Real domain. For example, we observe a glass falling to the floor as an event which we attribute causally to gravity, although we cannot see gravity. Repeating patterns of events provide a practical level of predictability in many cases, but as Bhaskar (2008, p. 1) stresses from the outset, there is an ontological distinction between causal law and patterns of events; in other words correlation is not causation. The corollary is that in order to gain greater understanding of the Real domain, we need to navigate beyond surface level events and correlation to underlying causal structures driving the patterns; essence of Systems Thinking.

Empirical

Empirical is the domain of reality in which we consciously experience, experiment with and measure events with the aim of effecting desired changes through deliberate intervention. CR recognises the difficulty in reconciling the knowledge we are able to derive in the Empirical layer with Real (Collier, 1994; Archer *et al.*, 1998); in other words gap between epistemological and ontological positions. This dilemma is called the Explanatory Gap (Levine, 1983) and, critically, does not demonstrate a gap in nature, i.e. Real, but in our understanding of nature.

This challenge is also highly relevant to human behaviour. For example, a bank customer switching their current account is an event resulting from a chain of causality involving not only Actual events, such as experience of poor service, but also mental dispositions influenced by, and in response to, events which reside within deep causal structures and are inherently difficult to determine precisely. The cyclic journey between deep ‘inherent cause’ and surface level ‘manifest effect’ is revisited in this section with reference to Eastern philosophy.

Mapping Critical Realism to Value as Energy Transformation

CR provides the philosophical grounding for a core tenet of this research, value framed as energy transformation between inputs, outputs and outcomes, mapped to the three levels of reality as shown in Figure 5.4.

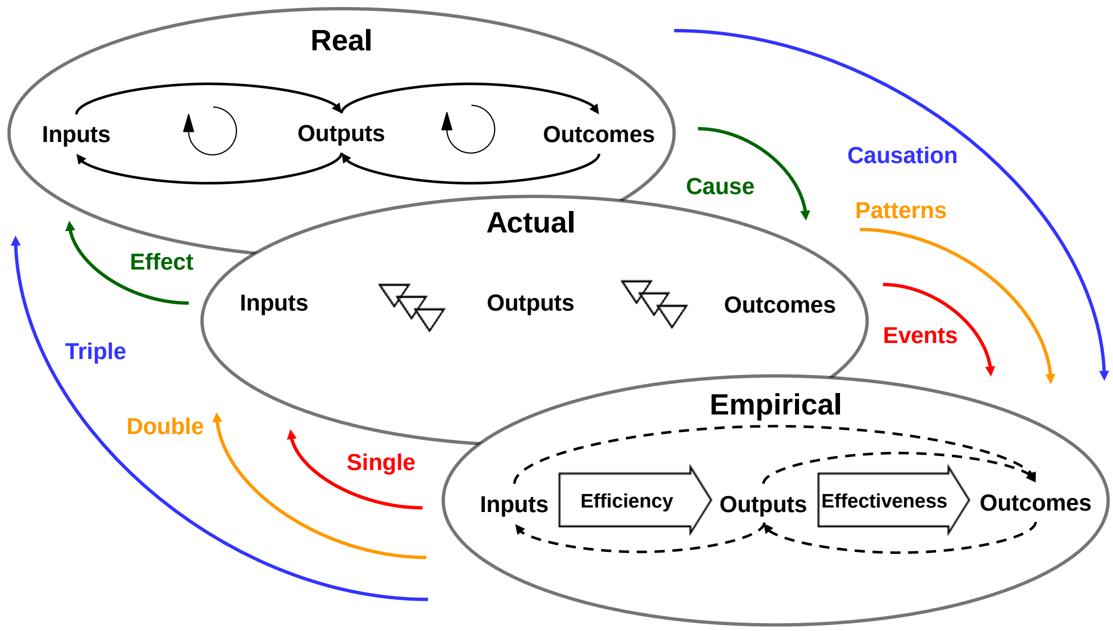

Figure 5.4: Mapping Critical Realism to Value as Energy Transformation

For Real, emphasis is on defining true causal relationships between inputs, outputs and outcomes. In Actual, the focus shifts to how events link the value elements. For example, customer contact (event) with a bank concerning a problem brings together a service agent, (input), the issue resolution (output) and degree to which the resolution meets actual customer needs (outcome). Empirical covers the conscious measurement, management and, if necessary, change of the customer contact process of transforming a problem into satisfactory resolution. The relationship between input and output, consumption of energy by the customer and service agent and implemented solution, concerns efficiency and between output and outcome, degree to which needs are met by the solution, effectiveness.

As important as reality levels are relationships between the levels, which represent feedback loops. The relationship between Real and Actual is manifested as events invoking reactive behaviour which completes the feedback to Real. Importantly, all change is effected through the Empirical layer. From a learning perspective, reactive feedback is single loop addressing only the specific issue associated with an event, with neither reference to cause nor relationship with other events. If an event is either not observed or does not invoke a reaction by any relevant agent, it is ignored and involves zero learning, characterised by Bateson (1972, p. 293) as an absence of correction.

Double loop learning, includes patterns of events to which a greater measure of response using a repeatable process is possible through recognition of similarities. Single and double loop learning operate between Empirical and Actual. Conversely, triple loop concerns conscious understanding of underlying causation in Real. Changes implemented in Empirical influence Real causal structures through the process of co-creation, via the Actual layer, between hard natural laws and agency operating in its highest form, meaning and purpose. Triple loop learning, involving contextual shifts, potentially has the greatest impact. For example, a shift in mental model in the Empirical layer changes behaviour and consequential events in Actual.

Mapping Critical Realism to Dynamics Modelling

The need for respecting causation over time in the value creation process dictates emphasis on dynamics modelling, which forms a significant role in this research covered in Chapters 8, 9 and Appendices B1 and B2. The process is adapted from the schema for verification and validation of simulation models proposed by Sargent (2013), comprising three layers, Problem Entity, Conceptual Model and Computerised Model. Although there is no pretence of an exact match, it is useful consider how CR maps against Sargent's model as shown in Figure 5.5.

Problem Entity is the situation or phenomenon to be modelled, which is effectively the presenting problem experienced in the form of events; Actual in CR terms. For example, events associated with, and leading to, a customer switching decision in the context of engagement in the Current Account market. The Conceptual Model is an abstraction of the problem entity, which for this research involves reverse engineering events relating to the problem entity to define underlying causal structures of the Real layer in CR. For example, causal relationships driving the customer journey from cognition of need to action in the form of a switching decision. Computerised Model is the physical implementation of the Conceptual Model, enabling analysis and intervention design for change, Empirical layer activities such as targeted communications to increase customer cognition levels, which manifests as events in the CR Actual layer of reality. Data provides the means for both verification and validation between the layers.

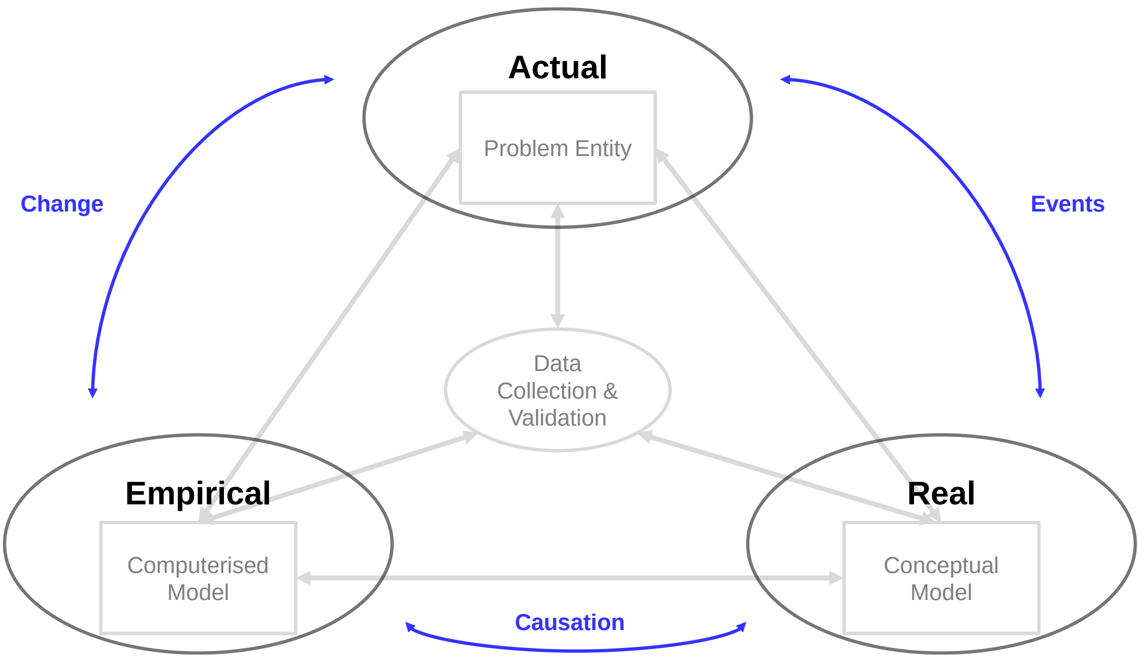

Figure 5.5: Mapping of Critical Realism to Dynamics Modelling

Mapping Critical Realism to Eastern Philosophies

Parallels in causal thinking between CR and Eastern philosophies, upon which Bhaskar drew heavily, are relevant to the new theory. Several commutators document links between modern science, such as Quantum Physics, Complexity and Chaos. For example, Goswami (1993, pp. 30-37) stresses the role of consciousness in measurement, expressed as Wave-Particle Duality in quantum physics. This relates to the notion that experience of reality depends upon focus; a tenet of many Eastern philosophies and in neuroscience expressed as Confirmation Bias (Kahneman, 2011, p. 81).

In a similar vein, Capra (1982); Capra (1996) draws on parallels between scientific advances and Eastern mysticism, including the Tao Te Ching of Lao-Tzu (Mitchell, 2000). Nichiren Diashonin (Mcgreal, 1995, pp. 327-329) translated Buddhist texts into the Lotus Sutra in 13th century Japan, encapsulating the critical essence into a single chant, Nam-Myoho-Renge-Kyo, the Ghonzon, which is equivalent to beatitudes delivered during Sermon on the Mount in Christianity (Barclay, 1975, p. 97). Literally meaning, ‘I devote my life to the Mystic Law of the Lotus Sutra’; or single truth. Nam-Myoho-Renge-Kyo maps to CR as shown in Figure 5.6, adapted from Causton (1995, pp. 182-183).

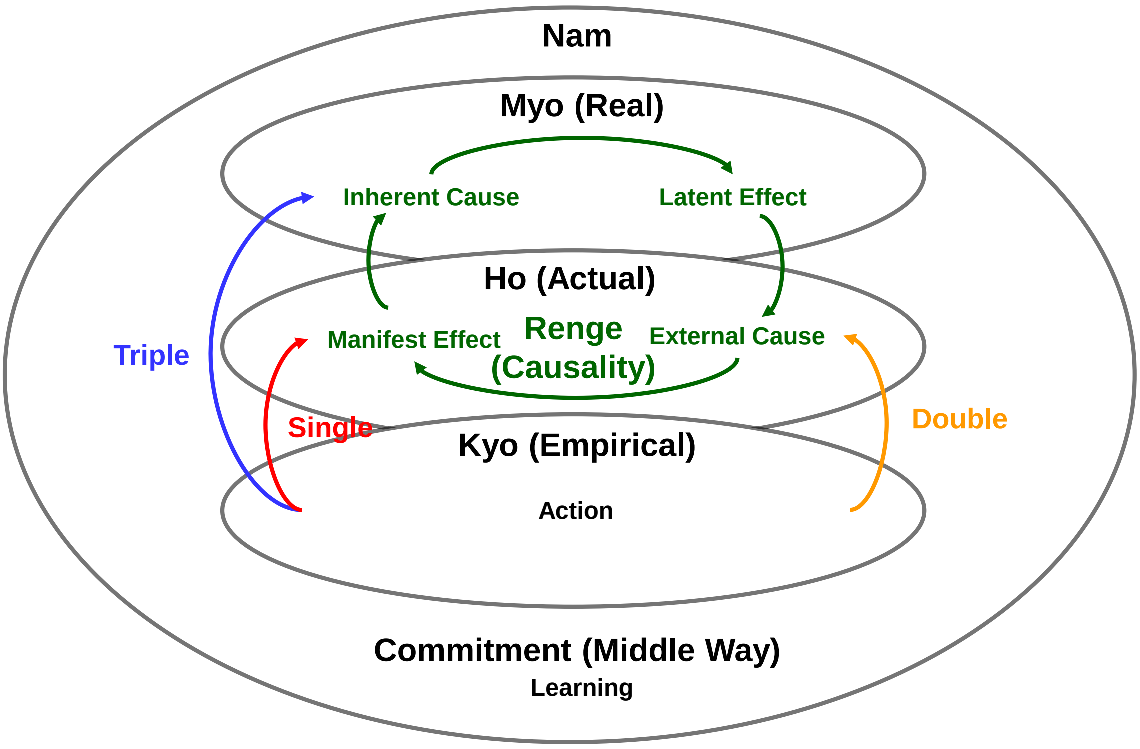

Figure 5.6: Mapping of Critical Realism to Nichiren Diashonin Buddhism

Of particular interest in this respect is Renge, Law of Cause and Effect, decomposed into four elements comprising a cycle bridging Real and Actual CR levels, as with the energy transformation paradigm discussed previously. The journey is most effectively explained through example. An offence (Inherent Cause) sets up strong negative association within a specific context (Latent Effect) which remains dormant until circumstances create an event (External Cause) triggering inappropriate behaviour (Manifest Effect) attracting a reaction, such as aggression, which repeats the inherent cause, thus reinforcing the cycle

Buddhism is practiced through the 'Middle Way' for dealing with this natural law by effectively providing a bridge between Real and Actual levels in CR. It also integrates 'soft' and 'hard ' factors in context of the new theory and the causal cycle is simulated in the Market Dynamics Model as a Learning Journey, covered in Chapter 8. In other words, causal thinking spans positivist and interpretivist worldviews.

There is also a link with learning levels. For organisations, single loop learning concerns output or product (Manifest Effect), double loop hones the production process (External Cause) and triple loop challenges meaning and purpose (Inherent Cause); corresponding to operations, management and leadership respectively. All change is effected from the Empirical level and latent cause can only be changed though other elements in the causal cycle, a logic explaining the importance of invoking change at the appropriate level; evolution versus revolution (Watzlawick *et al.*, 1974).

The nature of reality is also addressed in Islamic philosophy as articulated by Hixon (2003, p. 35). Allah in the Qur'an is rooted in two words which mean 'Ground of Being'. Being a Muslim requires commitment to belief in and experience of only 'One Reality', which translates closely to the Real and Actual levels in CR and Myo and Ho in Nichiren Diashonin Buddhism. The common thread is the imperative for behaviour to be congruent with causal reality; respect for the universal laws of cause and effect.

Meta Realism

Although Bhaskar originally developed CR as a secular philosophy, his thinking was strongly influenced by his Theosophist parents. Theosophy purports that there exists a single message articulated across different religions and philosophies, including Buddhism which is a philosophy rather than a religion (Rudy, 2019). Bhaskar extended CR to include values dimensions, incorporated within Meta Realism (Bhaskar, 2013). Under this frame, Real is further layered into two realities which determine how the energy of difference is manifested: Cosmic Envelope, or Co-presence, and Demi-Reality (Foster, 2013b).

Essentially, Co-Presence is emancipation and unity whereas Demi-Reality represents conflict and disunity, both of which are not just concepts but true realities. The former is seen as the means by which to counter the latter, lower level of reality. This perspective maps closely with Marxism, from which Bhaskar drew significantly, and which Foster (2013a) offers as an argument for superiority of socialism over capitalism. More importantly for this research is the linkage with values levels (Graves, 1970), in particular the power of Level 7 which provides the basis to harness energy of difference for win-win value creation. In Christianity, Moore (1999, p. 44) proposes that in the beatitude ”‘the meek shall inherit the earth’, the word ‘meek’, normally interpreted as humble, actually connotes strength with control and caring, the essence of Graves’ value level 7, proposed by the Author for achieving Co-presence between stakeholders through business models with mutually supporting stakeholder intention.

5.7 Approach

Approach refers to the direction from which theories used for, or developed by, the research are navigated in relation to the underlying philosophies. The essential choice is between deductive and inductive approaches, the main difference being that whilst deductive is aimed at testing theory, an inductive approach is concerned with the generation of new theory emerging from the data.

5.7.1 Deductive

A deductive approach involves development of a theory and hypothesis then designing research to test the hypothesis and is most associated with scientific research (Saunders *et al.*, 2006, p. 107). In this respect, deduction draws more influence from positivism and is the dominant approach for the natural sciences for which Collis *et al.* (2009) define six key characteristics: focus on hypothesised causality, controls to test hypotheses, highly structured methodology, quantitative measurement, reductionism through top down decomposition and generalisation across multiple contexts.

5.7.2 Inductive

For an inductive approach, theory follows data; a theory is developed from data typically collected through interviews with agents associated with the focus of study. Induction is most aligned with social sciences, drawing on interpretivism as a response to limitations of applying positivist deduction to complex human behaviour. It is likely to focus on a specific context within which events take place (Saunders *et al.*, 2006, p. 119). In many respects, the inductive research characteristics are diametrically opposite to those of deduction, for example, social science views causality with caution, embraces ambiguity, measures more qualitatively, aims to inject greater holism and avoids generalisation and reductionism.

5.7.3 Need to Integrate Inductive and Deductive Research

The key conclusion for this research is that both deductive and inductive approaches are essential because of the interaction between hard natural laws and soft behavioural factors in value creation. In the case of deduction, patterns of change programme failures led to the high level hypothesis that a Meta level causal structure is in play at the Real level of reality. Accordingly, a new theory comprising Value Principles and learning framework for choreographing their application is developed and tested using validation case studies to assess generic applicability across diverse contexts. Conversely, inductive exploration uses a developmental case study to assess viability of three key prerequisites for new theory efficacy in Table 4.1: Agile Learning, Causal Precision and Causal Certainty. Solutions relating to these prerequisites and associated objectives, which are also explored through interviews with subject experts, were developed and honed through an inductive process using iterative rapid prototyping and modelling.

5.8 Strategies

Strategies represent the transition from research philosophy to design. A core objective for this research is application of the principles and framework to realise intended stakeholder value in the real world. To this end, two strategies are selected, Action Research and Case Studies. Both apply Agile Development principles. Dynamics modelling forms a common thread throughout this research in the context of supporting stakeholder value creation and is embedded within the Action Research and Case Study strategies.

Other strategies considered were, Experiment and Grounded Theory. Experiment was intended for inclusion, testing the efficacy of the new theory in a control group of academics but this proved logistically prohibitive compared with real case studies. Grounded Theory (Glaser *et al.*, 2017) and surveys were candidates for acquiring Learning Power profiles across customer populations but not possible or practical with available resources. Also, Grounded Theory fails to recognise the embeddedness of the researcher and thus obscures a researcher's considerable agency in data construction and interpretation (Charmaz et al., 2007).

5.8.1 Action Research

Action Research is widely attributed to the work of Kurt Lewin which he exemplifies by group discussion and decision on the way to proceed. (Adelman, 1993). There are four common themes: emphasis on research purpose, direct participation in the research, iterative nature of the process and applicability across multiple contexts (Saunders *et al.*, 2006, pp. 140-141). Iterative steps proposed by Robson (2002), purposing, diagnosing and planning, taking action and evaluating, map to the Learning Journey steps (Deakin Crick *et al.*, 2017a) and PDSA Cycle (Deming, 1994, p. 131).This mapping provides further validity for framing change programmes as Learning Journeys and the iterative cycles form a learning spiral which translates into the entire Value Journey, expanded in Chapter 11, comprising increasingly maturing state transitions of change as shown in Figure 5.7.

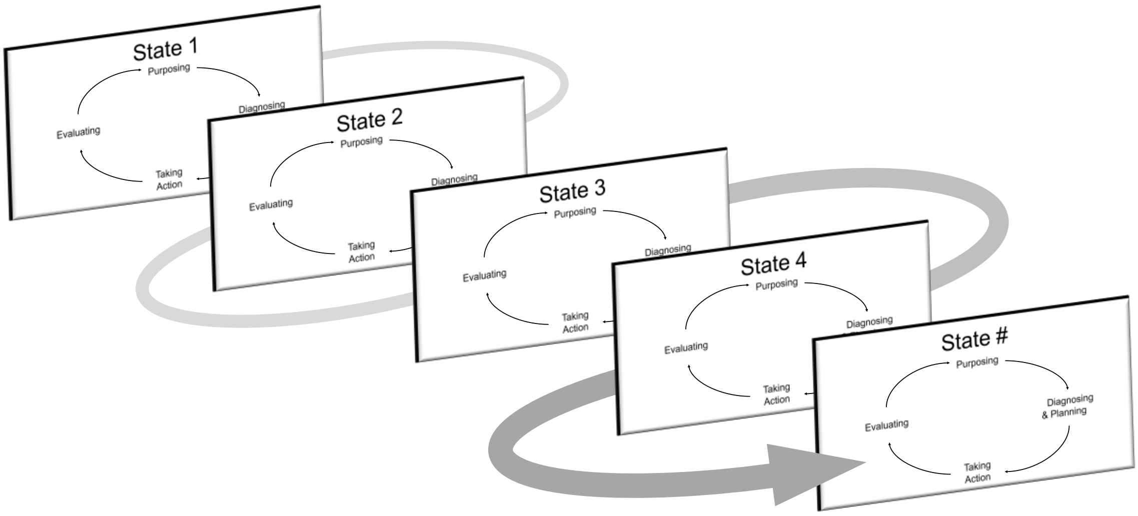

Figure 5.7: Action Research Iterative Cycle and Learning Spiral

Action Learning

Although not generally linked in the literature, Action Learning shares many principles with, and strongly complements, Action Research. It was developed by Reg Revans in response to the critical need for productivity improvement in the UK after the Second World War, a challenge now faced through COVID-19. The power of Action Learning lies in addressing real unfamiliar problems in unfamiliar contexts by a 'Set' comprising around six 'comrades in adversary' (Marquardt *et al.*, 1999; McGill *et al.*, 2003; Revans, 2011). This provides an intensely creative and collaborative learning environment through a combination of purposeful necessity and energy of difference. Key learnings from an MBA deploying Action Learning by the Author are incorporated in this work (Davies, 1989).

Agile Development

This research injected three highly related methods to counter a principal criticism of Action Research; the tendency for subjectivity and bias (Reason *et al.*, 2001; Brydon-Miller *et al.*, 2003; Bradbury-Huang, 2010): Rapid Prototyping, Fail-fast and Agile. Rapid Prototyping originated in design and manufacturing but recently applied more generally, including software architecture and development (Lantz *et al.*, 2010; Devadiga, 2017). Fail-fast in software development involves the inclusion of code assertions (Shore, 2004), which invoke a fail state if bugs exists, and is the basis for Test Driven Development (TDD) (Beck, 2003) applied rigorously by Harding (2018) to the MDM for this research. More broadly, a fail-fast approach, actively seeking and correcting errors as soon as possible, permeates throughout this research and is also incorporated in Value Principle 7 for the new theory; 'Combine right first time with feedback'.

Agile has evolved as a leading framework for software and systems development by combining speed with certainty (Subramaniam *et al.*, 2006). The most notable Agile process is Scrum (Purcell, 2016), which incorporates rapid iterations, called sprints, structured as a PDSA cycle

(Carroll, 2012, p. 68), rendering it a good fit for this research. Agile principles are now applied at organisational level, particularly in the context of complexity (Atkinson *et al.*, 2005). For inductive aspects of the research, agile techniques are combined with dynamics modelling to derive value principles and framework. Concerning deductive work, rapid research methods are applied for validating them.

5.8.2 Case Study

A case study is defined as a research strategy comprising five key characteristics: empirical investigation, contemporary phenomenon, real life context, multiple sources of evidence and specific context (Robson, 2002, p. 178; Yin, 2009). A case study approach is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context (Crowe *et al.*, 2011). It offers considerable ability to answer 'why?', 'how?' and 'what?' questions (Saunders *et al.*, 2006, p. 139); which forms a key frame concluded through synthesis from this research because these questions map to triple, double and single loop learning respectively (Engelbart, 2012). The emphasis on real life exploration renders a case study approach naturally complementary to Action Research and all characteristics are present and adopted for this work.

Types of Case Study

Stake (1995) defines three main categories of case study: intrinsic, instrumental and collective. An intrinsic case study concerns learning about a unique phenomenon, the focus of which is distinctions in the phenomenon. The instrumental case study is used to elicit a broader appreciation of an issue or phenomenon. The collective case study involves studying multiple cases simultaneously or sequentially in an attempt to generate a still broader appreciation of a particular issue. Crowe *et al.* (2011) stress that these categories are not mutually exclusive and all three categories apply to some extent to this research, for example, the viability of directing value creation in CAS environments, the phenomenon, across single and multiple cases (Yin, 2009).

This research applies two case study types which span Stake's categories: longitudinal and cross-sectional (Collis *et al.*, 2009, p. 77). The longitudinal case study of five years duration, covered in Chapter 8, is applied to explore phenomena critical to the new theory and test the efficacy of associated developments over time. Conversely, the entire Value Power Framework, constructed in Chapter 7, is validated across a number of diverse cross-sectional case studies, to validate learning under multiple contexts, in Chapter 9. The need for causal certainty within inherently uncertain CAS environments calls for Triangulation, the use of different data collection sources and techniques (Saunders *et al.*, 2006, p. 139).

Criteria for Assessment

A major challenge for case studies concerns assessment, in which respect there is a clear distinction between the case study process and product, both being equally important (Lincoln *et al.*, 1990). Stake provides a list of 20 criteria for assessing the standards of evaluation for case studies (Stake, 1995, p. 131). Key among these for this research is triangulation; the principle of obtaining a fix on the phenomenon under investigation from two known points, for example, different data, researchers, theoretical perspectives, methodologies and/or perceptual positions (Farquhar *et al.*, 2016), all of which are applicable to this work, covered in Section 5.10. Data were drawn from multiple sources. Although the Author retained overall responsibility for this work, other researchers provided major contributions, which are clearly attributed.

5.9 Choices

Choices refer to the nature of data used for research, often associated with philosophical positions; positivism and interpretivism being aligned most closely with quantitative and qualitative respectively.

5.9.1 Quantitative

Under a quantitative choice, research centres on the collection and analysis of clearly measureable data. For example, the developmental case study for this research is structured on a Learning Journey in which customer cognition of need and opportunity to switch provider builds through experience derived from two types of event. First, agents experience service events, such as positive or negative contacts with providers. Secondly, agents undergo contextual life events, for example, commencing university, starting a new job, buying a house or getting married. Both types of event are directly measureable and quantitative, albeit with some difficulty in many cases.

5.9.2 Qualitative

Qualitative research places greater weight on opinion and feelings of agents, often derived using interviews under an interpretivist philosophy such as Grounded Theory (Binder *et al.*, 2010; Glaser *et al.*, 2017). Both System Dynamics and Agent-based Models developed for this case study incorporate the concept of cognition level, comprising awareness of need and opportunity to switch. As cognition level increases, the probability that a customer actively considers switching is raised and the choice made is also influenced by relative levels of cognition pertaining to providers in the ‘consideration set’. Neither cognition as a state nor incremental impacts on cognition level as a result of events is measureable directly and requires a degree of qualitative assessment, even though assigned a numerical value for modelling purposes.

5.9.3 Need to Integrate Quantitative and Qualitative Choices

Focus on causation presents a major challenge concerning the need to integrate 'hard' parameters, for example service and life events, and 'soft' factors, such as consequential cognition level impacts. Both must be quantified numerically for dynamic simulation. The approach adopted for this research is to combine quantitative and qualitative choices for deriving numerical values with which to populate simulation model parameters, as proposed by Richmond (2001, p. 196). This involves the use of linear and non-linear scales and relationships for assigning essentially qualitative values. For example, customer cognition level, which is a latent effect in the causal cycle discussed in Section 5.6.4, is assigned using a scale of 0 – 100 and event impacts numerical values within this scale taking into account customer segmentation by financial circumstances and mental disposition.

5.10 Data

The inner most layer of the research onion is data and for this research principally concerns input for the Market Dynamics Model (MDM) evolved through the developmental case study, Chapter 8. The Author defined data requirements, together with precise units of measure for each parameter in the MDM and designed a prototype data transformation method and tool. Other team members then assumed ongoing responsibility for specifying, sourcing, transforming and structuring data into the parameters, incorporated in a model input template built in Excel. Initially, all MDM parameters were populated with indicative values by the Author. During the course of development over five years, these indicative measures were replaced with layers of validity as described in the following sections.

5.10.1 Published Sources

Valid published sources of primary data are used wherever possible covering hard factors. For this research examples include monthly current account switching levels complied by Bacs, customer life events using publically available data from the UK Office of National Statistics (ONS), such as marriages, university enrolment and house purchases, and customer segmentation by financial status published by the Money Advice Service (MAS).

5.10.2 Literature Research

The second major source of data is either extracted directly or inferred from academic papers and industry reports examined as part of the literature research. Peer reviewed papers were of particular interest due to their academic rigour and by linking the findings from individual papers provided essential breadth for the MDM. Consequently, the separate threads were synthesised into causal stories incorporated within the Causal Tracing Document (Davies, 2018), used as the Conceptual Model and principal control vehicle for MDM development. The process and associated documentation are described in Chapter 8 and Appendix B1.

5.10.3 Expert Opinion

Where formally compiled and published data were not available with which to populate MDM parameters, it proved necessary to acquire estimated values through structured interviews with industry experts. The key to ensuring efficacy of information derived through this method proved to be precise specification of required parameters, including units of measure, called Metadata in data engineering (Fletcher, 2018). This enabled experts to combine their experience with 'Fermi' calculations to construct viable input data, described next.

5.10.4 Fermi Calculations

Estimates based on expert opinion were strongly supported by Fermi calculations. This term, named after Enrico Fermi who correctly estimated the yield of the first atomic test by observing displacement of drizzled confetti, refers to numerical inferences derived from highly indirect observations (Hubbard, 2014, pp.17-18). Examples for the MDM included probability of customer service events based on contacts with providers, and word of mouth communication between customers using network size; both contact volumes and network dimensions being based upon expert experience.

5.10.5 Surrogate Survey Data

Most MDM input parameters are neither available from organisation nor public sources, particularly 'soft' measures. However, a significant proportion of surrogate data, from which values for model input parameters can be approximated, is sourced through commercially procured customer survey data configured against MDM data definitions (Huang, 2018b). Survey data proved particularly useful for probabilities relating to customer behaviour, in some cases by inversion. For example, Rich Harding inverted survey data on the likelihood that customers remain with their current provider to extract cognition level distribution and associated probability that customers consider switching (Davies, 2018, p. 74).

5.10.6 Data Transformation

In most cases, survey data provided atomised components which were combined and configured to constitute values needed for MDM input parameters through a data transformation process. An initial proof of concept was developed by the Author using a spreadsheet platform, which was enhanced and later converted into R code by Shaofu Huang who formally documented the method (Huang, 2017; Huang, 2018b).

5.10.7 Bayesian Inversion

Bayesian Inversion provides a means for transforming known but unwanted probabilities into unknown required predictions (Stone, 2013; Lambert, 2018). For example, the required but unknown probability that a customer considers switching given a specific cognition level can be calculated from the known but not required probability of a cognition level given that a customer considers switching, derived through survey data. The applicability of Bayesian Inversion was researched and rapid prototype provided by the Author then employed by Shaofu Huang as part of the data transformation process (Huang, 2017; Huang, 2018b).

5.10.8 Model Calibration

Despite all efforts to populate the MDM with input data from valid formal sources, approximately 20% relied upon informed estimates. The modelling process was used in two key ways to mitigate the impact of this limitation on results efficacy. First, sensitivity analysis determined the vulnerability to error posed by one or more estimated parameters. Secondly, calibration against known historic output, notably monthly switching levels, provided the means to hone the, surprisingly, small number of known unknown parameters to which the results were critically sensitive. It transpired that even with a significant proportion of estimated input data, the independent academic validation process concluded that predictive accuracy of switching level provided by the MDM was within 15% (Huang, 2018c; Taylor, 2018).

5.11 Research Design

The research was conducted as series of integrated Learning Journeys comprising specification of purpose, action, review and redirection. The research design, shown in Figure 5.8 with chapter numbers, comprises six main components: failure patterns, literature reviews, value theory and framework, developmental case study, subject expert interviews and validation case studies.

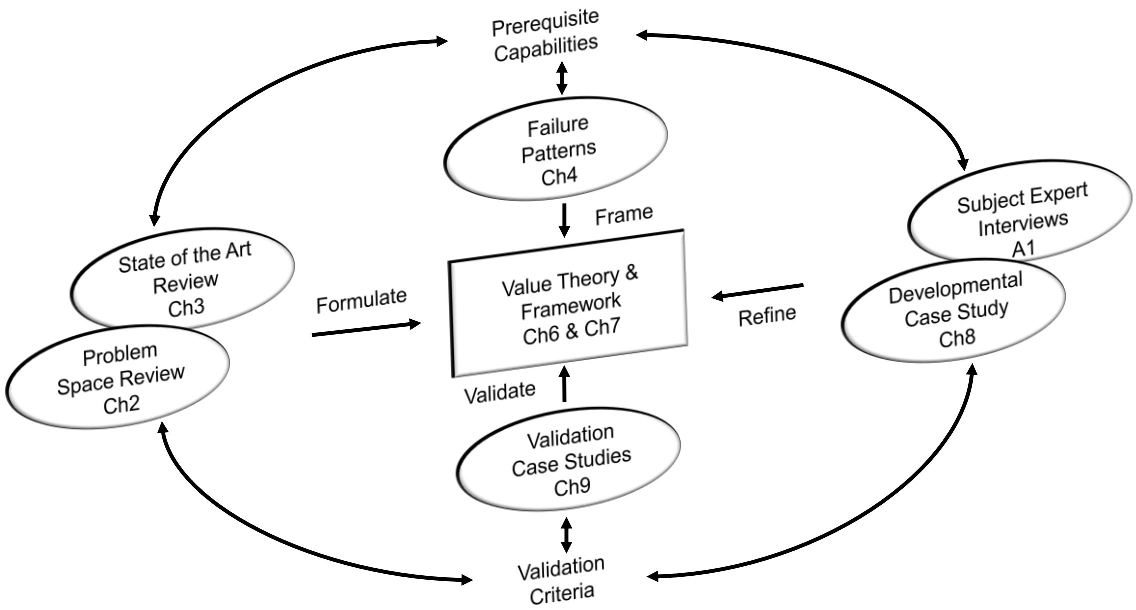

Figure 5.8: Feedback Loop between Literature and Interviews

5.11.1 Failure Patterns

The essential purpose and intention of the new value theory is directed through the Author's real world experiential research framed in the form of failure patterns, described in Chapter 4, which he defined from observation of archetypal thinking and behaviour preventing change programmes from delivering stakeholder value. This problem frame provides the scope and structure for the literature research comprising problem space and state of the art reviews.

5.11.2 Problem Space and State of the Art Reviews

The literature review is conducted from two perspectives: problem space and state of the art. Problem space, Chapter, 2 defines the contextual framework for the research. State of the art, Chapter 3, explores the latest thinking and advances pertinent to formulating the new value theory within the contextual frame. The reviews target key areas for further enquiry relating to prime concerns from experience, in addition to exposing potential gaps, ‘white space’, from which the new value theory is formulated. There is a strong emphasis on discovering completely fresh insights focusing on relationships between subject areas.

5.11.3 New Theory and Framework

The new theory is synthesised into Value Principles, Chapter 6, and Value Power Framework, Chapter 7, from the literature research, developmental case study and subject expert interviews. The theory comprises seven value principles which address repeating failure patterns, defined in Chapter 4, hypothesised through experiential research. The framework maps both the failure patterns and value principles to phases structured around learning levels.

From a research method perspective, everything up to the definition of principles, Chapter 6, is about establishing a detailed, complex hypothesis. The framework, constructed in Chapter 7 is a hypothetical solution, based on intelligent reasoning synthesised from the literature research and subject expert interviews, together with decades of direct and indirect insights by the Author in addressing complex multi-faceted problems. Part of the hypothesis is that piecemeal solutions are unlikely to work.

5.11.4 Developmental Case Study

A five year longitudinal case study develops and tests approaches, techniques and tools for addressing the three prerequisites capabilities, Agile Learning, Causal Precision and Causal Certainty, and associated objectives defined in Chapter 4, which were identified from the literature research and subject expert interviews.

5.11.5 Subject Expert Interviews

Subject expert interviews serve four purposes: corroboration, challenge, targeting and relationships. First, findings from the literature are corroborated or countered. Secondly, critical and often contentious aspects of the new theory are subjected to challenge. Thirdly, subject expert interviews target further literature research. Finally, there is a strong emphasis on identifying directly applicable relationships between subject areas. All interviewees reviewed and approved documentation of the interviews included in Appendix A1.

5.11.6 Validation Case Studies

Validation Case Studies, Chapter 8, exercise the efficacy of the entire new framework. This section describes the case selection process and situations deemed not suitable.

Selection Process for Validation Case Studies

The three validation case studies were real consulting assignments conducted through the Author's company Impact dynamics Limited (IDL). In this respect, the cases were opportunistic rather than purpose designed. The Oil and Gas and BIM cases arose from a direct client enquiries to the IDL website and Citizen-led Housing through the University of Bristol as a result of this research. However, all were considered for validation against criteria for suitability.

Four principal selection criteria were used. First, the case needed to embody the appropriate shift, type and intervention to be in scope as defined in Section 1.5. Secondly, it was crucial to cover the entire Value Power Framework, including those aspects relating to future implementation, such as 'Track'; specifically how success will be measured. Thirdly, it was necessary to demonstrate the generic applicability of the new theory by exercising the framework across a diverse range of cases; as was achieved through the selection for this research. Finally, evidence was needed to demonstrate that the new approach enables creation of value beyond that possible without it, by clients qualified and willing to conduct, review and approve before and after interviews in response to all questions structured in Table 5.2.

Table 5.2: Case Study Before and After Validation Questions

Before Question	After Question
What was the perceived challenge?	How did the approach improve framing and definition of the challenge?
Who were perceived as stakeholders and why was the challenge important to them?	How did the approach improve specification of intended stakeholder outcomes?
How was a solution to the challenge perceived as being prevented?	How did the approach improve causal analysis of the challenge?
What other approaches were tried or were available?	What solution was proposed?
How did other approaches tried or available fail to address the challenge?	How did the approach and deliverable capabilities address failure of alternatives?
What were the key criteria for success and to what extent were they not met?	To what extent were success criteria met in relation to alternative approaches?
What repeatable desired outcomes were not possible using other approaches?	To what extent did the approach enable repeatable success across different applications?

Case Studies not Suitable for Validation

In addition to failing any one of the selection criteria, it is also appropriate to consider two explicit circumstances under which case studies would not be suitable for validation. The first relates to the definition of strategic change programme targeted for this research. Specifically, this includes cases not involving a level of structural transformation, for example, Business as Usual (BAU) problem solving or incremental improvements under existing organisation, processes and capabilities.

The second, closely coupled scenario, is where any dependent part the organisation resists the necessary transformational change. This situation can arise in a number of ways, for example, managers seeing the shift as challenging their power or operational staff perceiving the change as a rouse to reduce staff. Whether manifested as subtle obstruction or overt resistance, the lack of active support renders such cases unworkable for validation; anything which is not total commitment is sabotage. Neither of these circumstances pertained to the selected validation case studies

5.12 Impact of Author's Experience on the Research Process

Section 5.3 includes a statement of position from three perspectives: background, dominant logics and mindset. The chapter also declared the Author's stance concerning paradigms, philosophy and approach, in addition to selection of research strategy and specific design. This section provides reflection relating to impact of the Author's experience and bias on the research process. Chapter 11 includes reflection on the converse; how this research shifted the Author's position.

Professional experience over a forty year duration can be crystallised as, 'creating actual results through transformational change driven by necessity to solve real world problems'. Consistent Exposure to this imperative dictated exploration and development of new, often unproven thinking, techniques and tools. For example, problems posed by absorption costing in quantifying benefits from automation led to causal thinking, application of Activity-based Cost Performance and dynamic simulation, then development of Value Management and, ultimately, the Toolset.

Greatest successes and associated recognition occurred through the convergence of creative freedom and collaborative teamwork with adequate authority within high trust learning environments, where failure is not an option yet success demands feedback and correction. This combination of circumstances is encapsulated under Action Learning, discussed in Chapter 3, and duly reflected in the incorporation of Action Research and Case Studies for the research method. Action Research centres on an iterative process akin the Author's own experience and Case Studies provide real world environments. Other important elements of the research method are rapid prototyping and agile fail-fast approach using dynamics modelling, all consistent with the researcher's experience.

The Author's background, mindset and experience injected bias which influenced the research process in three key ways. First, dominant values are freedom and creativity, which drive the thirst for learning and need for innovation through relating disparate areas. This was reflected in the research by encompassing a wide span of subjects, imposing the risk of excessive scope and inadequate rigor in one or more domains.

Secondly, career progression and subsequent success in running a niche consulting business depended upon real world results, favouring learning through action rather than academic research. Consequently, significant time and energy was demanded to master essential application of academic rigour, requiring supervisory support; readily given and gratefully received.

Thirdly, a Learning Power profile, taken by and assessed on behalf of the Author, corroborated previous other psychometric indicators of a 'fragile' learning style requiring multiple confirmation of the Author's own judgement. This dispositional characteristic influenced the use of subject expert interviews in addition to research. It is also pertinent to note that confidence in research and self-learning significantly increased as a direct result of the research.

5.13 Essence

This research is necessarily cross-disciplinary due to the close relationship between objective natural laws and subjective human behaviour in the creation and delivery of stakeholder value. To this end, Critical Realism (CR) is selected as the philosophical grounding because it provides a bridge between positivist and interpretivist positions, together with associated anthropological, ontological, epistemological and axiological worldviews and deductive and inductive approaches. The focus on real world application of the new theory and framework directs the combination of Action Research and Case Studies for method strategies, both driven by agile development of models encompassing fail-fast and rapid prototyping principles. A longitudinal developmental case study explores and evidences success of solutions for objectives relating to key prerequisites for the new theory. Cross-sectional case studies validate the entire framework across contexts. The research design is structured around six mutually supporting components: failure patterns, literature reviews, value theory and framework, developmental case study, subject expert interviews and validation case studies.

PART III NEW THEORY AND FRAMEWORK

Part III formulates the new value theory by combining research from Part I with the Author's experiential research into seven Value Principles and constructing a framework through which the principles are integrated. Principles and corresponding framework phases map to the failure patterns defined in Chapter 4.

6 Formulation of New Value Theory

6.1 Introduction

This chapter develops a new value theory comprising seven Value Principles which address the failure patterns defined in Chapter 4. The Value Principles are named by the Author as follows and map to the failure patterns as shown in Figure 6.1 using consistent colour coding.

- 1 Value Frame: Do the right things then do things right
- 2 Value Intention: Specify mutual stakeholder intentions
- 3 Value Model: Align value causality
- 4 Value Programme: Eliminate waste and respect essential redundancy
- 5 Value Alignment: Optimise value resilience in magnitude and time
- 6 Value Certainty: Integrate intuition and analysis
- 7 Value Track: Combine right first time with correction

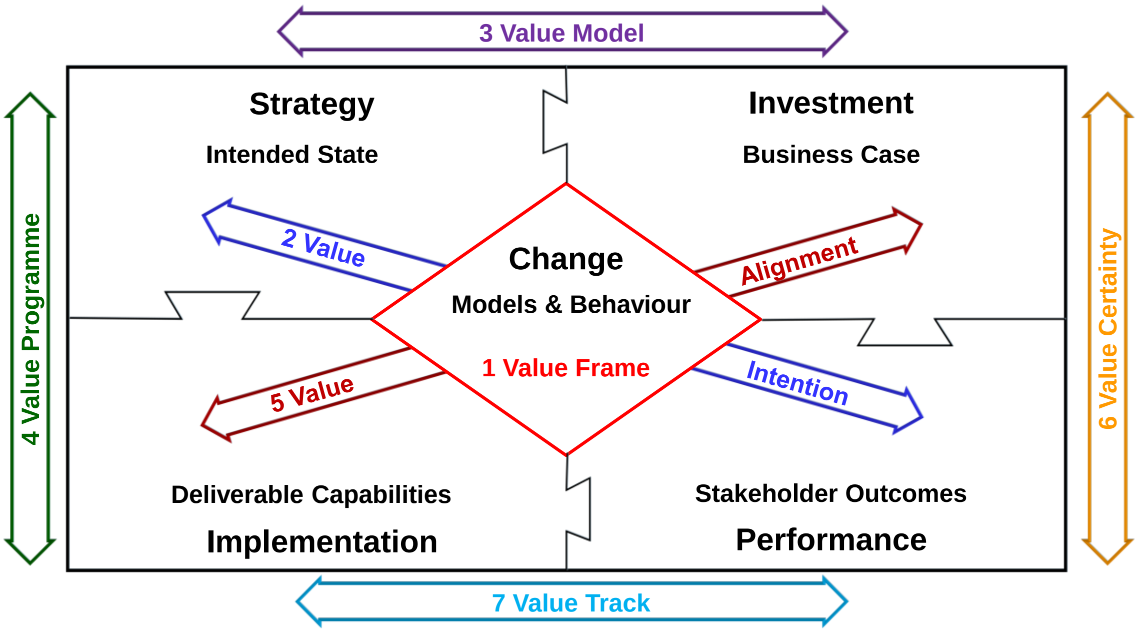

Figure 6.1: Value Principles Mapping to Change Perspective Interfaces

Principles are each defined and configured into a V-Model schema, widely deployed in Systems Engineering (INCOSE, 2010), also using consistent colour coding, with the aim of rendering explicit translation into the Value Power Framework in Chapter 7. Principles are then expanded through synthesis from the research.

6.2 1 Value Frame: Do the Right Things then Do Things Right

Frame change programmes on value, structured in the sequence of intended purpose, causal process and essential capabilities; why, how, what

Value Principle 1 shown in Figure 6.2 provides a frame for all other principles. It focuses on a key theme permeating throughout this research; the imperative to order and integrate correctly effectiveness and efficiency, defined as doing the right things and doing things right respectively (Drucker, 2006, p. 2), to create and realise stakeholder value. The power of purpose is first introduced then framed in a business context with reference to research relating to Meta level rules for creating and realising exceptional performance.

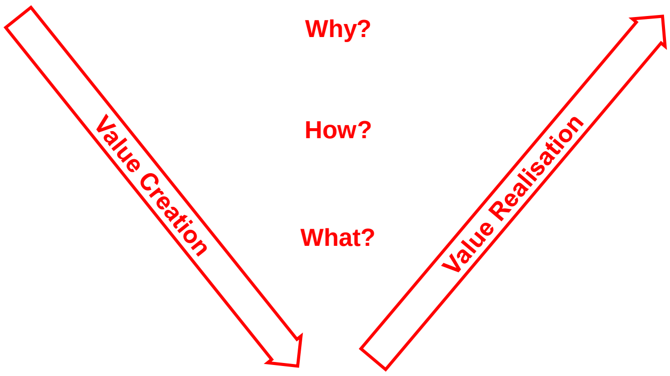

Figure 6.2: Value Frame

6.2.1 Power of Purpose, Meaning and Values

In the context of strategy, Sinek (2009, p. 37) proposes the order why, how and what, a sequence he calls the Golden Circle purporting that successful businesses sell through purpose and values which inspire emotionally driven trust and loyalty; an argument corroborated by Pink (2011). Referencing Restak (2009), Sinek (2009, pp. 57-58) asserts that decisions made from the limbic brain tend to be faster and higher quality than those derived rationally from the neocortex. Whilst, as Kahneman (2011) cautions, 'gut' decisions must be tempered against bias and over-confidence, these insights strongly support the power of purpose in the context of motivation and behaviour.

Frankl (1985) contends that for people to have purpose they must perceive meaning. Wheatley (2006, pp. 129 & 132) cites Frankl when she frames meaning as the single most critical fractal 'strange attractor' in organisations which, importantly, she links with purpose, intent and values. Fractals originated through the work of (Mandelbrot, 1977) who subsequently applies the theory to markets in offering explanations for the 2008 global financial meltdown (Mandelbrot *et al.*, 2007).

It is important to recognise that goals do not necessarily reflect purpose and Epstein argues that 'Match quality', the degree to which what we do matches meaning, is key to long term, sustainable success (Epstein, 2019, p. 128). In this respect, values, i.e. those things most meaningful and important to us (Business Dictionary, 2015b), are critical. Goals without meaning lack commitment. Shephard (2005b) makes a distinction between moving away from and moving toward values, the former being scalar the latter vector, possessing both magnitude and direction.

6.2.2 Business Context

Many authors have sought to determine a formula behind sustainable business success by exploring what exceptional corporations ***do*** that is different, notably (Peters *et al.*, 1982) and (Collins, 2001; Collins, 2009). Whilst useful steers, Raynor *et al.* (2013c, pp. 35-36) caution that this approach injects bias, and instead separate signal from noise by focusing on how exceptional companies ***think***. This analysis results in just three universally applicable rules which corroborate the why, how, what sequence, prioritising purpose:

Rule 1: Better before cheaper

The first rule concerns strategic positioning; the capability to ***create*** value for customers in the market relative to competitors. Raynor *et al.* (2013c, p. 10) define two choices for strategic positioning, price and non-price, the latter including functional and service excellence, categories consistent market leadership disciplines (Treacy *et al.*, 1995). Their research demonstrates that the most exceptional companies consistently adopt a non-price position; even if this puts them at a cost disadvantage. Critically, this does not imply that cost is unimportant, but that the priority must be to deliver products and services which fulfil customer needs, i.e. purpose first. Therefore, this rule strongly supports the principle of putting effectiveness, doing the right things, before efficiency, doing things right.

Rule 2: Revenue before cost

The second rule focuses on profitability; the capability of a business to capture**,** i.e. ***realise***, value for the owners, such as shareholders. The primary measure of profitability is Return on Assets (ROA), which reflects how effectively a company's resources are utilised to generate income, i.e. profit. ROA comprises the product of Return on Sales (ROS), profit divided by sales, and Total Asset Turnover (TAT), sales divided by assets, i.e. resources. Consequently, there are only three ways in which a company can improve ROA: increase revenue, decrease cost or decrease assets (Raynor *et al.*, 2013c, p. 15), as shown explicitly in the formulae below:

$$\text{Profit (Income)} = \text{Revenue} - \text{Cost} \tag{6.1}$$

$$\begin{aligned}\text{Return on Assets} &= \text{Return on Sales} \times \text{Total Asset Turnover}\\ &= (\text{Profit} / \text{Sales}) \times (\text{Sales} / \text{Total Assets})\\ &= (\text{Revenue} - \text{Cost}) / \text{Total Assets}\end{aligned} \tag{6.2}$$

Raynor *et al.* (2013a); (2013b) conclusively revealed that companies which focused on revenue not only consistently outperformed those with stronger cost and asset measures, but also attained exceptional status. Revenue is a measure of the degree to which customer needs are being served effectively, whereas cost relates to efficiency. Again, the authors do not denigrate the importance of containing costs and assets but argue through evidence that excellence is favoured through prioritising revenue.

The findings are consistent with those of Sinek, who cites Apple’s premium pricing (Sinek, 2009), and Kaiser who cautions against cost cutting for short term efficiency gains, ‘red line’, at the expense of sustainable ‘blue line’ strategies (Kaiser *et al.*, 2013). It follows that this rule is another instance of the imperative to do the right things then do things right. Raynor *et al.* (2013c, pp. 73-96) further propose that value creation positioning, through Better before Cheaper, is analogous to potential energy, whilst value capture, profitability through Revenue before cost, relates to kinetic energy. This analogy is useful because it is consistent with the derivation of Value Productivity from an energy transformation perspective (Odum, 2007) introduced in Chapter 2.

Rule 3: There are no other rules

The third rule is that there are no other rules. This means that the exhaustive research concluded that no other strategic factors correlated with exceptional performance. Articulated more usefully, any strategy has the potential of being successful as long as it is pursued respecting the other two rules: better before cheaper and revenue before cost.

6.3 2 Value Intention: Specify Mutual Stakeholder Intentions

Structure change programmes around purpose specified as intended stakeholder outcomes which are causally reinforcing through both values congruence and logical dependence

Value Principle 2 ensures that stakeholder intentions are specified precisely as measurable outcomes, as shown in Figure 6.3. Intention goes beyond want and desire (Lexico Oxford, 2019a) to the creation of reality (Zukav, 1991, p. 120) and in neuroscience is closely related to Confirmation Bias (Kahneman, 2011, p. 81). Paradigms of human interaction are explored and mapped to both systems archetypes and values levels and the power of win-win introduced. The concepts are placed in a business context by considering key stakeholder relationships. Finally, redesign for business is proposed which shifts systemic conflicts into mutually supporting intentions.

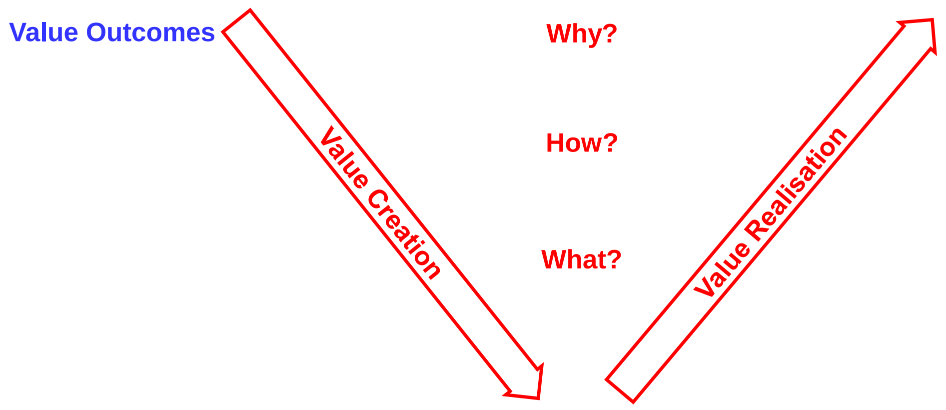

Figure 6.3: Value Intention

6.3.1 Paradigms of Human Interaction

Covey (1992) defines four key paradigms of human interaction, structured as permutations of win and lose, of particular interest for this research as shown Figure 6.4; generic names are proposed by the Author:

Win-Lose Competition	**Win-Win** Collaboration
Lose-Lose Attrition	**Lose-Win** Appeasement

Figure 6.4: Paradigms of Human Interaction

Lose-Lose

In lose-lose one party is prepared to risk sacrifice in order to control or constrain another party within a given context. This leads to attrition as both parties are forced to exert increasing effort to control each other, leading to an 'Escalation' archetype (Senge, 1990, p. 384). A business example is a dominant market incumbent eliminating new entrants by out-spending them on advertising rather than quality. This pattern was evidenced from simulation modelling using the Market Dynamics Model (MDM) in the Bacs case study, Chapter 8. It is also important to recognise that agreed compromise is a form of lose-lose on the grounds that both parties give up something as the sacrifice for agreement; not to be confused with win-win covered subsequently.

Lose-Win

Lose-win involves one party attempting to control another party's behaviour by appeasing them through their own or someone else's sacrifice. This can lead to the giving party being obliged to increase their sacrifice as the other party makes increasing demands, leading to a 'Fix that Fails' archetype (Senge, 1990, p. 388) where the outcome proves worse than the presenting problem. Business examples include appeasement by weak management of bullying behaviour in order to avoid confronting the bully.

Win-Lose

Win-lose positioning is where one party sets out to win, if necessary at the expense of another party. The interaction is expressed as competition under a scarcity mindset, where the first party assumes that there is only so much to go round so there can only be winners or losers under a Darwinian 'survival of the fittest' reality. In business, an extreme example of this 'Success to the

Successful' archetype (Senge, 1990, p. 385) is the 'winner takes all' scenario where a complete market segment is dominated by a single player, examples being Amazon, Facebook and Google.

Win-Win

The term win-win, originally coined by Victor Baranco (Living Experiment, 2019) and brought into popular use by (Covey, 1992), is founded on the belief that all parties can acquire more through collaboration. As Covey stresses, win-win is the hardest of the paradigms to achieve but provides the most sustainable system through alignment of intentions. Business examples include effective payment systems, where fast, secure transactions benefits all legitimate players in markets relying on shared infrastructure where standards enable interoperability; ports and containers being another instance.

The validity of this assertion is the subject of research by Axelrod using the deceptively simple Prisoner's Dilemma model (Axelrod *et al.*, 1981; Axelrod, 1990; Axelrod, 1997). He concluded that the optimal and most sustainable strategy was 'Tit for Tat', where each party simply responds with the same action as the other, which converges towards steady state where both players end better off. Importantly however, the maximum points are earned through win-lose if the other party appeases. This key insight confirms Covey's assertion that for win-win to work all parties must collaborate, but also the need to view the long term. This demands partnership, an imperative closely related to values level 7 (Graves, 1970; Beck *et al.*, 2014).

Generic System Archetypes

Further categorisation of system archetypes (Senge, 1990) by loop pairings and focus on system boundaries, reveals existence of archetypal, 'holistic', solutions (Wolstenholme, 2003; Wolstenholme, 2004) as shown in Table 6.1:

Table 6.1: Generic System Archetypes and Solutions

Senge Archetypes	Generic Categorisation	Generic Solution
Escalation Eroding Goals	Relative Control Balancing - Balancing	Commit to agreed standards
Fixes that Fail Shifting the Burden	Out of Control Balancing - Reinforcing	Tackle problem directly
Success to the Successful	Relative Achievement Reinforcing - Reinforcing	Regulate dominance
Limits to Growth Tragedy of the Commons	Underachievement Reinforcing - Balancing	Match supply and demand

Human Interactions and Systems Archetypes Mapping

Although there is no pretence of an exact match, it is useful to map system archetypes to human interactions as shown in Figure 6.5. Mutual Intention, i.e. win-win, is not a Senge archetype and is proposed by the Author as a basis for sustainable, equitable stakeholder value.

Win-Lose Success to the Successful Reinforcing-Reinforcing (Opposing)	**Win-Win** ***Mutual Intention*** Reinforcing-Reinforcing (Congruent)
Lose-Lose Escalation Eroding Goals Balancing-Balancing	**Lose-Win** Fixes that Fail Shifting the Burden Balancing-Reinforcing

Figure 6.5: Interaction and Systems Archetypes Mapping

Escalation and Eroding Goals are essentially lose-lose archetypes comprising two balancing loops, which interact to generate increasingly less favourable outcomes for each party. For example, the arms race, which damages the economies of both antagonists, is an instance of Escalation and exam grade erosion, which ultimately harms students, employers, accrediting bodies and the economy, an example of Eroding Goals.

Fixes that Fail and Shifting the Burden represent lose-win patterns comprising a balancing loop attempting to contain a reinforcing problem. Often the result is not only worse than the initial problem but tends to increase over time. For example, appeasing bad behaviour in children, an instance of Fixes that Fail, typically increases the problem which drives even greater expectations of reward in order to contain the behaviour. Shifting the burden of mental patients to ‘care in society’ to reduce pressure on hospitals often manifests in behaviours which exceed the cost of specialist care, for example police dealing with crimes or citizens suffering violence associated with mental illness.

Success to the Successful is epitomised as uncontrolled competition where, as one party gains advantage, their dominant position increases exponentially at the expense of others vying for the same resource. Primary examples include the ‘rich getting richer’ pattern creating wealth inequality through capital (Piketty, 2014) and ‘winner takes all’ market dominance of internet companies such as Amazon, Facebook and Google.

Although not included in this matrix, ‘Limits to Growth’ and ‘Tragedy of the Commons’ archetypes concern resources and have a critical role, leading to an imperative for overwhelming resourcefulness (Beigi *et al.*, 2017; Taylor *et al.*, 2020) which is particularly important for win-win because this interaction requires capacity for requisite variety (Ashby, 1956; Beer, 1984; Hoverstadt, 2008) to facilitate mutually supporting intention, now explored.

Win-Win: The Missing Category

Whereas ‘Success to the Successful’ comprises two opposing reinforcing loops, the Author proposes ‘Waste Creates Waste’ as a problem archetype in which two reinforcing loops work in the same direction. Under this structure nugatory work, rework and duplication not only consume recourses in their own right but also demand disproportionate effort to manage. In addition, this pattern consumes limited resources which cannot be deployed on value-added activities. The generic solution to this archetype is causally aligned, mutually reinforcing intentions and actions between stakeholders; win-win. A prerequisite for win-win to work is that Wolstenholme’s generic solutions are in place where other archetypes are operating.

6.3.2 Human Interactions and Value Levels Mapping

It is possible and useful to map values levels to the win and lose pairings as shown in Figure 6.6 and outlined below, based on Master Practitioner NLP course material (Shephard, 2005c) in which values levels are framed as containers holding values, the content. Names are proposed by the Author.

Win-Lose Level 5 Entrepreneurial Growth Reinforcing-Reinforcing (Opposite Directionality)	**Win-Win** Level 7 Responsible Growth Reinforcing-Reinforcing (Same Directionality)
Lose-Lose Level 6 Sacrificial Equality Balancing-Balancing	**Lose-Win** Level 4 Command and Control Balancing-Reinforcing

Figure 6.6: Human Interactions and Values Levels Mapping

Level 4 Command and Control is essentially lose-win because members are expected to make sacrifices to benefit the organisation which controls any reward. Level 5 Entrepreneurial Growth agents do not generally aim for others to lose but prepared for that outcome if deemed necessary for them to win; this level is win-lose. Level 6 Sacrificial Equality often converges towards a steady state of shared lower expectations, rendering this level lose-lose. Level 7 Responsible Growth involves a significant shift from all previous value levels supporting win-win as the default but, critically, with the ability and preparedness to operate at any of the lower levels as necessary until conditions are conducive for resuming win-win. This is consistent with Tit for Tat (Axelrod, 1990).

6.3.3 Mutual Stakeholder Intention Business Model

To design a generic business model framework in which stakeholder intentions are mutually reinforcing, we need to restructure business in five critical ways. First, it is necessary to satisfy essential physiological needs (Maslow, 1943; Pink, 2011). Secondly, shift stakeholders from being adversaries to partners sharing highest level meaning and purpose. Thirdly, intentions are framed around each stakeholder's most critical values, i.e. what is most meaningful and motivating for them with greatest influence on their behaviour after essential needs are satisfied (Shephard, 2005b). Values do not need to be the same, but sufficiently similar and mutually supportive in the context of shared purpose. For example, the manager of a hospital may place money higher in their values hierarchy than a nurse more concerned with care, but both must place sufficient value on the common purpose, patient wellbeing; a misalignment exposed with tragic consequences in the Stafford Hospital case in Section 4.4.1 Fourthly, broaden the timeframe to allow realisation of purpose within the causal structure of the business CAS ecosystem. Finally, a win-win business model must be capable to adapting to any other values level, competition, appeasement or attrition, as necessary.

The proposed business model structure is shown in Figure 6.7 for a commercial enterprise. However, the framework is generic and equally applicable for public sector and non-profit organisations. By shifting the frame from profit to purpose maximisation, all relationships between each stakeholder and the business are not only reinforcing in their own right but, through responsible growth of the business, mutually reinforcing. Profit is now an outcome of purpose and the value through which it is generated equitable and sustainable. The process of visioning, design, approval and commitment of a change programme is a form of negotiation. In this vein, transformation from an adversarial to the mutual intention model is an instance of focus on stakeholder interests, as opposed to position, as advocated by Fisher *et al.* (2012).

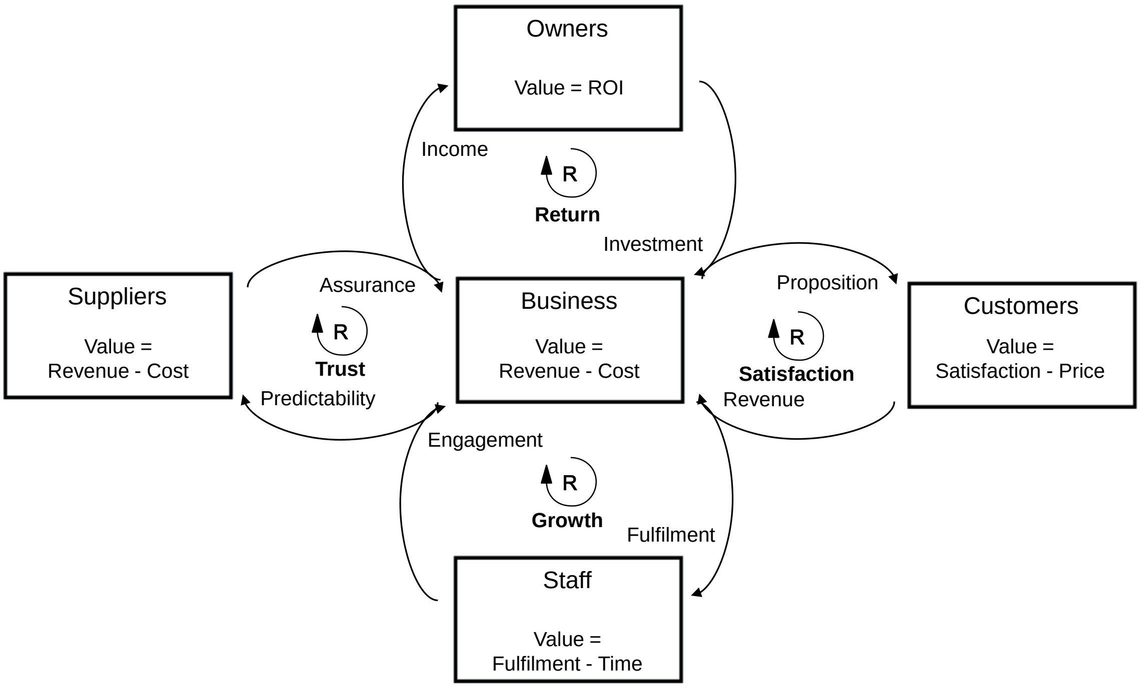

Figure 6.7: Mutual Stakeholder Intention Business Model

6.4 3 Value Model: Align Value Causality

Model relationships between outcomes, outputs and inputs to align within the deep causal structures of the entire value ecosystem

Value Principle 3 extends Principle 2, which aligns intention, by ensuring causal coherence between the primary building blocks of value: outcomes, outputs and inputs, as depicted in Figure 6.8, This is achieved by looking beyond surface level events, i.e. effects, to the deep causal structures comprising value drivers and associated systemic relationships. Systemic levels of causality are first defined and causal precision viewed from three perspectives: surface events versus deep structure, big picture versus detail, and storytelling. Measurement is then considered in the roles of increasing certainty, value attractor and causal standard. This is followed by exploring the integration of hard and soft measures using a combination of Systems Thinking and dynamics modelling.

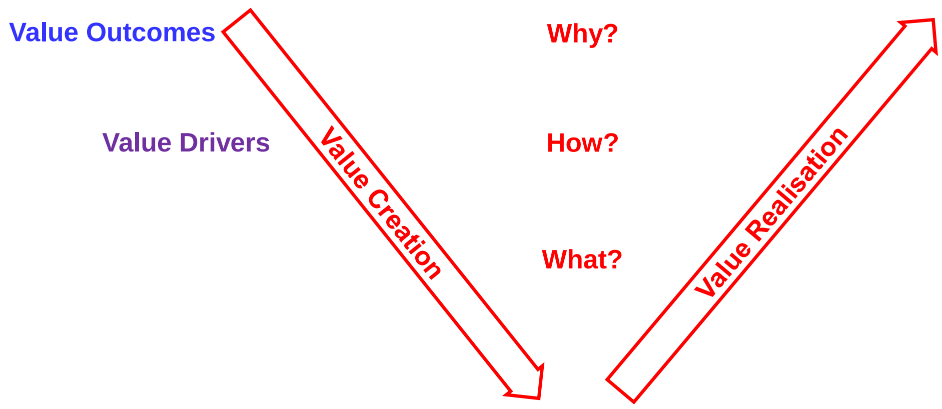

Figure 6.8: Value Model

6.4.1 Systemic Levels of Causality

The problems associated with misalignment are recognised and articulated in various forms, such as need for ‘joined up thinking’, ‘holistic solutions’ and “treating crime and the causes of crime”. All these descriptions boil down to the imperative for causal alignment, which involves causal levels. Senge (1990, p. 52) defines three levels of causality: structure, patterns and events, together with their associated interventions: generative, responsive and reactive respectively. Although not a precise one-for-one mapping, these levels both correspond to triple, double and single loop levels of learning (Argyris, 1976; Tosey *et al.*, 2011) and also structure, relationship and data levels of modelling (Morecroft *et al.*, 1994; Sterman, 2000; Borshchev, 2013).

Structural changes involve shifts in mental models, addressing the question why? using triple loop learning, often requiring contextual reframes (Bandler *et al.*, 1982). For example, consider the Growth reinforcing loop between the business and staff in Figure 6.7, which involves a contextual shift from staff as cost consumers to value creators. For this structure to operate effectively, perceived value to staff must be created through fulfilment from opportunities provided through their work. This increases motivation for productive engagement (Proto, 2016; Bellet *et al.*, 2019), thereby generating value for the business and further opportunities for fulfilment. This more precise narrative is shown as a simplified Causal Loop Diagram (CLD) in Figure 6.9, which includes the nature of relationships and, by inference, associated data.

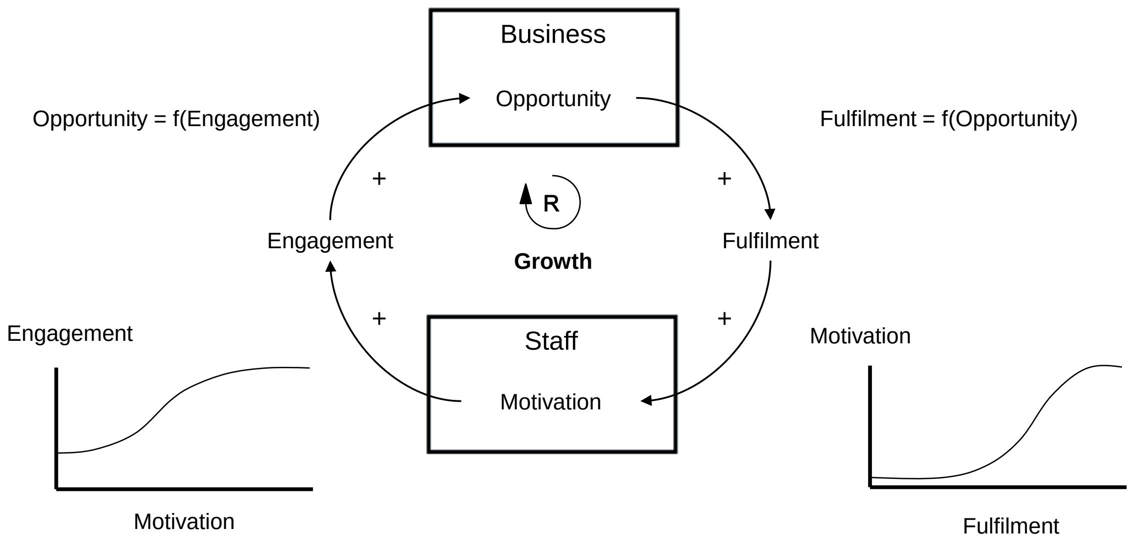

Figure 6.9: Causal Precision of Business – Staff Value Relationship

6.4.2 Causal Precision

Causal precision involves achieving a balance of model structure, level and data which represents causal reality sufficiently to enable realisation of intended purpose (Sargent, 2013). In this pursuit, there are three further areas for examination: surface level vs deep structure, big picture vs detail, and power of storytelling.

Surface Level Events vs Deep Causal Structure

Problems are generally experienced in the form of surface level events which are readily visible and immediate action is apparently obvious. However, the presenting problem usually only represents symptoms rooted in a deep causal structure (Senge, 1990) and focusing purely upon surface events is likely to return flawed understanding. The NLP Meta Model (Bandler *et al.*, 1976; Lewis, 1990, p. 92; Grinder *et al.*, 2012, p. 45) transforms superficial events into underlying causal structure by correcting erroneous thinking.

Former Governor of the Bank of England Mervyn King (2017, p. 8) provides a dramatic example of the need to see below surface events to the deep structure in challenging the dominant argument for stimulus, notably money printing and negative interest rates, to kick-start the economy post 2008. Conversely, King argues that there are four causal factors operating at a systemic level: disequilibrium between spending and saving, radical uncertainty concerning the future, prisoner's dilemma where unilateral action will disadvantage the first mover, and loss of trust in the market and its players. Together, these factors render the inevitable shift to a new more painful equilibrium, for example negative interest rates exacerbate the disequilibrium. Instead, he advocates systemic solutions involving self-interest driven collaboration (King, 2017, p. 347); in other words, align stakeholder intentions and associated drivers.

Big Picture vs Detail Data

The second consideration is the level of perspective using data, three aspects of which are particularly relevant to the new value theory. The first concerns absolute or relative frames. Blastland *et al.* (2007) demonstrate how politicians make their claims on spending sound impressive by stating them as large absolute numbers, which actually represent minute relative increases; £10 Million more spent on education sounds more impressive than just over £1 per pupil, for approximately 9 million pupils in England.

The second aspect relates to the human tendency to perceive and focus on extremes. Rosling (2018, p. 21) exposes massive errors in estimation in relation to global wealth and poverty due to this flawed mental model, which he calls the 'gap instinct'. He proposes 'Factfulness', the acquisition and presentation of big picture data as the means to countering flawed mental models and consequential interventions. Thirdly, Agrawal *et al.* (2018, p. 18) frame Artificial Intelligence, which employs Big Data, as increasing the value of judgement by reducing uncertainty through prediction. In conclusion, big picture and detail are not competing but complementary in achieving causal precision and injecting certainty.

Storytelling

Campbell (1993, p. 30) shows that myths developed over the millennia generally possess a common architectural structure comprising a journey with three key elements: call, journey and return, together with some form of preparation, depicted as a circle. The transformations of Jesus, Mohamed and Gautama Buddha are cited as examples. Storytelling is becoming increasingly important as a tool for change in organisations, for example (Denning, 2006; Miller, 2011a), all citing Campbell as the source.

Research suggests that storytelling in organisations shares values, builds trust, cultivates norms, transfers tacit knowledge, facilitates unlearning of flawed mental models, and generates emotional connections (Sole *et al.*, 2002). In this regard, these authors provide five guidelines for an effective approach: clarify purpose, simplify and make accessible, apply multiple media, track how the story is received and develop deep listening. Significantly, recent research into the science behind storytelling concludes that whilst structure is critical, characters in the plot are more important in storytelling (Storr, 2019).

Pearson (1991, pp. 8-12) adopts Campbell's work, defining twelve archetypes representing attributes of our character, drawn from Jungian psychology, as guides in navigating change. Mark *et al.* (2001, pp. 133-136) map Pearson's archetypes to categories of enterprise, for example Harley-Davidson and Apple display revolutionary 'outlaw' characteristics; a process called Archetypal Branding. Pearson (1991, p. 3) stresses that journeys are neither linear nor circular but perpetual spirals of change This frame provides important linkage with several other areas of this research, such as the Deming Cycle of continuous improvement (Deming, 1994, p. 132) and Learning Journey (Deakin Crick *et al.*, 2017a), as shown in Figure 6.10.

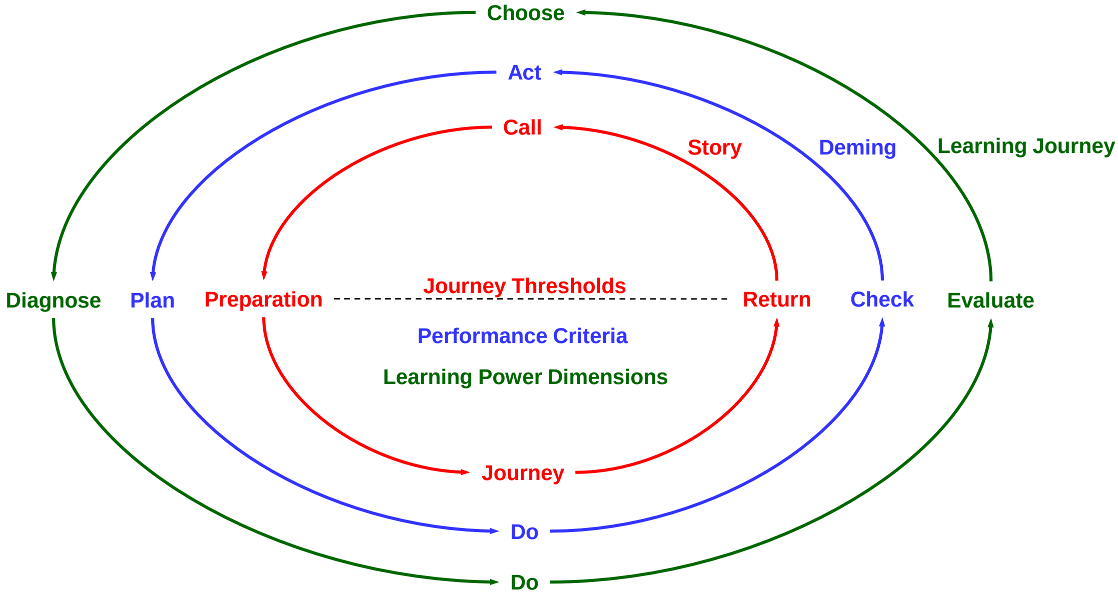

Figure 6.10: Story - Deming Cycle – Learning Journey Mapping

Furthermore, framing the archetypal story structure as a continuous spiral of change, shifting from one state of equilibrium to another, is analogous to values levels (Graves, 1970; Cowan *et al.*, 2005; Beck *et al.*, 2014) and the physical equivalent, basins of attraction drawn from chaos theory, the concept of which is generally applicable to significant state change (Thompson *et al.*, 1989). Exploring the science behind storytelling Storr (2019) provides four insights relevant in to this research concerning: cause and effect, curiosity (Loewenstein, 1994), our flawed selves and confirmation bias (Kahneman, 2011). In essence, we live in a hallucinated world created by our neurology honed to particular survival needs (Storr, 2019, p. 33).

The NLP Meta Model III structure (Dilts *et al.*, 2000, p. 743) invokes all aspects of storytelling science and offers a powerful means for translation into dynamics models. For example, Richmond (2001) structures training in System Dynamics as building stories and this technique is used in constructing the Value Power Framework in Chapter 7 and employed for the developmental case study in Chapter 8 (Davies, 2018).

6.4.3 Causal Certainty: Real Role of Measurement

Whilst it is argued that inappropriately defined targets can destroy value through misalignment (Seddon, 2003; Seddon, 2008), appropriate quantitative measurement serves a critical role of in value creation. However, in pursuing causal certainty when dealing with CAS environments it is necessary to reframe measurement in three important ways: from absolute quantification to relative certainty, cost avoidance to value attraction and misaligned targets to causal standards.

Measurement as Relative Certainty

We are schooled to think of measures, such as length, weight and time, and their units as absolute characteristics of the universe, rather than what they are; man-made tools for defining and navigating causal reality. For example, time was not used in Japan as a key measure until relatively recently (Hashimoto, 2008). Even reality itself is not a given but dependent on consciousness, as evidenced by wave-particle duality in quantum measurement (Goswami, 1993, p. 39). Hubbard (2014, p. 8) frames measurement as need for reducing uncertainty in making decisions To this end, he focuses on the worth of measurement in terms of value creation made possible as a result of reduced uncertainty, i.e. increased certainty. Adopting the Pareto or 80/20 Principle, Hubbard (2014, p. 160) argues that what counts is not quantity of data but quality of the information it provides in relation to the purpose as shown in Figure 6.11.

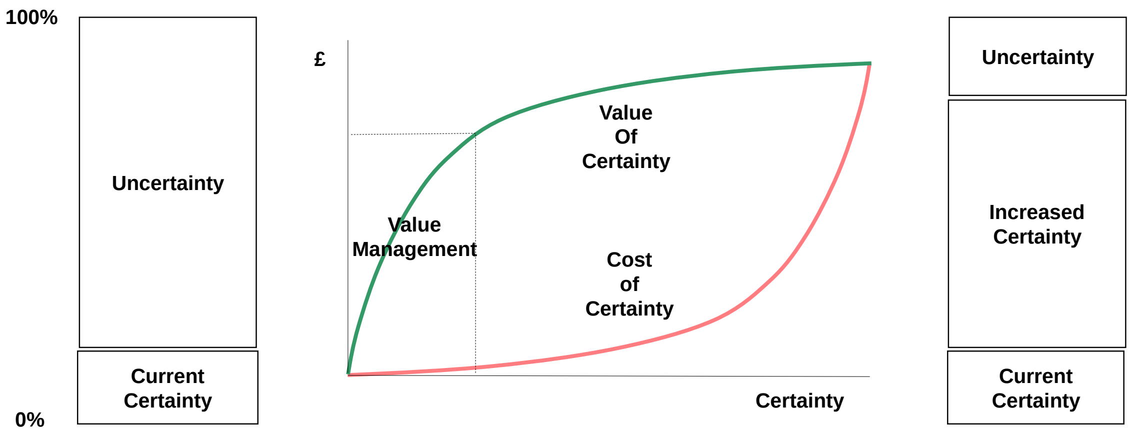

Figure 6.11: Measurement as Value of Certainty

Measurement as a Value Attractor

The importance of measurement is encapsulated in the commonly accepted sentiment credited to Peter Drucker, “If you can’t measure it you can’t improve it” (Lavinski, 2019; MacKenzie, 2019). More specifically, Drucker (2001, p. 120) states that measurement is needed to assess performance against goals, with the important qualification that clear simplicity is more important than rigid, exact quantification. (Ariely, 2010) extends this proposition by stressing that both physiologists and economists converge on the simple truth that humans adjust behaviour based on the metrics against which they are assessed; in other words we get what we measure.

The corollary is that measures are a form of focus and attract manifestation related to them and to achieve different outcomes we need to change our mental models underpinning the measures through the Law of Attraction (Losier, 2007, p. 12),widely attributed to personal achievement (Byrne, 2008). Neuroscience offers stronger scientific credibility for the link between focus and manifestation, Manson (2015) proposing confirmation bias (Kahneman, 2011) as the true causal explanation. With limited capacity for attention to all the things happening around us, humans choose to pursue what they focus on. This explains the power of social networks which Manson calls the new business model of attention (Manson, 2014).

Confirmation bias is well researched and has relevance in several guises, including the positive aspects of achieving goals through focus (Nickerson, 1998). Kahneman (2011, p. 81) also makes reference to confirmation bias in the context of human tendency to focus on evidence that supports beliefs, known as ‘positive test strategy’. Further causal explanations drawn from neuroscience relate to Logical Levels (Dilts, 1990, p. 56), proposing that values and beliefs influence capabilities which drive behaviour determining results in the environment. This linkage is related to the NLP Communications Model (James, 2016) which maps closely to the cognitive functional framework (Baars *et al.*, 2013, p. 31) in both structure and operation.

Measurement as Causal Standards

A key conclusion from the previous discussion is that measurement is a strong attractor for change from current to new states of equilibria in environments exhibiting non-linear behaviour. In physics, these new states are referred to as basins of equilibrium (Thompson *et al.*, 1989), which have equivalents for change in any domain, for example economic, societal or personal. In business, current and desired future states are often called ‘as-is’ and ‘to-be’ respectively, as defined using measures structured in a performance management framework, such as Balanced Scorecard (Kaplan *et al.*, 1996), corresponding to a desired status.

In this respect, there is an important distinction between targets and standards .Targets are defined for motivational purposes (Pink, 2011) but when misaligned often cause severe problems, as evidenced government targets (Seddon, 2008). For example, to avoid government penalties on target appointment times General Practitioners gamed the system, an unintended consequence of which, working people could not book future appointments, exposed the Prime Minister on national television (McSmith, 2005); an instance of output focus. Conversely, a standard represents necessary attainment for a measure in order that the entire system, of which the item being measured is a part, operates to defined level of performance.

Whereas targets are generally single values, standards are defined as upper and lower tolerances within which maintenance of system performance is supported. The degree to which variation between tolerance limits is minimised determines efficacy and is the essence of quality focus, widely credited to (Deming, 1982; Deming, 1994). Targets are aspirational, standards are causally non-negotiable. This distinction is illuminated in safety critical situations. For example, would we want to fly on an aircraft fitted with turbojet engines maintained to aspirational targets rather than rigorous standards? The application of tolerances is finding application in other fields, notably economics where (Raworth, 2017) defines maintaining an acceptable level of growth between ensuring equitable wealth creation and distribution and ecological sustainability as ‘doughnut economics’.

6.5 4 Value Programme: Eliminate Waste and Respect Essential Redundancy

Programme causal coupling between deliverable capabilities, value drivers and intended stakeholder outcomes, removing waste whilst providing essential redundancy to ensure both effectiveness and efficiency

Value Principle 4, shown contextually in Figure 6.12, provides two key assurances. First, precise causal linkage between deliverable capabilities and value drivers ensures strong value coupling with stakeholders. Secondly, efficiency is realised by elimination of waste, together with effectiveness by releasing value-adding capacity from reduced waste. The distinction between waste and redundancy is defined, together with the importance of flexibility and the associated Law of Requisite Variety. Distinguishing characteristics of value and non-value added work are then examined and mapped to Lean thinking. The critical role of essential redundancy is introduced and the need to remove waste before redundancy stressed. Finally, key findings are applied to practical implications for effective interventions.

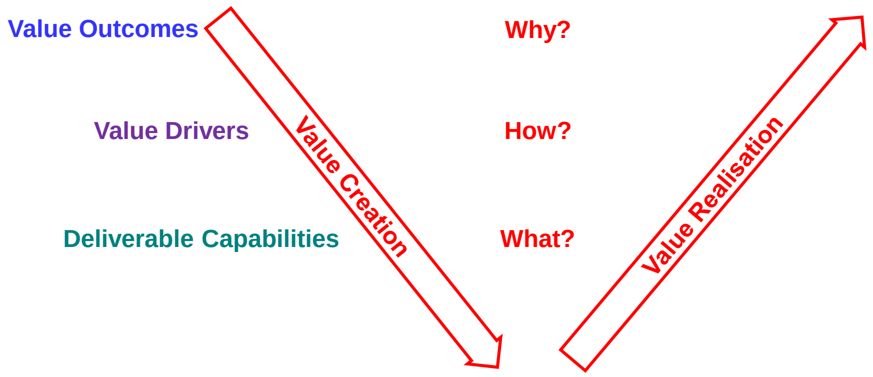

Figure 6.12: Value Programme

6.5.1 Waste and Redundancy

Value was previously shown to comprise effectiveness and efficiency. Humans generally recognise the impact on output efficiency by removing waste. If it is then assumed that more outputs translate into a proportional increase in outcomes, by implication efficiency equates to effectiveness and these terms are often treated as synonymous (Bartuševičienė *et al.*, 2013). However, this premise is flawed, particularly under CAS situations, due to the distinction between waste and redundancy.

Waste

Waste is the unnecessary or wrong use of resources (Cambridge Dictionary, 2019h) and the focus of most performance improvement initiatives. Ohno (1988), the force behind Lean production at Toyota, defines seven types of waste in the context of manufacturing processes: defects, overproduction, inventories, processing, movement, transport and waiting. Additional categories are often added by Lean practitioners, for example, design of goods and services which do not meet users' needs (Womack *et al.*, 2003, p. 355) and non-utilised talent (Six Sigma Daily, 2019).

In analysing the value stream, activities are sorted into three categories: activities creating value as perceived by the customer, activities creating no value as perceived by the customer but are needed to enable the first category, and tasks which neither add nor enable perceived customer value. The second and third categories map to essential redundancy and waste respectively. The Author proposes consolidation into four generic categories of waste: nugatory work, rework, duplicated work and management of waste, which are more readily applicable to change programmes whilst also mapping to Lean, as shown in Table 6.2. Increased waste imposes increased waste management, an archetype comprising two reinforcing loops both operating in the same direction, which the Author names 'Waste creates waste' also referred to as firefighting (Sterman, 2000).

Table 6.2: Waste Categorisation

Lean	Nugatory Work	Rework	Duplicated Work	Waste Management
Defects		✓		✓
Overproduction			✓	✓
Inventories			✓	✓
Unnecessary Processing			✓	✓
Movement	✓			✓
Transport	✓			✓
Waiting	✓			✓
Customer Needs not Met	✓			✓
Talent Underutilisation	✓		✓	✓

Essential Redundancy

Value requires effectiveness as well as efficiency. However, in complex systems effectiveness comes at a price, essential redundancy (Morgan, 1997, p. 108), the spare capacity required to provide flexibility, requisite variety (Ashby, 1991), to deal with complexity. Removal of essential redundancy may increase efficiency in the short term but generally at the expense of reduced effectiveness and sustainability of stakeholder outcomes later. An increasingly important aspect of what Senge (1990) terms the Learning Organisation is self-organisation, related to dissipative systems which find their own order emerging out of chaos (Prigogine *et al.*, 1984). Morgan (1997, pp. 108-110) stresses that any system with the ability to self-organise must have a degree of redundancy which creates spare capacity to enable innovation and development.

Emery defines two methods for designing redundancy into systems: parts and functions (Emery, 1978; Emery, 2012). Redundancy of parts involves adding items to replace components which fail. Conversely, in redundancy of functions extra functions are added to each of the operating parts, so that each part is able to perform a range of functions. For organisations, the latter provides great flexibility as a result of the holographic characteristics (Talbot, 1991). This 'whole in parts' holographic design supports self-organisation and encourages mutual support and responsibility, countering the 'silo effect' (Tett, 2015).

In the context of process, Goldratt demonstrates the futility of high utilisation in batch manufacturing due to the interaction between two phenomena: dependent events and statistical fluctuation (Goldratt *et al.*, 1989, pp. 86-87). The primary message from this insight is that for complex systems to survive, it is necessary to release the intuitive trap of matching capacity with demand, in favour of allowing a level of redundancy which enables effective stakeholder value delivery. Goldratt formalises these ideas into the Theory of Constraints (Goldratt, 1990).

6.5.2 Flexibility: Law of Requisite Variety

Ashby (1956) addresses how much flexibility should be built into a system through the Law of Requisite Variety, which suggests that the internal diversity of any self-regulating system must match the variety and complexity of its environment in order to deal with challenges posed by that environment (Morgan, 1997, p. 112). From a value creation perspective, two shifts stand out, size and specialisation.

Flexibility vs Size

The corollary of this law in the context of influence is that the part of a system which is most flexible can exert greatest influence on the entire system (Mckenna *et al.*, 1998). In other words, agility trumps size where network effects are in play. This is evidenced dramatically by the dominance of Microsoft over IBM through a combination of agility and innovation leading to a De Facto Standard business model (Slywotzky *et al.*, 1997, p. 62). The traditional argument for size, economies of scale, which held true for mass, uniform production, is replaced by the imperative for rapid learning and adaptation (Senge, 1990; Atkinson *et al.*, 2005) where revolutionary ideas are fostered (Syed, 2019).

Flexibility vs Specialisation

With increasing complexity, pace and interconnectedness, flexibility also dominates over specialism, a trend reflected in employment. Bridges (1996) predicted much of what is now manifesting in the job market and proposed that people focus on the value that they can deliver rather than what they do. In a similar vein, Trump *et al.* (2006) observe erosion of the middle class as a result of the way value is shifting in the job market. Most recently, Epstein (2019) stresses superiority of the capacity to deploy a wide range of skills. All these authors converge on the need to create value through agility provided by multiple, overlapping capabilities in order to thrive in what Talbot (1991) calls the 'holographic universe'.

6.5.3 Categories of Work

To reiterate, there are three categories of work under Lean: value added, necessary but not adding value and neither value adding nor needed, which are equally applicable for product and service industries (Womack *et al.*, 2003, p. 38).

Non Value Added Work Categories

Of the three categories, the second is called Type One Muda and the third Type Two Muda, which translate into essential redundancy and waste respectively. Both Type One and Type Two Muda are non-value adding. However, whereas Type Two can be eliminated immediately, Type One translates into essential redundancy and cannot be removed without damaging the value adding work; unless the underlying drivers are removed first. For example, inspection is Type One Muda and cannot be removed until rendered unnecessary, whereas pointless meetings are Type 2 Muda. (Saukkoriipi, 2004) compares three key approaches to performance improvement; Lean, Activity-based Costing and quality focus centred on Deming's work, demonstrating the difficulty in reconciling the different perspectives. However, all definitions converge towards the three activity categories under Lean.

Value Added Work Categories

Under Lean value is added through the Value Stream comprising three value added (VA) activities: problem solving, i.e. decision making, physical transformation and information management (Womack *et al.*, 2003, pp. 19, 356). These definitions of value added (VA) activities are particularly powerful for the new value theory in that they map to key organisational models, performance frameworks and the definition of value developed in this research, examples of which are outlined below:

VA Mapping to the Viable Systems Model

Self-organising systems possess three characteristics: energy exchange, self-reference and resilience (Morgan, 1997). Dissipative systems counter entropy, i.e. decay over time, by exchanging energy with the environment (Prigogine *et al.*, 1984) and can be designed to be effective through systemic problem solving.

The self-referential ability to change in response to new requirements through effective energy transformation is autopoiesis (Maturana *et al.*, 1987), and the raw material for achieving success is information. The resulting adaptability provides resilient stability, i.e. viability over time to deliver intended value. The Viable Systems Model (VSM) applies requisite variety and autopoiesis to organisational design (Beer, 1984; Hoverstadt, 2017). More specifically, VSM Systems 1 and 3, Operations and Delivery, relate to physical transformation. Systems 4 and 5, Development and Policy, focus on problem solving for future viability. Systems 2 and 3*,Monitoring and Coordination, concern information management (Hoverstadt, 2008, pp. 25-37).

VA Mapping to the Balanced Scorecard

Since its inception in 1992 (Kaplan, 2009), the Balanced Scorecard (BSC) has become a leading framework for developing strategy and measuring business performance (Hoque, 2014), and is incorporated in this research. The BSC is structured around four perspectives: Financial, Customer, Internal, including supply chain processes, and Learning and Growth which translates into staff and other resources, including information systems (Kaplan *et al.*, 1996; Niven, 2002). The Learning and Growth perspective also maps onto design and development problem solving activities. The Internal view relates to physical transformation.

VA Mapping to Value Components

Lean categories of work also map to the two key components of value, effectiveness and efficiency. Problem solving and information management activities, for example, research and development (R&D), are concerned with doing the right things, effectiveness. Physical transformation activities, such as production of deliverable products and services for customers, focus on doing things right, efficiency. Further, framing and modelling value as transformation of energy (Odum *et al.*, 2000; Odum, 2007) using the building blocks of value: inputs, outputs and outcomes, has information exchange at its heart.

6.5.4 Causal Definitions for Essential Redundancy and Waste

The Author proposes that resources are consumed in three ways as shown is Figure 6.13; value adding, non-value adding and necessary but non-value adding. The final category is essential redundancy, needed to cover interaction between dependent events and statistical fluctuation (Goldratt *et al.*, 1989, pp. 86-87), characteristics of complex systems.

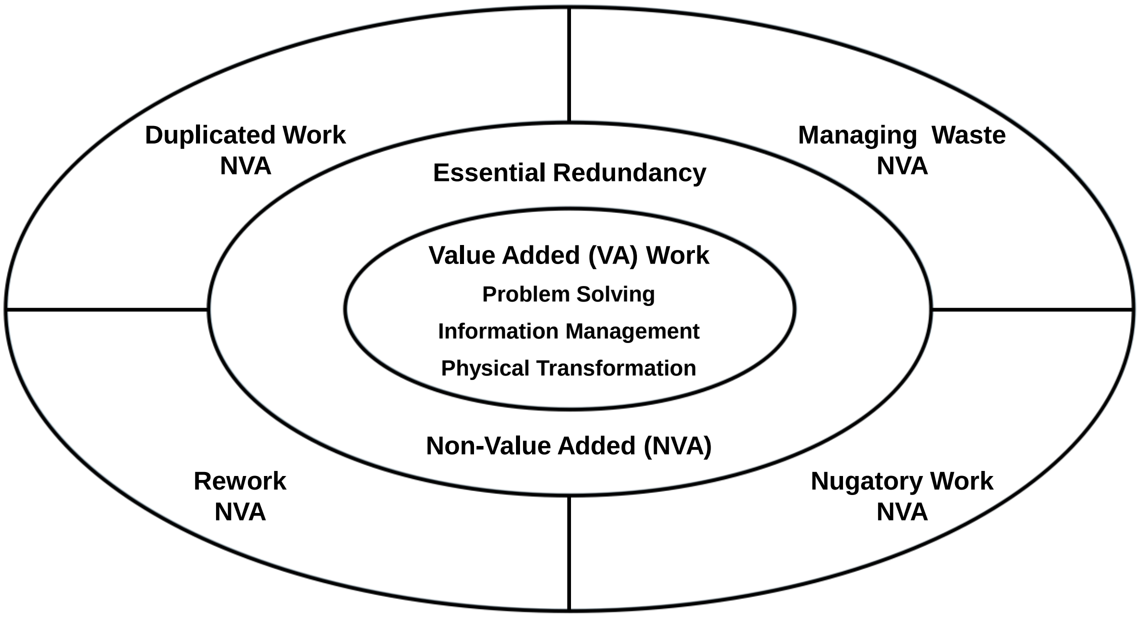

Figure 6.13: Value Added and Non-Value Added Map

The removal of waste and essential redundancy both result in immediate increased efficiency. However, the causal impact over time is diametrically opposite. If essential redundancy is removed, intended outcomes are compromised and additional waste generated through corner cutting, often resulting in Fixes that Fail and Shifting the Burden archetypes (Wolstenholme, 2004) , manifested as firefighting. It follows that essential redundancy can be defined by the Author as follows:

> Essential redundancy is the minimum level of spare capacity needed for a system operating in a given environment to deliver intended stakeholder outcomes, the removal of which reduces value by causing deterioration of outcomes and generation of waste.

Conversely, the removal of waste both reduces resource consumption by the waste, thereby releasing resources which can then be deployed on value added activities; the most knowledgeable resources often being engaged in firefighting errors (Impact Dynamics, 2018). Under this frame, waste elimination is used, not for short term cost saving but to build resilience through resourcefulness (Chandler, 2014; Beigi *et al.*, 2017; Taylor *et al.*, 2020) for the purpose of creating and delivering stakeholder value. In this respect waste is defined by the Author as follows:

> Waste is capacity consumed by a system in producing output which neither contributes directly to nor indirectly enables intended stakeholder outcomes, the removal of which increases value by causing reduced consumption and release of resources to create value.

6.5.5 Practical Implications for Intervention Design

In the extreme, interventions can, and often do, simply automate waste. For example, a highly automated facility within Plessey, a major defence company where the Author was a Chief Engineer in the 1980s, required a 'JIT warehouse' to store inventory which was overproduced very efficiently by cutting edge automation; the irony being lost on management. However, the most prevalent mistakes are cost cutting essential redundancy, often motivated under pressure to maximise share price, 'red line thinking' (Kaiser *et al.*, 2013) and optimising efficiency of local functions, 'silo effect' (Tett, 2015), which often operate together.

From the analysis of value added, redundancy and waste, it is possible to draw three clear guidelines for sound design of interventions. First, essential redundancy must be respected to achieve effectiveness by supporting all VA activities. This principle is consistent with, and supports, the two rules proposed by (Raynor *et al.*, 2013c): better before cheaper and revenue before cost. Secondly, elimination of waste is required to achieve efficiency and enable effectiveness, the corollary of which is that waste, together with the need for NVA activities which control waste, must be removed before essential redundancy. Thirdly, problem solving and information management are recognised as integral VA activities, in the same way as physical transformation. The key real world implication of this mindshift is that focus is redirected from cost to value.

6.6 5 Value Alignment: Optimise Value in Magnitude and Time

Design change programmes to target, align and prioritise deliverable capabilities for optimal magnitude and timing of stakeholder value whilst respecting logical dependence

Value Principle 5, shown contextually in Figure 6.14, optimises Value Power, the rate at which stakeholder value is created and assured, by building sufficient resilience through the Target, Align and Prioritise (TAP) process. TAP integrates leverage, alignment and timing to optimise stakeholder value. Programme dynamics is initially described, in the context of the critical distinction between functional and value dependence and associated work and value breakdown structures. Optimisation of stakeholder value is then discussed with reference to the TAP process for designing an Implementation Strategy.

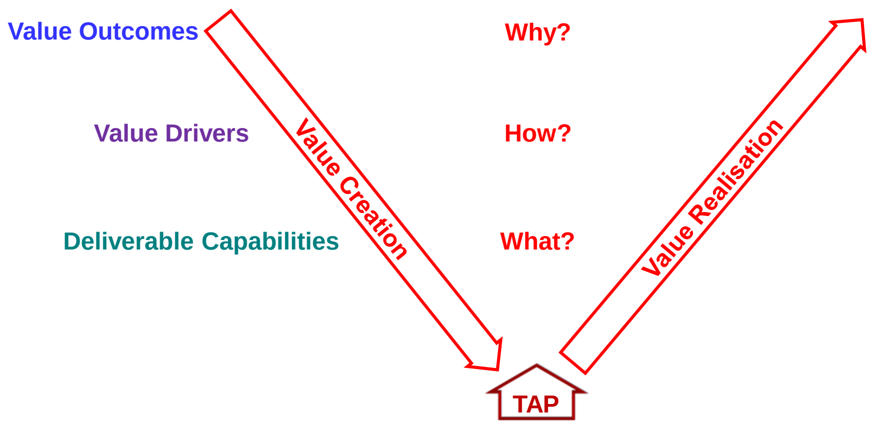

Figure 6.14: Value Alignment

6.6.1 Programme Dynamics

Programme dynamics concerns dependence of which there two types, functional and value.

Functional Dependence

Functional dependence is the degree to which one or more elements of functionality are needed in order to enable one or more other functional components (Davies *et al.*, 2011, p. 111). For example, foundations for a house are needed before walls are constructed, which are required before the roof is erected. Functional dependence is driven by the universal laws of cause and effect which cannot be circumvented without risking unintended consequences.

Value Dependence

Value dependence is the degree to which one or more elements of functionality lead to causation of stakeholder outcomes, either directly or by enabling one or more other functional elements to cause benefits. For example, in a new housing development, properties with the highest margin could be scheduled for completion first, resulting in greatest financial return for the developer. Value is scalar and must be vectored to stakeholders in order to ensure equitability and sustainability. Therefore, value dependence inevitably leads to questions of prioritisation and ethics, the former considered in this section, the latter, although out of scope is the subject of research in relation to values alignment in AI (Sierra *et al.*, 2019).

In order to reconcile costs and benefits to optimise value, programmes must combine function and value dependence into a single coherent design. This can be achieved by integrating a Work Breakdown Structure (Devi *et al.*, 2012) with a Value Breakdown Structure (Devaux, 1999; Devaux, 2015, pp. 112-118) previously discussed in Chapter 3. Value dependence is the critical relationship between programme work and value breakdown structures manifested as the degree to which costs and benefits are attributable to deliverable phases. There are essentially four value dependence structures shown as a matrix in Figure 6.15, in which red lines are cumulative cost and green lines are cumulative benefits.

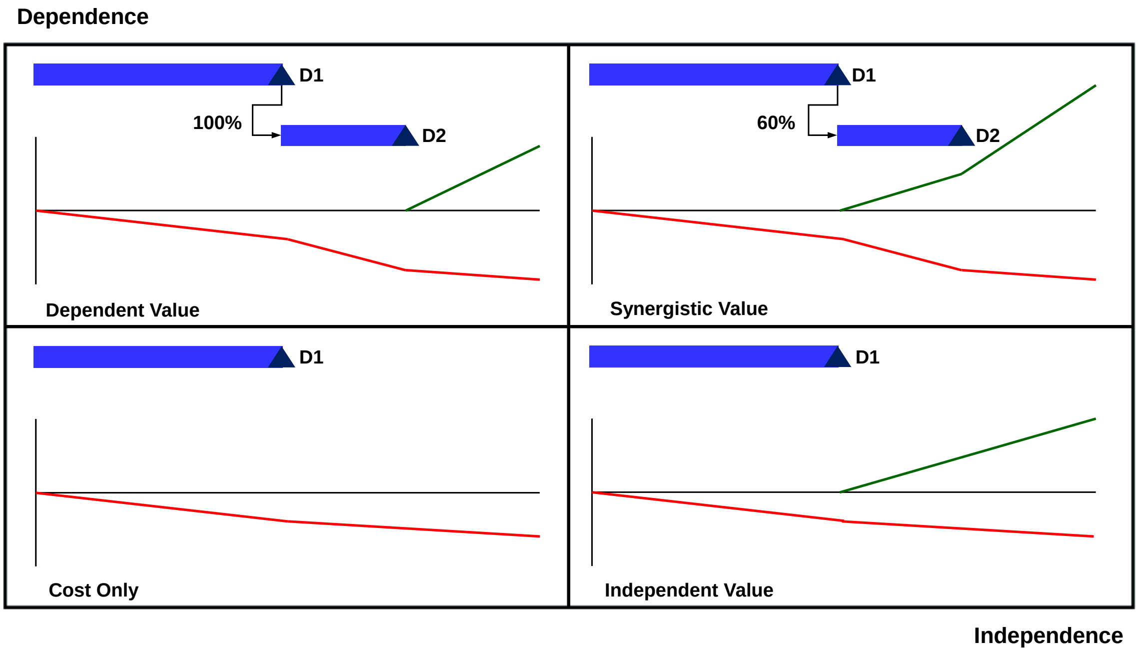

Figure 6.15: Value Dependence

Cost Only refers to phases which consume costs but deliver no benefits, the viability of which should be challenged. **Independent Value** phases deliver value in their own right, such as a standalone application. **Dependent Value** concerns phases which do not cause value independently but enable one or more other phases to deliver value. **Synergistic Value** refers to the situation where a phase not only delivers value independently but also enables one or more other phases to deliver value. This is usually the most powerful scenario for value optimisation. For example, an application may deliver some value in standalone mode, which can be delivered quickly, and also enables another application to cause greater value than it can on its own once the network comes on stream. In reality, these four value dependence structures are archetypal and operate in combination.

6.6.2 Value Alignment: Target, Align, Prioritise (TAP) - Implementation Strategy

For a change programme to optimise stakeholder value, it is necessary to align and integrate value within both the business and programme into deliverable implementation phases. Davies *et al.* (2011, p. 123) define Value Alignment as the state in which all levels of the business and programme are focused on and working directly towards the common vision. The Target, Align and Prioritise (TAP) process targets programme deliverables to points of power, leverage, in the system where greatest influence is possible, aligns components of value, inputs, outputs, and outcomes then prioritises implementation to optimise stakeholder value in magnitude and time. The result is an Implementation Strategy, which optimises programme value (Davies *et al.*, 2011, p. 137), a roadmap for which is shown in Figure 6.16.

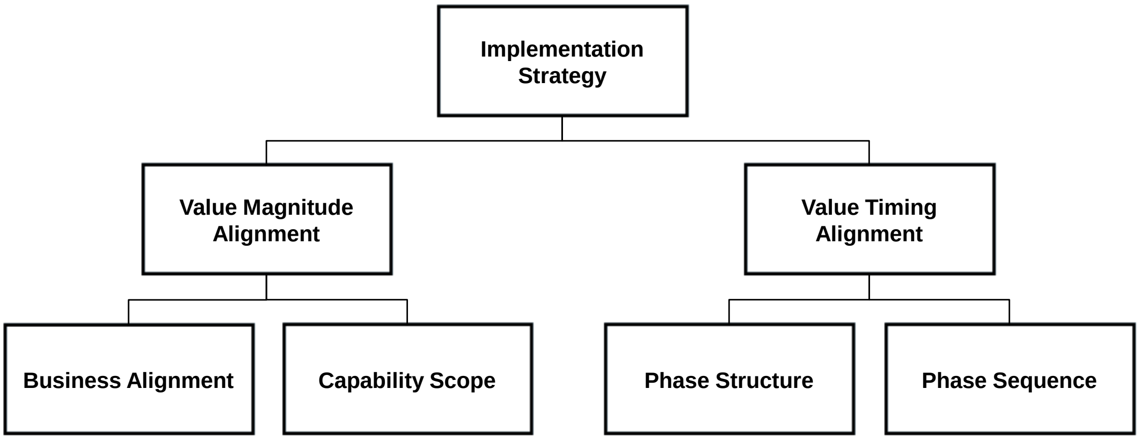

Figure 6.16: Implementation Strategy Roadmap

Value Magnitude Alignment: Business Alignment

Business alignment concerns assurance that all parts of the organisation perform coherently, reflected in causal linkage through levels of performance measures (Niven, 2002, p. 209) as shown in Figure 6.17. In this respect, it is important to recognise the systemic distinction between level and lateral alignment. Watzlawick *et al.* (1974, p. 10) articulate the need to determine the appropriate levels for dealing with a problem, as to whether we need evolution or revolution, which they term first and second order change respectively. In systemic terms, revolution involves structural change, whilst evolution concerns change within a given causal structure. This observation has very important practical implications. For example, repeatedly changing managers to improve performance under a flawed policy will inevitably fail; an instance of structure influencing behaviour (Senge, 1990, p. 42) . Conversely, it may be necessary to replace a long standing manager who obstructs a new policy essential for addressing fundamental market shifts.

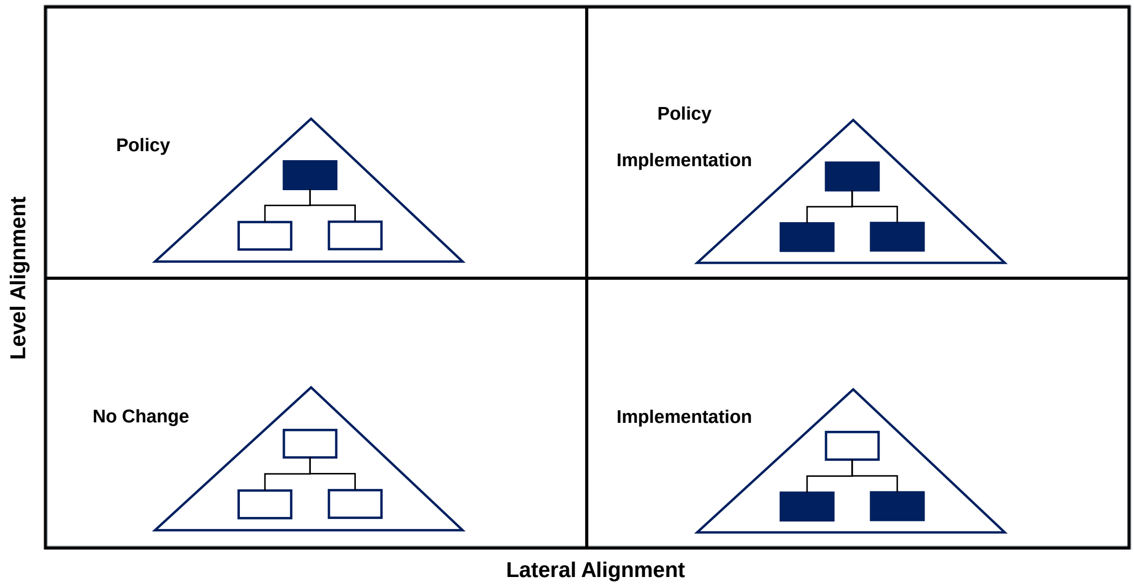

Figure 6.17: Business Alignment

Developing and authorising policy is concerned with doing the right things through leadership and doing things right as a result of sound management and competent operation (Drucker, 2006). **No change** is always the first option to consider, ensuring that intervention is not undertaken without clear purpose. **Implementation** refers to a requirement for improved execution of existing policies. **Policy** concerns the necessity for change in or improvement to rules, which may be driven by practicalities of current operation. **Policy and Implementation** is the most common change scenario where a structural policy shift is needed which also demands implementation of operational changes and associated management.

Value Magnitude Alignment: Capability Scope

Capability scope is the degree to which full or partial capability is implemented within a given part of the business, in terms of value. There are four permutations as shown in Figure 6.18. **Partial Capability and Partial Business** is where a subset of deliverable functionality, D1, is implemented within part of the business, for example, a pilot. **Partial Capability and Full Business** pertains to the situation where a subset of capability, D1, is rolled out across the entire business. **Full Capability and Partial Business** is the diametric opposite, where a core division within the business can generate greatest value as first mover but only if all functionality, D1 and D2, is available. **Full Implementation** combines all capability integrated and deployed across the entire business.

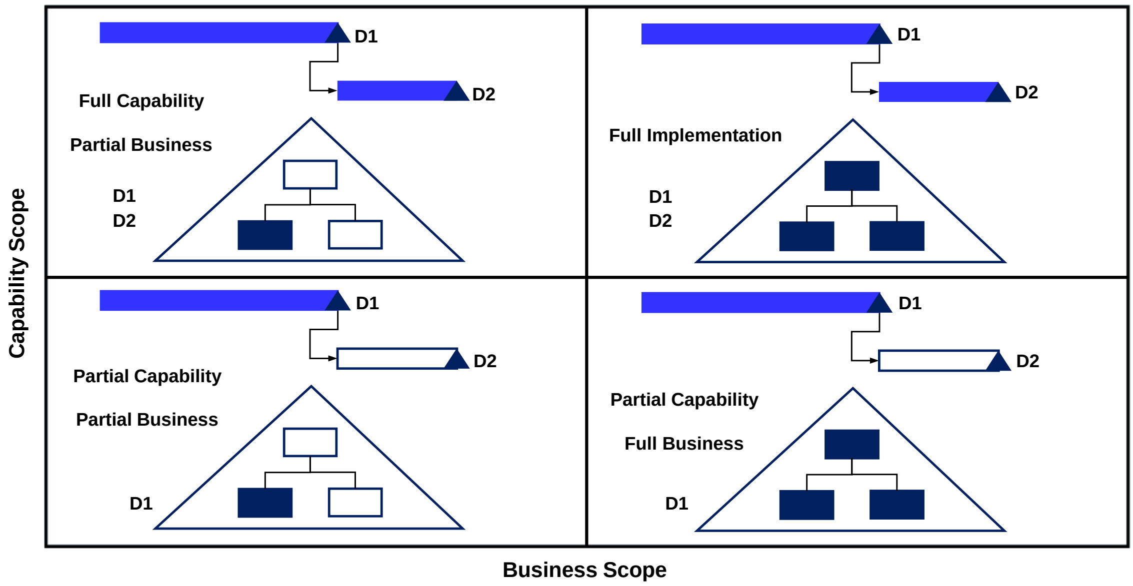

Figure 6.18: Capability Scope

Value Timing Alignment: Phase Structure

Phase structure relates to how value attributable to deliverables is distributed across phases. There are essentially four ways in which this can be achieved as shown as a matrix in Figure 6.19. **Single Deliverable per Phase** is the simplest configuration where full value potential of a new or enhanced capability is output from an individual phase. **Multiple Phases per Deliverable** covers an option to decompose the overall potential value of a deliverable across two or more phases. **Multiple Deliverables per Phase** is the diametric opposite where a single phase outputs whole or partial value attributable to more than one deliverable. **Multiple Deliverables and Phases** combine the previous two configurations and offers the greatest potential for optimising value magnitude, which can be further enhanced by considering phase sequence.

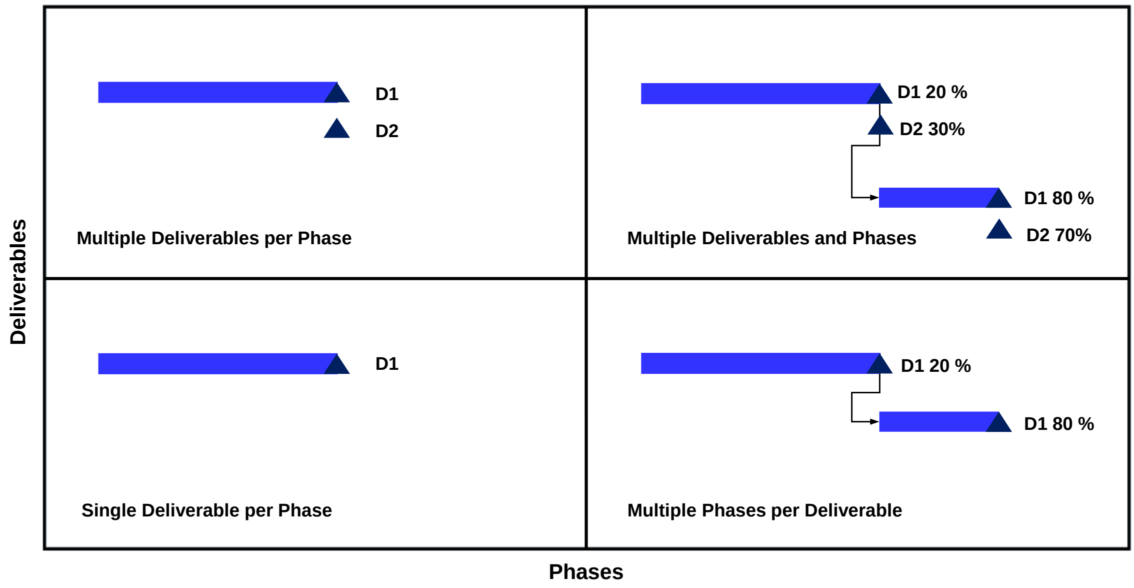

Figure 6.19: Phase Structure

Value Timing Alignment: Phase Sequence

Phase sequence refers to how programme phases are ordered to deliver value optimally across stakeholders. This aspect covers both order in which phases are configured, taking into account functional dependence, and concurrence, the degree of parallel working between phases. There are four permutations of, in the Author's experience, the two key phase dependence relationships, finish-to-start and finish-to-finish, from a value perspective as shown in Figure 6.20.

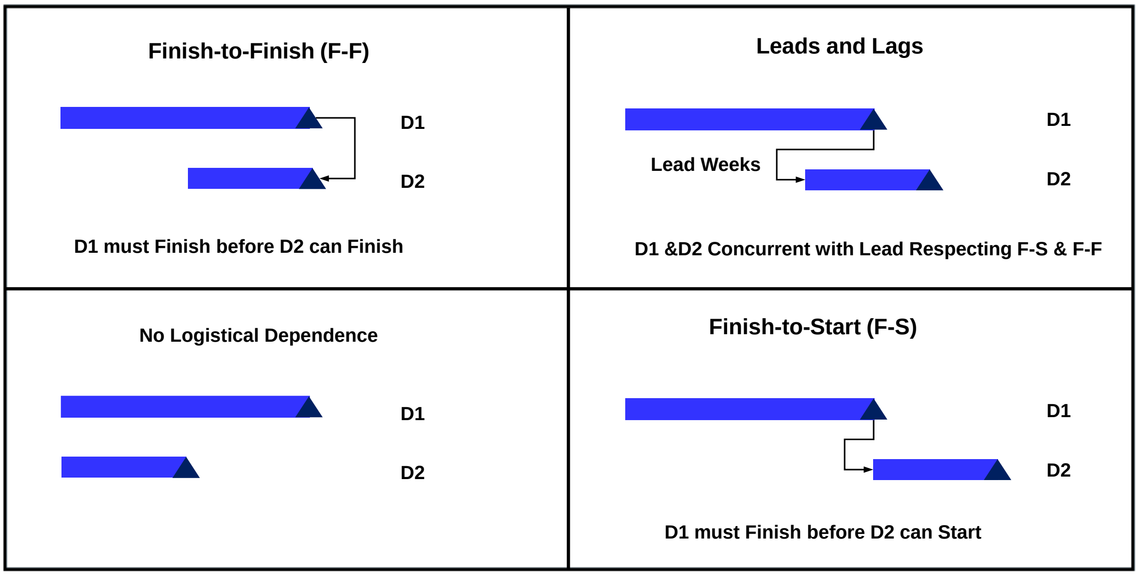

Figure 6.20: Phase Sequence

No Logistical Dependence is the simplest case where there is no functional interaction between phases, so from a logistics perspective the phases can be executed in any order to optimise value. In **Finish-to-Start** the precedent phase must be completed before the subsequent phase can start. The third configuration is **Finish-to-Finish**, where work can be conducted in parallel but the precedent phase must be completed before completion of the subsequent phase. Finally, it is often possible to inject a degree of concurrency between otherwise dependent phases, using **Leads and Lags** (Vanhoucke, 2012). The most general case is lead applied to a finish-to-start link as shown in Figure 6.20. For example, it may be that training for a new application cannot be conducted until it is in operation and value will not accrue until the training is complete, but much of the training material can be prepared in advance.

Implementation Strategy

The TAP process results in what the Author calls an Implementation Strategy, which optimises stakeholder value through integration of business and programme by aligning both the magnitude and timing of value. An indicative Implementation Strategy is shown in Figure 6.21. There are several key points concerning the structure in real world situations. First, the plots will be more complex curves, at least because cost profiles will vary and benefits take time to build up to their maximum level. Secondly, although shown for completeness, the cost and benefits plots are generally omitted, leaving just the NPV. Thirdly, NPV is not the exact arithmetic difference between cumulative benefits and costs due to adjustment by the discount factor calculated from cost of capital. Fourthly, the archetypal shape of an NPV plot is a ‘J-curve’ or ‘hockey stick’ due to early negative net cashflows.

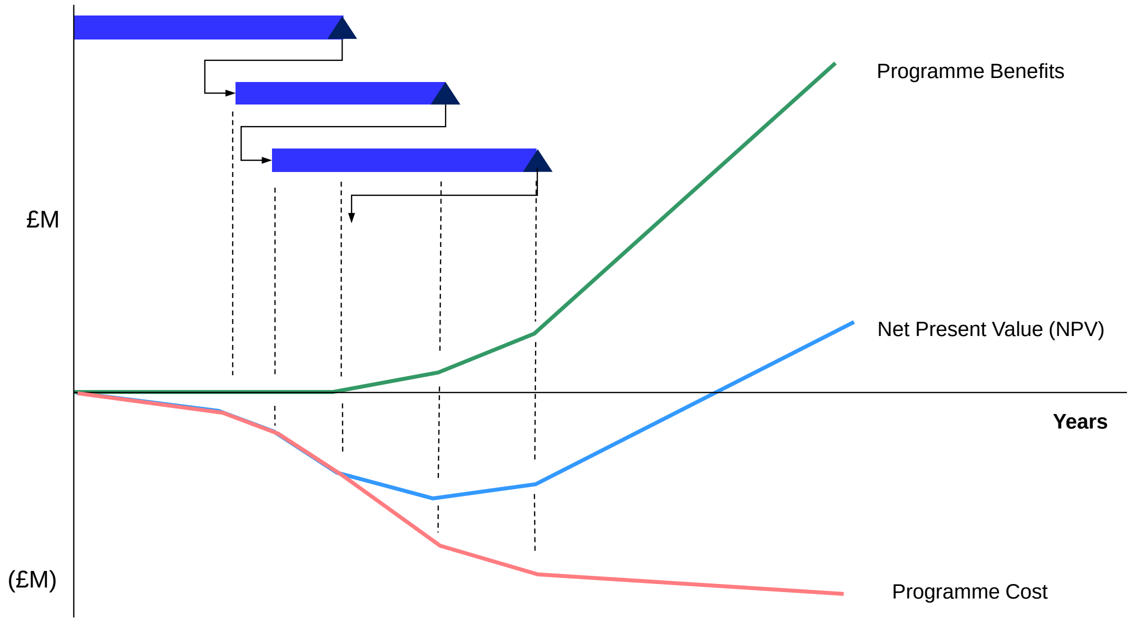

Figure 6.21: Implementation Strategy

As we show in the next section, the value of strategic change programmes is often much more sensitive to timing of deliverable capabilities than programme costs. This argument is counterintuitive and often contentious, requiring strong evidence. This is where the ability to support programme value dynamics with quantitative simulation modelling transcends from desirable to essential. To this end, the Value Management Toolset™ is shown in Chapter 11.

6.7 6 Value Certainty: Integrate Intuition and Analysis

Inject certainty of delivering stakeholder value by integrating the human capacities of creativity and causal intuition with corroborative analytical rigour

Value Principle 6 infuses certainty that intended stakeholder value is delivered at why, how and what levels of causal coupling, as shown contextually in Figure 6.22. This is achieved by harnessing the human strengths of creative innovation and speed of intuitive insight balanced by objective analytical challenge and quantification to assure certainty of value delivery. How intuitive and analytical causal thinking are combined to both specify success criteria for achieving the vision and expose risk is first discussed. In particular, this includes intuitive powers of causal acuity and capacity for rational analysis. The section concludes with programme risk dynamics and value testing.

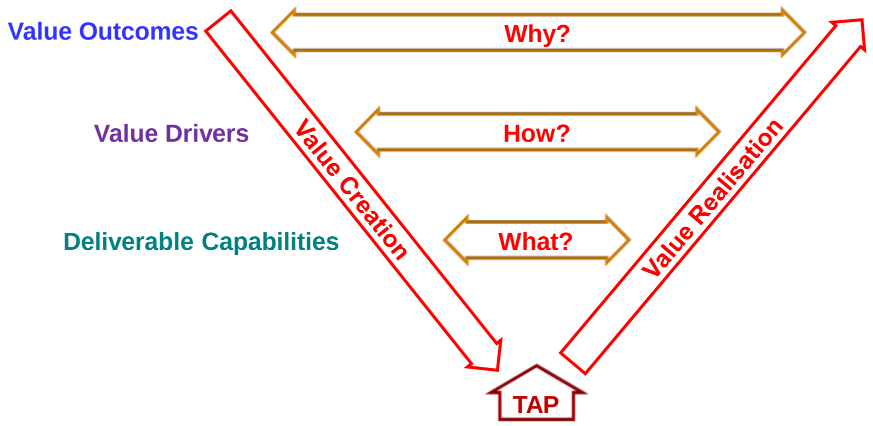

Figure 6.22: Value Certainty

6.7.1 Integrating Intuition and Analysis

A key conclusion from this research is that humans have evolved incredible powers of intuition, System 1, but which instils overconfidence which must be balanced with the slower analytical capabilities of System 2 (Kahneman, 2011). More specifically, humans inject three categories of error: distortion, generalisation and deletion, encapsulated in the NLP Communications Model (James, 2016). These flaws can be corrected through the Meta Model process of precise directed questioning (Bandler *et al.*, 1976; Lewis, 1990; O'Connor *et al.*, 1996). Storytelling also moderates bias (Denning, 2006).

Gladwell (2005) provides key ways in which System 1 limitations can be countered whilst retaining our intuitive powers. These include: priming the context through appropriate framing, injecting multiple perspectives and expertise, agreeing sound rules and processes which include time to prevent over-reaction and controlling the environment to avoid prejudice and prejudgement These measures are consistent with other researchers, for example reframing is advocated by Watzlawick *et al.* (1974) and is a founding principle of NLP (Bandler *et al.*, 1982). The superiority of multiple perspectives through team mix is corroborated by the work of (Belbin, 2004) and (Margerison, 1987). In a similar vein, Epstein (2019) demonstrates the power of range over specialisation and Syed (2019) the case for diverse thinking in the context of the new global, complex and fast pace landscape. Gladwell goes further, citing the 'talent myth' as a significant factor in the collapse of Enron (Gladwell, 2002).

6.7.2 Risk vs Certainty Management

It is important to frame risk management in the context of ensuring certainty of value delivery, which necessitates a distinction concerning intention. Often, risk management is a process of due diligence (Howson, 2003) with the intention of avoiding contractual, regulatory or legal consequences of failure; a form of insurance which, whilst protecting the provider, does not ensure success in delivering value. Similarly, risk management in programmes can be rigorous but tends to focus on securing outputs (OGC, 2007a) rather than value. Due diligence also instils a mental model of blame for failure rather than accountability for success.

Conversely, the Author argues that certainty management is the process of focusing resources on the delivery of intended stakeholder outcomes with a 'failure is not an option' mindset (Davies *et al.*, 2011, p. 143). In this frame, full rigour of risk management is directed to the realisation of intended stakeholder value. Hubbard (2009, pp. 8-9) challenges the traditional definition which conflates risk with uncertainty (Knight, 1921) and provides valuable definitions for this research of risk and risk management as, "Something bad could happen" and "Using what you have to get what you need" respectively. While it is possible to conduct due diligence using a static model of costs and benefits, ensuring certainty demands a much greater understanding of dynamic behaviour of the programme value delivery process. This is because it is necessary to correct negative impacts rather than simply make provision for them. This leads to Programme Risk Dynamics, expanded subsequently.

Certainty is injected through rigorous risk management by drawing on Poppers distinction between verification and falsification in relation to induction, that multiple observations of white swans do not prove that all swans are white, whilst one observation of a black swan falsifies it (Magee, 1973. p. 22). This can be achieved by shifting focus from confirming success, confirmation bias (Kahneman, 2011, p. 81), to actively determining limits using the engineering principle of destruction testing (Blokdyk, 2018). For example, by questioning what individual or combination of parameter values cause a model to break. To this end, advanced risk analysis techniques include Monte Carlo Analysis, under which parameters are assigned a range of potential values (Winston, 2008; Hubbard, 2014, p. 125).

6.7.3 Programme Risk Dynamics

Principle 4, Value Programme, initiates value resilience through provision for essential redundancy. Principle 5, Value Alignment, enhances resilience by deploying magnitude and timing dimensions of value to determine the optimal structure and sequence of deliverable phases. Magnitude and timing dimensions are now used to consolidate resilience under risk extremes; a process the Author calls Programme Risk Dynamics (Davies *et al.*, 2011, p. 143) and draws on destruction testing applications (Blokdyk, 2018) used for safety critical engineering where failure is not an option.

As with value dynamics, risk dynamics is essentially about changing mental representations, which possess content and form (Gardner, 2004, p. 11). Content, or semantics, is the basic idea being represented and form, or format, the particular language and specific notation used to present the content. Both are needed to ensure that the right content is correctly interpreted. in In this case, content is the core idea that value provides the most appropriate frame for linking purpose to performance and driven by two dimensions, magnitude and timing. Form is provided by graphical representation of the dynamics linking these dimensions to programme deliverables. This form is illustrated in Figure 6.23 by considering combinations of magnitude and timing impact on programme costs and benefits, simplified for illustration.

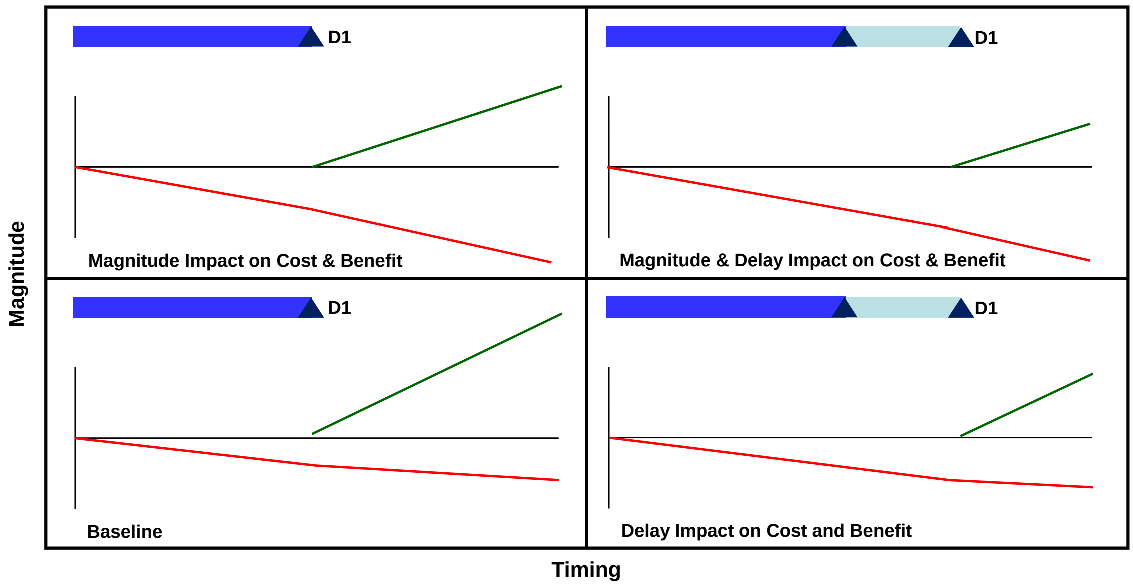

Figure 6.23: Programme Risk Dynamics

The **Baseline** case considers a single deliverable phase assuming linear cumulative development and support costs, together with benefits which start to accrue as soon as deliverable D1 is complete. **Magnitude Impact on Cost and Benefit** covers a situation where both development and support costs escalate and benefits decrease relative to the baseline case. **Delay Impact on Cost and Benefit** involves a delay, or slip, in the phase finish, which significantly influences the overall value through different effects on costs and benefits. The impact on development costs depends upon contractual structure. The case for time and materials is shown in Figure 6.23, exhibiting a 'marching army' effect which, counterintuitively, often has greater leverage on value than large single cost increases. For example, a change of scope may introduce an additional cost while a slippage may lead to the marching army cost escalation. For fixed price contracts, delays result in later payment for the client which, perversely, appears to increase value. However, more significant is the delay in benefits as a result of late delivery of D1.

Magnitude and Delay Impact on Cost and Benefit represents the most common and insidious scenario where not only are costs increased and benefits reduced in pure magnitude, but are also subject to the effect of delays, in which the previous two cases conspire in a negative 'shearing' on value. In practice, relatively modest and subtle combinations of magnitude and timing can result in significant impact on value which can only be exposed through robust analysis of programme risk dynamics. The Value Management Toolset™, covered in Chapter 11, was originally developed by the Author to expose and harness this phenomenon.

6.7.4 Value Testing

Closely related to risk dynamics is value testing, which combines dynamics with structured challenge to determine the degree of resilience of the programme against risk in the context of stakeholder value delivery. Three key complementary approaches are of particular relevance, all designed to determine the resilience bounds with available data: sensitivity, Monte Carlo and peer group and stakeholders. Sensitivity analysis exercises the programme by varying one or more parameters to determine the impact on value. Monte Carlo risk analysis applies statistical analysis to determine bounds (Hubbard, 2014, p. 125) and structured peer group and stakeholder reviews (Fagan, 2002; Mostashari *et al.*, 2012) provide multiple perspective scrutiny.

In all cases, the principle of destruction testing, used for extreme aero-engine assurance (Dutchvolvofan, 2009), is applied through the question, "What individual or combination of circumstances would render the programme unviable from a stakeholder value perspective?" From the Author's real world experience, applying this approach proves particularly effective at Board level, for example, several Chief Financial Officers (CFOs) shifted from positions of scepticism to stated commitment as a direct result of clear and open destructive testing of business cases, articulated in hard financial measures.

6.8 7 Value Track: Combine Right First Time with Correction

Minimise risk through precise preparation and planning and maximise certainty of value realisation by rapid feedback and correction

Value Principle 7, as shown contextually in Figure 6.24, focuses on value realisation, protecting stakeholder value through rigorous planning combined with rapid feedback and correction. Key lessens from Complexity Theory are introduced in the context of value realisation. These insights are incorporated into tracking performance at three levels: value, business, and programme, which mirror why, how and what questions introduced under 1 Value Frame.

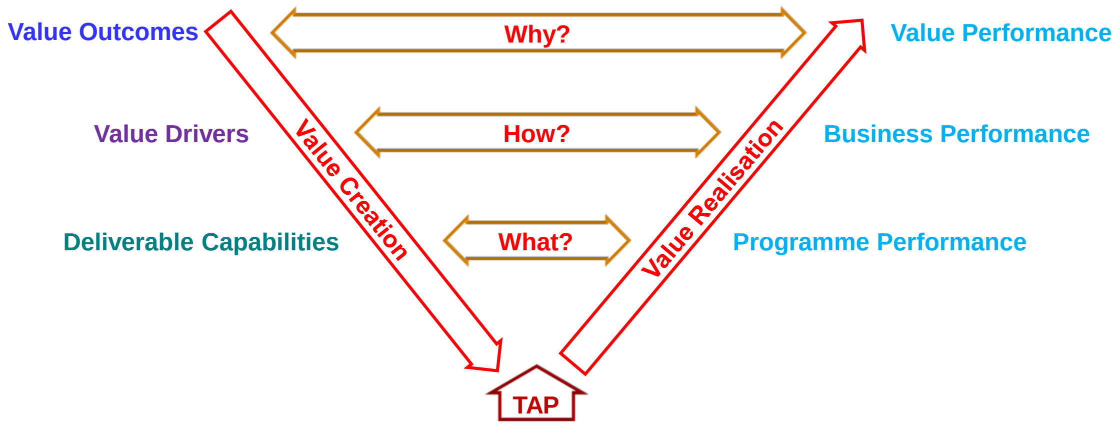

Figure 6.24: Value Realisation

6.8.1 Lessons from Complexity Theory

Gribbin (2005, p. 3 and p. 59) asserts that complexity is based on two simple ideas: sensitivity to starting conditions and feedback, which is corroborated by other researchers (Lewin, 1993; Waldrop, 1994; Mitchell, 2009). Causal patterns provide a powerful foundation for designing and implementing interventions which create value in CAS (Dooley, 1997; Miller *et al.*, 2007). Further, the Law of Requisite Variety (Ashby, 1991; Morgan, 1997; Hoverstadt, 2008) dictates that change programmes must themselves facilitate comparable or greater complexity than the CAS landscapes which they are intended to influence; requiring essential redundancy.

It follows that certainty of change programmes to deliver intended stakeholder value can be enhanced through rigorous specification of purpose and sound planning, together with rapid effective feedback and correction, whilst ensuring sufficient capacity for essential redundancy. These insights are built into three integrated levels of dynamic performance tracking to ensure stakeholder value delivery. Programme Performance tracks deliverable capabilities, Business Performance tracks value drivers and Value Performance tracks value outcomes.

6.8.2 Tracking What: Programme Performance

Chapter 3 explored advanced approaches to project, programme and portfolio management (OGC, 2008) including Earned Value (Fleming *et al.*, 2000; Webb, 2003; Ziyash, 2018). Chapter 4 proposed seven failure patterns to explain how despite these and other advances change programmes still fail to deliver intended stakeholder value. The real world case for Value Erosion concerned reporting in major aerospace programmes for which the Author developed a System Dynamics model, a simplified version of which is accessible through Impact Dynamics (2018). The model demonstrates, using real data across all key functions, that whilst errors are injected during the earliest stages of a programme, associated waste is manifested later often in different functions from those in which the errors originated, an example of causal separation in time and space, as shown in Figure 6.25.

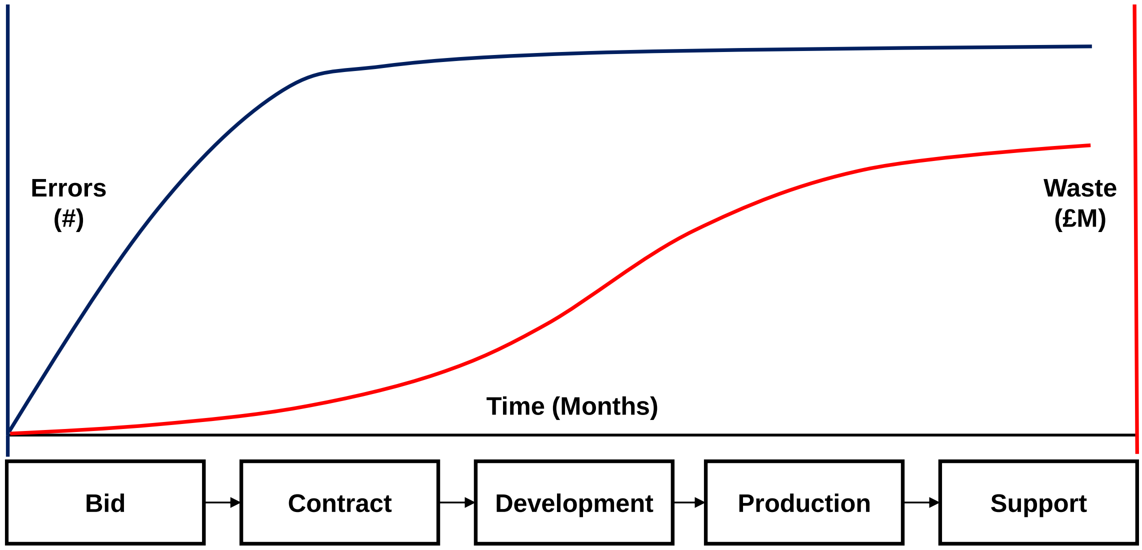

Figure 6.25: Relationship between Errors and Associated Waste

Waste is manifested in additional resource consumption and associated cost above the baseline as shown in Figure 6.26. Waste comprises nugatory work, rework, duplicated work, which includes poor reuse, and managing waste.

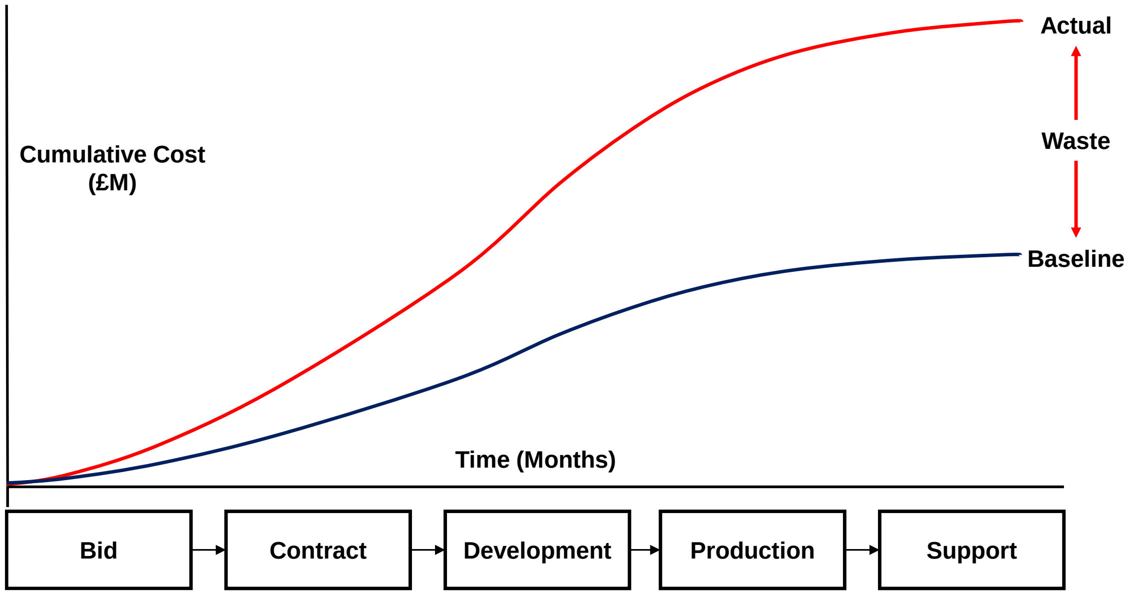

Figure 6.26: Typical Baseline and Actual Cumulative Cost Profiles

The archetypal solution comprises two key corrective measures: provide greater resourcing to coordinate functional disciplines during early phases to reduce avoidable errors, then encourage blameless collaboration to expose and eliminate residual errors as soon as possible. This conclusion for managing dynamics of complex programmes is a manifestation of combining right first time and correction. The emphasis on early risk containment requires additional investment in certainty management, including quality assurance which is an instance of essential redundancy, with subsequent disproportionate reduction during later stages as a result of eliminating waste, as shown indicatively in Figure 6.27

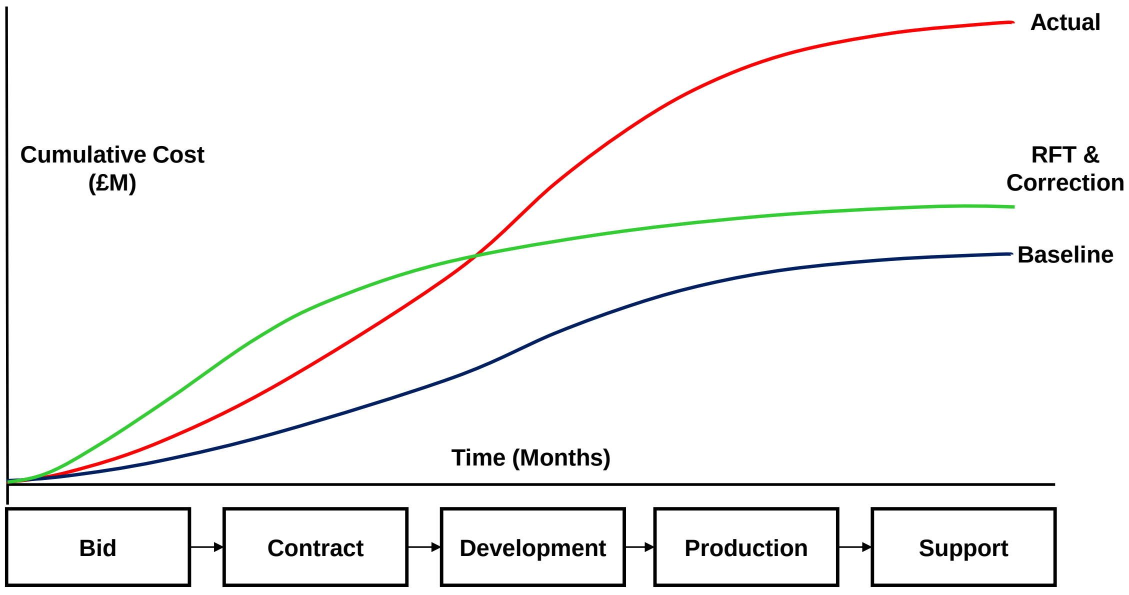

Figure 6.27: Right First Time and Correction

6.8.3 Tracking How: Business Performance

Whilst Earned Value (Webb, 2003) provides a powerful measure for tracking deliverable capabilities in a change programme, use of the term 'value' is deceptive in the context of this research. Earned Value is effectively 'earned cost', the proportion of the latest estimate of total spend that current cumulative spend represents at any given time. The need to extend tracking beyond cost to benefits calls for precise quantification of the link between deliverable capabilities and stakeholder outcomes.

Practical application involves using a causal measurement framework, such as the Balanced Scorecard (BSC), which can integrate change programmes with business as usual activities through strategy (Kaplan *et al.*, 1996). A BSC is developed as a Strategy Map (Kaplan *et al.*, 2004), comprising perspectives decomposed into objectives, depicted as ovals, and associated measures, shown as rectangles, illustrated using a call centre example in Figure 6.28. Objectives, perspectives and overall BSC are tracked using scores, derived and rolled up from the lowest level measures. The deliverables are overlaid onto the framework against the measures most directly impacted, representing points of power.

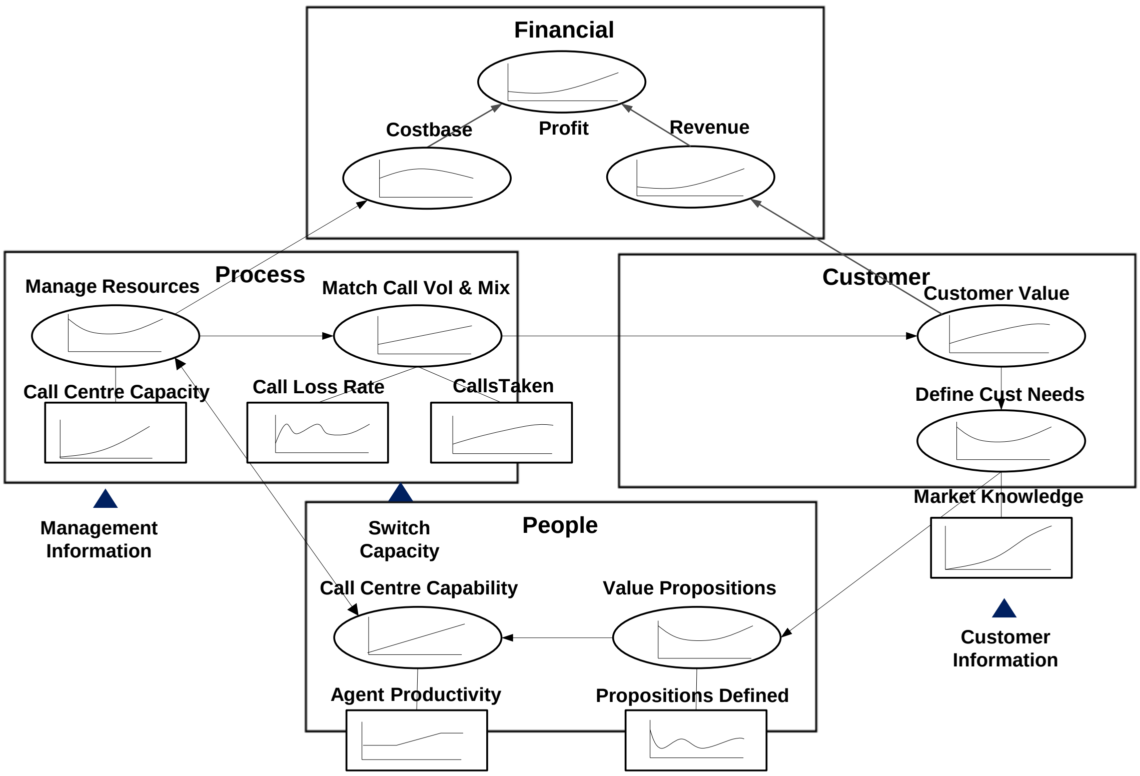

Figure 6.28: Performance Dynamics Framework

Figure 6.29 illustrates how measures are tracked as both real values and scores against tolerances, Standard and Minimum Standard can translate into visual colour coding on a red-amber-green (RAG) view [not shown] and planned change. A key imperative is that there is a dynamic linkage between the programme deliverables and measures so that the impact of any change in compliance and timing of capabilities can be traced to, and interrogated in terms of, business performance.

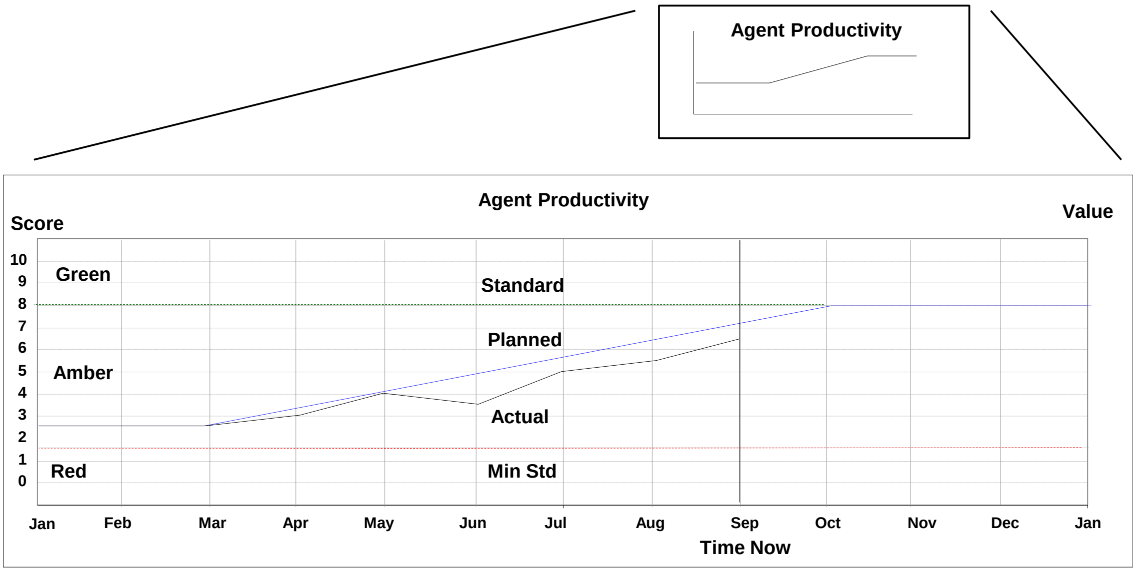

Figure 6.29: Business Performance Trend Graph

6.8.4 Tracking Why: Value Performance

For practical reporting purposes, it is necessary to provide explicit dynamic linkage between the deliverables output from programme phases and stakeholder value. Value performance can take the form of DCF where costs and benefits are in the same units, as shown in Figure 6.30, or Value Productivity and Value for Money where benefits are non-financial. The Value Management Toolset™, covered in the Chapter 11, provides full dynamic causal coupling between programme deliverables and stakeholders outcomes, measured as Value Power.

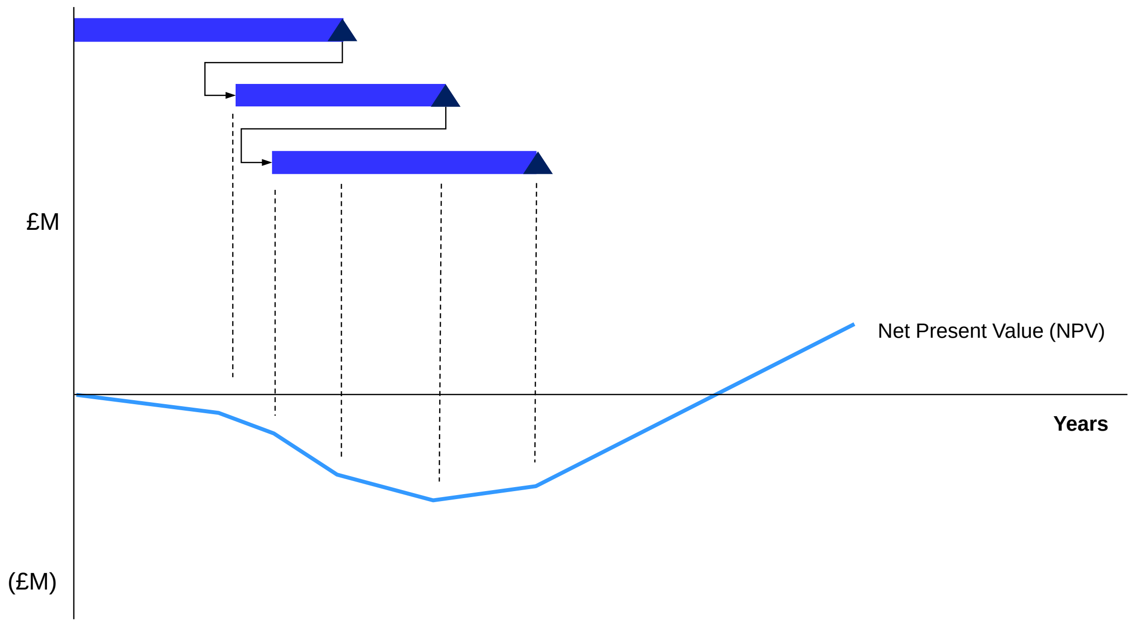

Figure 6.30: Programme Value Dynamics

6.9 Essence

This chapter formulated a new value theory by developing Meta level principles which address the seven repeating failure patterns defined in Chapter 4. The mapping between repeating problem patterns and value principle is shown in Table 6.3.

Table 6.3: Problem-Principle Mapping

Problem Patterns	Value Principle
Value Inversion: Solution before purpose	Value Frame: Do the right things then do things right
Value Imbalance: Conflict of intention	Value Intention: Specify mutual stakeholder intentions
Value Mismatch: Event without a cause	Value Model: Align value causality
Value Uncoupling: Cause without capability	Value Programme: Eliminate waste and respect essential redundancy
Value Fragility: Function over value	Value Alignment: Optimise value resilience in magnitude and time
Value Exposure: Assured to fail	Value Certainty: Integrate intuition and analysis
Value Erosion: Lost in transition	Value Track: Combine right first time with correction

In practice, the value principles operate holistically, promoted and facilitated by the Value Power Framework covered in the next chapter. To this end, the critical essence from the principles is consolidated into a fractal approach comprising four integrated elements: Frame, Level, Inquisition and Precision (FLIP). The Author names this process Precise Simplicity which is described with practical examples in Chapter 11.

7 Construction of Value Power Framework

7.1 Introduction

To reiterate the research method described in Chapter 5, everything up to this point is about establishing a detailed, complex hypothesis. The schematic developed in Chapter 6, provided a contextual structure for the Value Principles. This chapter develops this schematic into a formal framework, as shown in Figure 7.1, using consistent colour coding, within which value principles are orchestrated effectively. The resulting Value Management Framework is a hypothetical solution based on intelligent reasoning from the research, together with decades of direct and indirect insights to address complex multi-faceted problems. The framework comprises seven Phases which are integrated and mapped explicitly to both problem patterns and principles with the aim of providing a coherent generic learning framework, validated in Chapter 9.

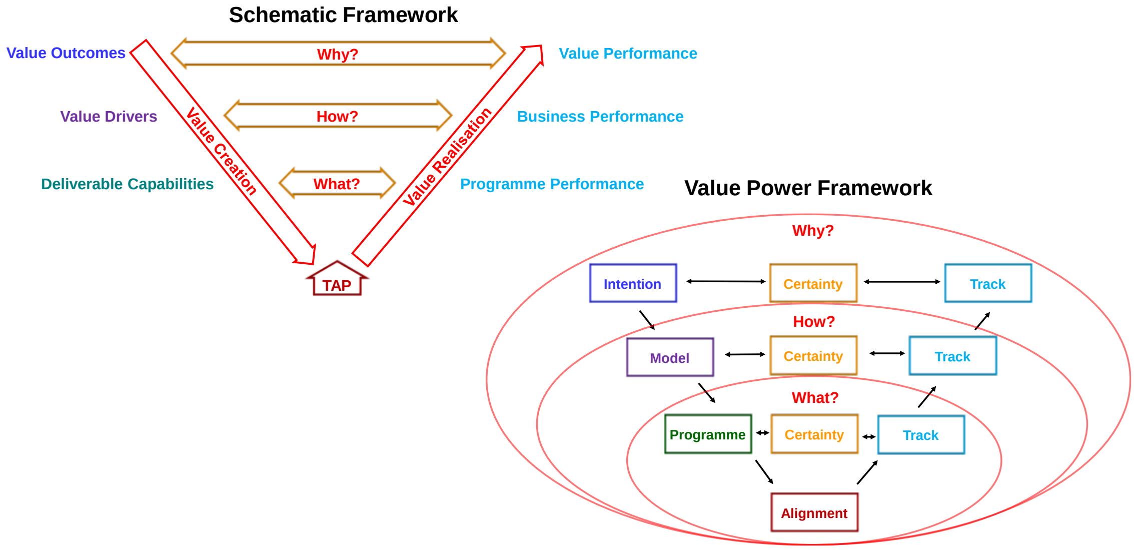

Figure 7.1: Schematic Framework to Value Power Framework

This chapter focuses entirely on framework construction. To this end, each construction step is detailed and the complete Value Power Framework summarised. Critical to effective deployment is that all phases of the framework are populated as a whole at the same time and incorporated within temporal Master Stages of a programme structured as a cyclic Value Journey. The Value Journey and extension into a continuous portfolio of journeys, Value Transformation, are covered in Chapter 11, together with an overview of the Value Management Toolset™ developed to support this entire Value Management process.

7.2 Construction Steps for the Framework

The framework is built in seven construction steps, each enhancing the emerging state. There is no direct relationship between construction steps and either failure patterns or principles. However, Phases of the framework map to both. Steps draw on aspects of the research and the most specific cross-references to previous chapter sections are provided in Table 7.1. There is some duplication, which is justified on two grounds: need for restatement in the context of relevant construction steps and reinforcement of arguments.

Table 7.1: Construction Step Cross-References

Construction Step	Cross-References
Step 1: Effectiveness, Efficiency and Efficacy	Section 4.5.2 Pattern Analysis: Construction of Universal Value Equations
Step 2: Learning Loops and Deming Cycles	Section 3.6.4 Learning as a Process
Step 3: Extended V-Model	Section 6.1 Introduction
Step 4: Internal and External Learning Journeys	Section 3.6.4 Learning as a Process
Step 5: Learning Journeys in Extended V-Model	Section 3.6.3 Levels of Learning
Step 6: Causal Linkage	Section 4.4.3 Resolution: Align value causally
Step 7: Directed Questions Mapped to the V-Model	Section 6.4.2 Causal Precision

7.3 Step 1: Effectiveness, Efficiency and Efficacy

The first construction step relates to Value Principle 1 Value Frame and combines value alignment provided by the Golden Circle as proposed by (Sinek, 2009, p. 37) with Value Equation expressed in terms of effectiveness and efficiency (Davies *et al.*, 2011). Sinek uses the Golden Circle as a metaphor to ensure that three key questions in the context of strategy are addressed in the correct order: why?, how? and what? The question why? relates to purpose (Mirriam-Webster Dictionary, 2019d). How? concerns changes needed to causal factors and relationships between these factors in order to realise purpose (Mirriam-Webster Dictionary, 2019b). The question what? concerns the specific action, or means, by which the casual factors and relationships are changed in order to realise the purpose (Lexico Oxford, 2019c).

Drucker distinguishes effectiveness and efficiency as doing the right things and doing things right (Drucker, 2006, pp. 1-2) and also associates leadership and management to effectiveness and efficiency respectively (Drucker, 2001). Value for Money is defined as comprising the three E's: effectiveness, efficiency and economy, (OECD, 2012; NAO, 2017). Economy is defined as input for a given cost. It follows that Value for Money can be expressed mathematically, as previously defined in Section 4.5.2:

$$\begin{aligned} \text{Value for Money (VfM)} &= \text{Economy} \times \text{Efficiency} \times \text{Effectiveness} \\ &= (\text{Input / Cost}) \times (\text{Output / Input}) \times (\text{Outcome / Output}) \\ &= \text{Outcome / Cost} \end{aligned} \tag{7.1}$$

The question 'what?' concerns inputs, i.e. means and capabilities, which influence factors and relationships in the cause and effect linkage between inputs, outputs and outcomes. Capabilities must result in outputs which enable intended stakeholder outcomes, through effectiveness, whilst enabling the efficient transformation of inputs into outputs. The capability to deliver an intended outcome is encapsulated in efficacy, defined as the ability to produce a desired or intended result (Oxford Dictionary, 2017). Efficacy, therefore, is interpreted for this research as doing the right things right, as shown in Figure 7.2:

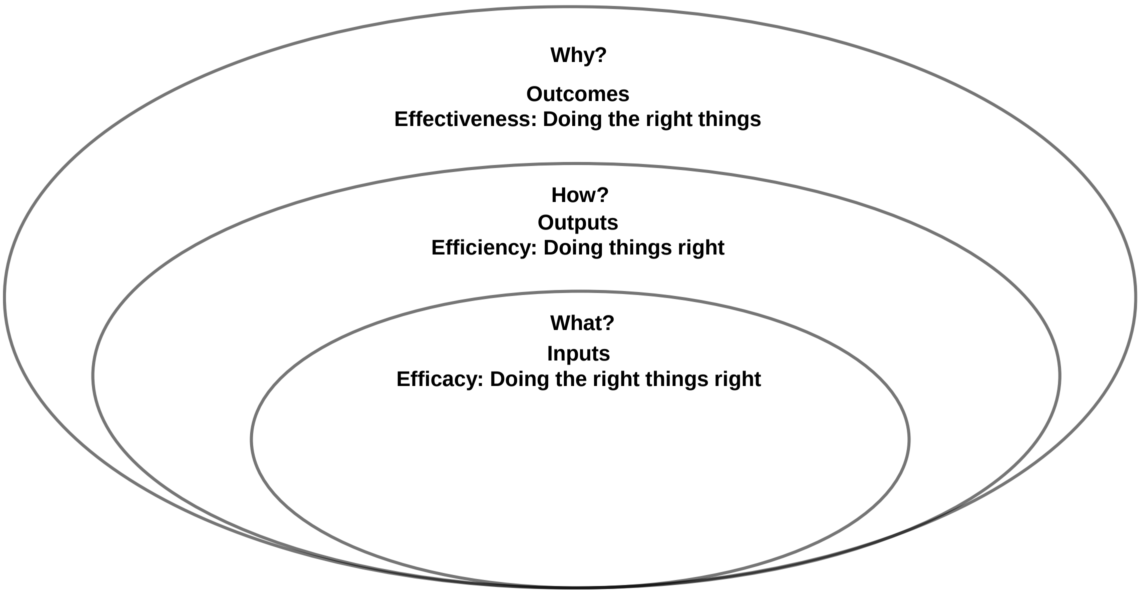

Figure 7.2: Step 1 Effectiveness, Efficiency and Efficacy

At each level in the Why-How-What structure, three other key questions are asked which inject essential additional information and specificity: where? who? and when?

Where?

Where? refers to the intended specific destination. For example, at the highest level in the case of a commercial enterprise, this will include which markets to serve with which products through which channels, together with associated profit. Where concerns clear targeting through precise specification of purpose and associated intended stakeholder outcomes. Consequently, the question where? is closely related to, and provides further context for, why a change programme is being undertaken.

Who?

Who? defines stakeholders and the critical relationships between them in the context of value creation, distribution and sustainability. Interdependence between stakeholders includes their structural coupling (Maturana *et al.*, 1987) necessary to create win-win relationships which support the overall value chain. For example, for shareholders to gain adequate financial return there must be sufficient profitable revenue from customers, which will only be realised if customers are served well by staff and suppliers, who require investment through development of trusting relationships, training, progression and remuneration. Therefore, the question who? is principally related to aligning intentions between stakeholders and the causal factors which optimise value across all stakeholders.

When?

When? defines the timing of value delivery to stakeholders, the necessary changes in the drivers of value and the interventions needed to effect these changes. From a value perspective timing is often more critical than cost. For example, DCF analyses often show that a few months slip can deplete the NPV far more than a disproportionate increase in cost. As a result of functional and value dependence, the order and sequence of programme deliverables exert a critical influence on NPV, as addressed by Value Principle 5 Value Alignment.

The Author proposes that where? who? and when? also map to the TAP process for optimising value resilience in magnitude and timing:

- **T**arget: Focus on points of power where greatest impact is caused; where
- **A**lignment: Mutually supporting value creation between stakeholders; who
- **P**riority: Order and sequence of change to optimise stakeholder value; when

7.4 Step 2: Learning Loops as Deming Cycles

This step combines single and double loop learning (Argyris, 1976) and, critically, triple loop learning (Tosey *et al.*, 2011; Engelbart, 2012) with the Deming cycle for continuous improvement (Deming, 1994, p. 131) to support and integrate the entire why-how-what level structure in the Value Power Framework. The meaning of, and distinction between, single and double loop learning is well understood. Ashby (1952) uses the example of a home thermostat to illustrate the difference. When a thermostat is controlling the heating to match a fixed temperature, the system is in single loop learning. If the temperature is then changed by the householder, the system is correcting to a new goal and in double loop learning. Conversely, there is less agreement on the meaning and application of triple loop learning, yet this is particularly important for transformational change because research links it to purpose and mental models, (Tosey *et al.*, 2011). For example, for what purpose heating is necessary.

In the context of decision making, it is useful to frame learning as the correction of error (Argyris, 1976). Just as in the thermostat example, where the system is correcting the variance, error, between the current room temperature, in decision making Argyris describes single loop as learning to perform against a defined set of goals and assumptions which are not challenged. Most organisations tend to operate single loop learning which is closely related to conformance, the essence of values level 4 Command and Control (Graves, 1970).

Conversely, in double loop learning underlying assumptions and goals are challenged with the aim of dealing with a changed set of circumstances or need to raise the level of performance. It is important not to assume that double loop learning is invariably superior to single loop. As Watzlawick *et al.* (1974) argues in the context of change, not only can the latter be effective but also more appropriate for a high level of stability, where compliance and alignment to specified goals under clear rules can be advantages.

The problem with single loop learning manifests under conditions of significant change, where assumptions and goals governing behaviour are no longer appropriate, rendering action intended to resolve the problem inadequate. This is when double loop learning becomes much more effective. However, the challenge for organisations then becomes managing and directing necessary challenges to the status quo without losing essential control. The answer lies in raising the level of direction from pursuit of output objectives to purpose. This requires a significant shift in both mental and physical models and involves triple loop learning.

There is considerable controversy surrounding the concept of triple loop learning. However, Tosey *et al.* (2011) cross-references key thinkers on the concept, notably, Argyris *et al.* (1978) who, whilst not using the term explicitly, introduce the concept of ‘deutero-learning’, which they define as learning how to carry out single and double-loop learning. Tosey also references Bateson’s Learning III which has a strong emphasis on recursion (Bateson, 1972). Of particular relevance, Romme *et al.* (1999) equate single loop learning with “doing things right”, double-loop learning with “ doing the right things” and triple-loop learning with “making well-informed choices regarding strategy, objectives etc.” The latter can also be regarded as part of ensuring the right things are done right, previously states as the definition of efficacy.

Tosey summarises the various conceptualisations of triple-loop learning as concerned with underlying purposes, principles or paradigms; strong grounds for associating this level of learning with the question why? Engelbart (2012) corroborates the mapping of single, double and triple loop learning to what? how? and why? questions respectively. In the previous section Deakin Crick *et al.* (2017b) are cited designating single, double and triple-loop Learning Journeys doing the job, learning to improve and transformational learning respectively. In the context of business transformation Zaffron *et al.* (2011) propose three laws of performance relating to: how situations appear, how situations occur in language and how language transforms how situations appear. Although the authors do not make the linkage explicit, these laws map closely to learning levels. Further, each learning level can be represented by a Deming cycle, which operates as a fractal structure, and nested in order to integrate the levels as shown in Figure 7.3.

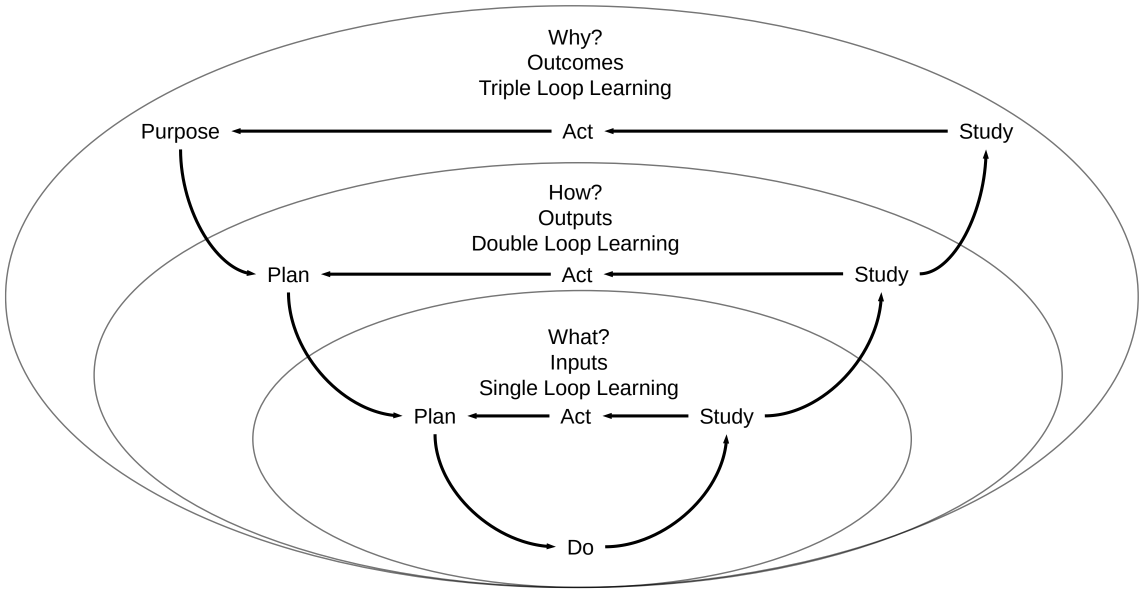

Figure 7.3: Step 2 Learning Loops as Deming Cycles

7.5 Step 3: Extended V-Model

The third step extends the V-Model, widely used for Systems and Software Engineering, to include two additional levels to integrate how? and why? with what? Phases in this resulting framework correspond to and address the seven repeating failure patterns. The V-Model is proposed by the International Council on Systems Engineering (INCOSE) as the basis for focus on process undertaken during each major life cycle stage in a programme (INCOSE, 2010, P. 27). It is useful to frame the V-Model in the context of extremes; the traditional waterfall development cycle at one extreme and agile development at the other (Balaji *et al.*, 2012).

The waterfall approach comprises sequential phases, typically, analysis, design, development, testing, implementation and maintenance. For example, the approach generally starts with user requirements, which are then translated into system design, decomposed into unit design and then implemented, which in the case of software means coding the functionality. Each phase is frozen before the next is started, although in practice this rule is usually violated, often with catastrophic results. It is very silo oriented (Tett, 2015). In particular, testing is typically only conducted after development is completed and there is little or no collaboration between the business and developer.

Conversely, the agile approach still decomposes a project into phases but unlike the waterfall, adopts a 'sprint' method, the most prominent being Scrum, to deliver smaller self-contained tested releases much more quickly. Importantly, Scrum theory applies a variant of Deming cycle, reflecting the iterative nature of the approach (Carroll, 2012, p. 68; Purcell, 2016).

The V-Model possesses two important strengths. First, the framework integrates verification and validation and explicitly respects the distinction between them. The distinction is subtle but crucial. Both verification and validation involve confirmation by examination and provision of objective evidence. Verification confirms that specified requirements have been fulfilled, validation that the requirements for a specific intended use or application have been fulfilled (ISTQB, 2015). Therefore, verification questions whether we delivered to speciation, whilst validation challenges whether the intended real world utility has been met. In other words, verification concerns doing things right and validation that we are doing the right things.

The second key strength of the V-Model is the generic nature of this framework which can be applied to any life cycle model. This is particularly important for agile project management approaches, which are becoming increasingly user-driven by the need for a rapid response to change (Atkinson *et al.*, 2005). The generic character is both challenged and corroborated through the subject expert interview with Pontin (2017) included in Appendix A1. Specifically, Figure 7.4 shows how the Value Power Framework integrates robust Systems Engineering disciplines with single, double and triple learning levels and also relates inputs, outputs and outcomes to deliverables, drivers and benefits respectively; a critical mapping for Step 6.

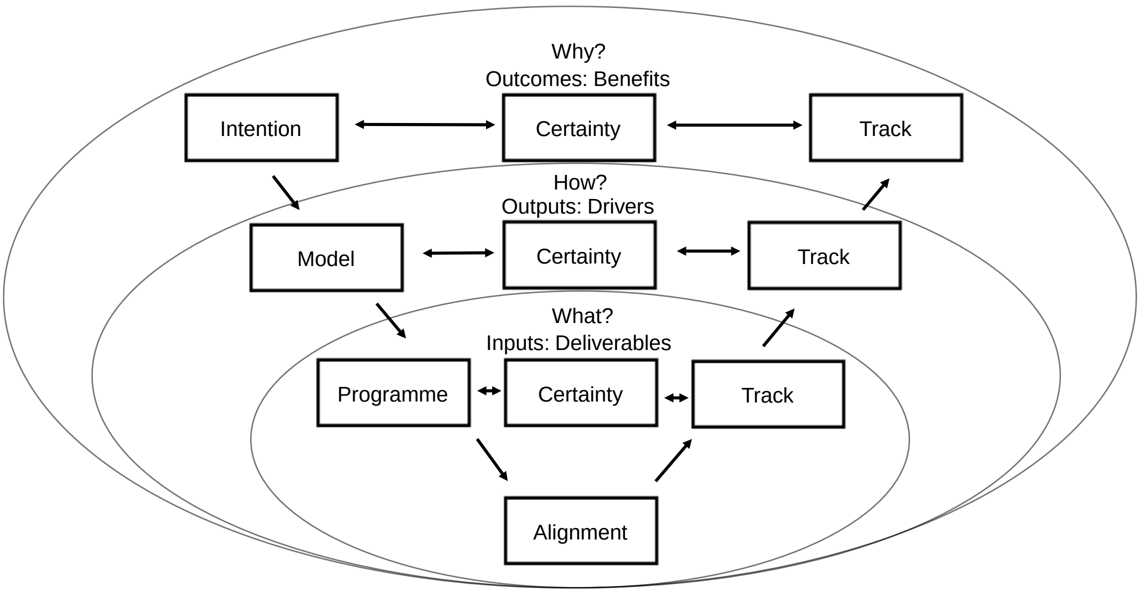

Figure 7.4: Step 3 Extended V-Model

7.6 Step 4: Integration of Internal and External Learning Journeys

The fourth step integrates internal learning by individuals, teams and entire organisations in value creation with external journeys required to realise intended stakeholder outcomes. Learning Journeys are framed as Deming cycles to provide a means of integrating internal and external Learning Journeys, each mutually reinforcing. For this approach to be valid it is essential to ensure consistency with latest theory and practice covering Learning Journeys and Learning Power. Learning Power was originally developed for education (Claxton, 2002; Deakin Crick *et al.*, 2012), as was the application through Learning Journeys.

However, to be of practical use for the new value theory, it is essential that these concepts are generally applicable. To this end in the context of infrastructure, Deakin Crick *et al.* (2017b) define Learning Power as the process through which we regulate the flow of energy and information over time in the creation of value, and a Learning Journey as the process of directing that energy to manifest value through the transformation of purpose into performance. These researchers further decompose a Learning Journey into four interrelated processes: forming identity and purpose, generating Learning Power, structuring Information and producing value, which can be summarised as the transition from purpose to performance.

Although not stating the link explicitly, Deakin Crick *et al.* (2017a) also frame a Learning Journey as a form of Deming PDCA cycle, used as the basis for a platform supporting the approach. In this frame, the processes are renamed: choose purpose, diagnose and plan, do the job and measure and evaluate, which closely map with the Deming cycle, thus providing the means to apply Learning Journeys in achieving external outcomes, for which the PDCA cycle is intended. The viability of framing a Learning Journey as a Deming cycle is also corroborated through subject expert interviews (Tracy, 2018; Huang, 2018a).

Learning Power is a measure of the energy and capacity of an agent to undertake the Learning Journey. Therefore, the Author argues that Learning Power is one of a number of key criteria for success in navigating the journey, rather than a process in its own right; a view which is corroborated by Tracy (2018). This frame is further corroborated through updated academic research by Deakin Crick *et al.* (2015) which consolidates Learning Power dimensions into a scale of Openness to Learning; a state not a process. The mapping between Learning Journey and Deming Cycle is shown in Figure 7.5.

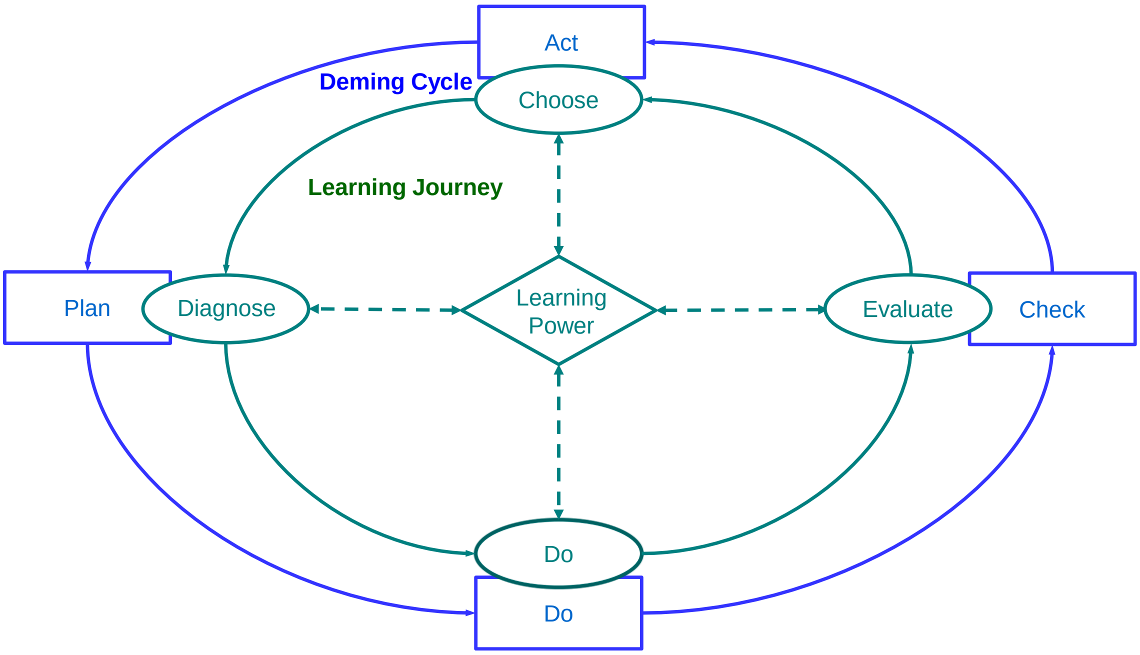

Figure 7.5: Mapping of Learning Journey and Deming Cycle

Learning Power performs three roles, as discussed in Section 3.6.5. First, it provides measureable status of an agent's capacity to learn at any given time in terms of seven self-assessed dimensions which are consolidated into a single scale of Openness to Learning (Deakin Crick *et al.*, 2015). Secondly, by quantifying each dimension separately, it is possible to diagnose an agent's readiness to learn within a specific area and context. Thirdly, this level of precision facilitates both self-knowledge and coaching of an agent to tailor and improve their performance, either generally as in education, or to undertake a specific task, such as engaging in a change programme. For example, if a person scores particularly low on collaboration yet high on creativity and is required to work in a team environment, coaching can be directed to harness their creative power more effectively by improving their collaborative capability. An important corollary of this multiple role is that the relationship between Learning Power and integrated internal and external Learning Journeys is mutually reinforcing. Each step in a Learning Journey is both impacted by Learning Power of the agent and supports growth of Learning Power in the agent, as shown in Figure 7.6.

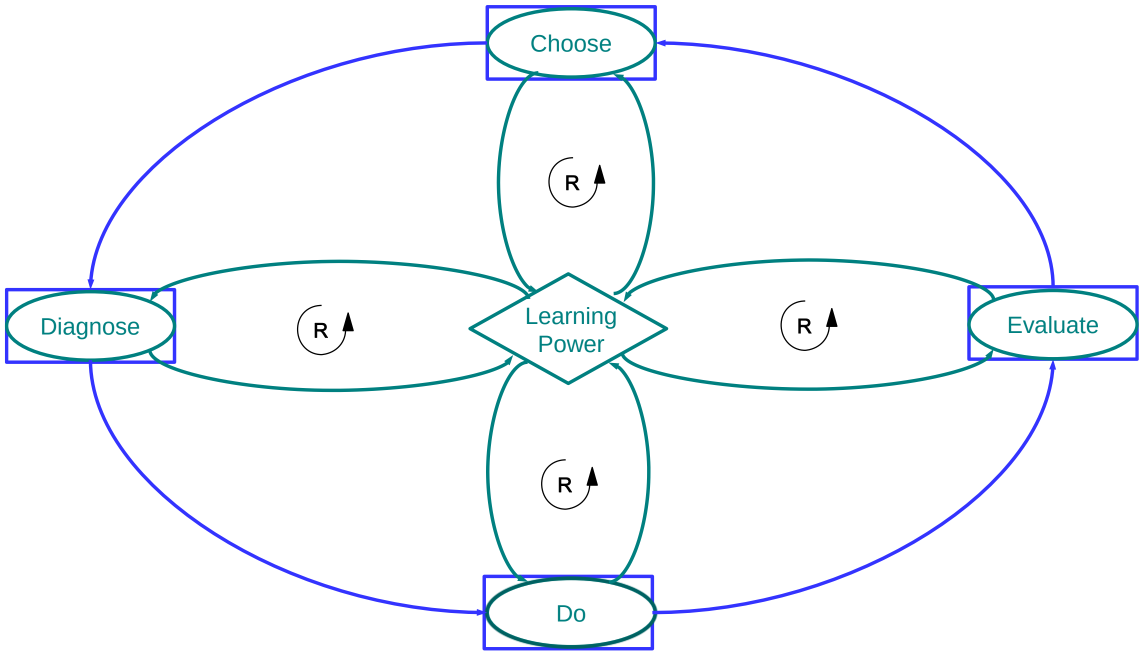

Figure 7.6: Step 4 Integration of Internal and External Learning

A practical approach for implementing this model is Action Learning, covered in Section 3.6.5 (Revans, 1982; Marquardt *et al.*, 1999; Revans, 2011). Action Learning is outcome-centric with an emphasis on learning from doing and delivering a specified outcome, working in non-competitive, highly diverse and collaborative teams, called Sets. A key aspect in the context of internal-external Learning Journey integration concerns synchronisation of goals. Set members choose their own internal purpose as a learning stakeholder, such as a qualification and career advancement, and simultaneously propose and agree their external journey and associated intended stakeholder outcome in their role in the change programme.

In addition, use of the term agent rather than person is deliberate on the grounds that an agent can be a machine learning AI system. For example, as confirmed by Tracy (2018) many of the Learning Power dimensions, in particular creativity, collaboration and sense-making, are generic across human and machine learning. In a similar vein, the Lovelace Test is designed to measure the creative capabilities of computers (Bringsjord *et al.*, 2003; Ferrucci *et al.*, 2017).

7.7 Step 5: Integration of Learning Journeys with Extended V-Model

The fifth step broadens internal and external Learning Journey integration across the entire extended V-Model structure of the Value Power Framework. The consolidated structure also integrates triple, double and single learning through nested loops within the why-how-what frame. Another important aspect of framing a Learning Journey as a Deming cycle lies in the need to provide a fractal, iterative process operating at, and integrating, all three levels in the why-how-what structure defined in Step 1. This mapping is provided by learning levels.

Significantly, Deakin Crick *et al.* (2017b) also structures a Learning Journey in the context of single, double and triple-loop learning, designated: doing the job, learning to improve and transformational learning respectively. Tracy (2018) and Huang (2018a) both stress the importance of learning levels in the context of framing Learning Journeys as Deming cycles. The precise definition and application of learning levels operating as Deming cycles was developed in Step 2. We now integrate Learning Journeys into the extended V-Model structure as shown in Figure 7.7.

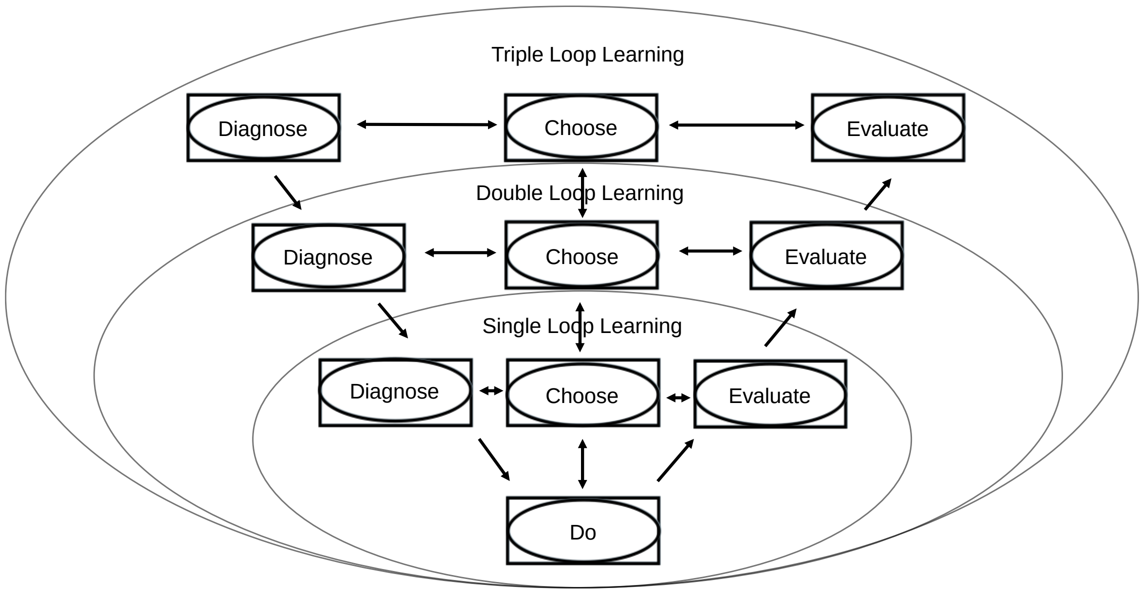

Figure 7.7: Step 5 Integration of Learning Journey Levels with Extended V-Model

This integration offers a powerful means by which learning can also be precisely targeted, aligned and prioritised (TAPped) in order to optimise stakeholder value resilience. For example, the discipline of populating the entire Value Power Framework from cradle to grave of a change programme is used to assess existing capabilities and knowledge and, more importantly, learning required in acquiring essential new and releasing latent resources. The practical process for achieving this insight is covered in Step 7 Directed Questions.

7.8 Step 6: Cause and Effect Linkage

The sixth step provides explicit casual linking between programme deliverables, value driver measures and stakeholder benefits. Most importantly, this layer provides a practical means of implementing Principle 4 Value Programme, eliminate waste and respect essential redundancy, by tracing and quantifying relationships between inputs, outputs and outcomes precisely through causal storylines, so building a complete and coherent value story.

Step 3 extended the Systems Engineering V-Model beyond functional deliverables to include performance drivers and stakeholder benefits and mapped these components to inputs, outputs and outcomes respectively. Step 6 now provides the practical means to define and quantify this cause and effect linkage. Essential mapping against the extended V-Model is shown in Figure 7.8.

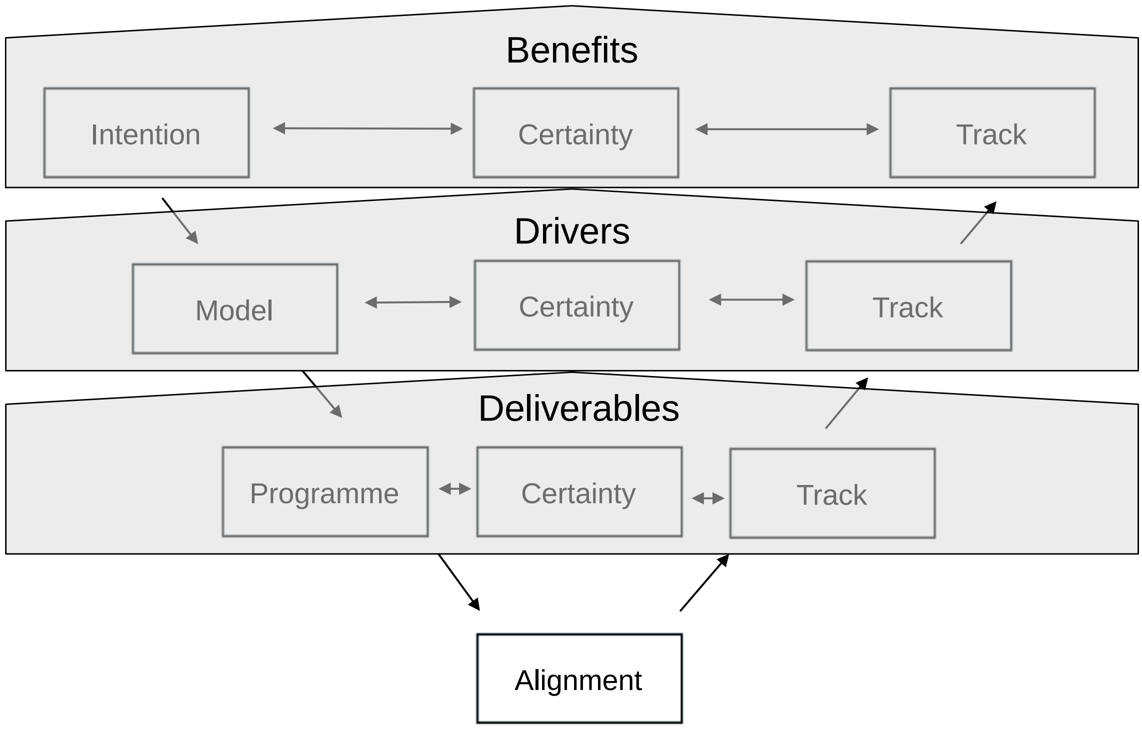

Figure 7.8: Deliverable, Driver, Benefit Alignment

Rotating this structure by 90 degrees provides a more intuitive, horizontal view to model the cause and effect linkage, which is further enhanced with reference to a performance management framework. For example, referring to Figure 7.9 using BSC perspectives, suppose that a capability to provide advanced cancer treatment is through a new care facility. The facility is an input which consumes resource both to build and operate; in cost terms CAPEX and OPEX respectively.

Treatment is in the form of operations, outputs. Outputs are defined through drivers of which there are essentially two categories, efficiency and effectiveness, both of which can impact outcomes. For this example, an efficiency driver is Operations per Day and effectiveness Success Rate of operations. The outcome is actual benefit realised by a stakeholder, in this case Cured Patients. The benefit is calculated using both categories of driver: Cured Patients = Operations per Day x Success Rate.

Drivers can also be a combination of hard and soft measures. For example, suppose that another capability of the new facility is provision of attractive career development which impacts Staff Retention, a hard efficiency measure influenced by soft factors, such as staff satisfaction.

This approach is drawn from a number of authors, all of which converge on very similar structures (Bryson *et al.*, 2004; Ward *et al.*, 2006; Bradley, 2010; Jenner, 2012)

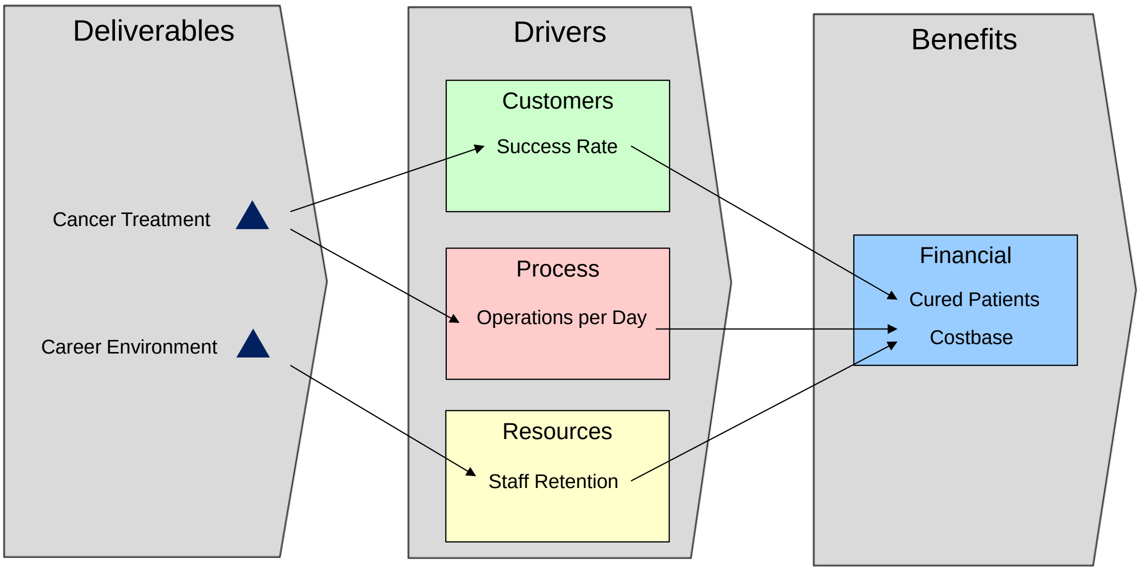

Figure 7.9: Step 6 Cause and Effect Linkage

In reality, the causal threads, storylines, are not mutually independent as implied in Figure 7.9 but highly interdependent, systemic and operating in feedback loops. For example, in addition to reduced recruitment and training costs, Staff Retention may also impact both Operations per Day and Success Rate, which may feedback on Staff Retention. These complex relationships can be modelled more precisely using System Dynamics or other simulation modelling techniques (Sterman, 2000; Richmond, 2001). However, the Author finds that adopting this simplification can greatly assist the causal thinking process, particularly during early stages and when a client is unfamiliar with systemic approaches. It also provides raw material for dynamics models, which are sometimes developed simultaneously in Breakthrough workshops, discussed in Chapter 11.

7.9 Step 7: Directed Questions Mapped to the V-Model

The final step draws on applications of the NLP Meta Model which harness the power of precise language using directed questions to realise a specific result; in this case a populated Value Power Framework. The questions are structured to inject energy while simultaneously eliminating biases and inappropriate heuristics. Further, by both spanning the entire Value Power Framework and mapping to specific phases, the questions provide strong interlocking between learning levels.

Chapter 6 described the NLP Meta Model, which provides a means to drill down below the surface level of a presenting problem to its deep underlying causal structure (Dilts *et al.*, 2000, pp. 733-747). Meta Model I proposed precisely structured questions designed to eliminate distortions, generalisations and deletions, which are a verbalised reflection of flawed mental models. This core Meta Model, as defined by Bandler *et al.* (1976) modelling Satir's systemic family therapy (Satir, 1988; Spitzer, 1992), replaces low energy nominalisations, spoken as static nouns, with dynamic processes articulated as verbs . For example, in the context of decisions from, "We are making poor decisions" to "How is our decision-making process resulting in poor outcomes?"

Meta Model II applies the directed questions to create well-formed outcomes in goal setting, which involves adding specificity (Dilts *et al.*, 2000, p. 742). For example, a goal is often stated as a vague wish, "We want this business to be financially secure." Meta Model II questions would include, "How much cash reserve is available and at what date in order to realise this goal?" expressed in the present tense in order to ensure that the client is in an emotionally energised associated state.

Meta Model III is the third generation of the approach involving directed questions in order to achieve a specific result, comprising well-formed elements (Dilts *et al.*, 2000, p. 743). The generic structure for Meta Model III, having first used Meta Model I to eliminate distortions, generalisations and deletions from a presenting problem, comprises questions directed in three parts: problem, flip and solution (Shephard, 2005a; Empowerment Partnership, 2019) as shown in Figure 7.10.

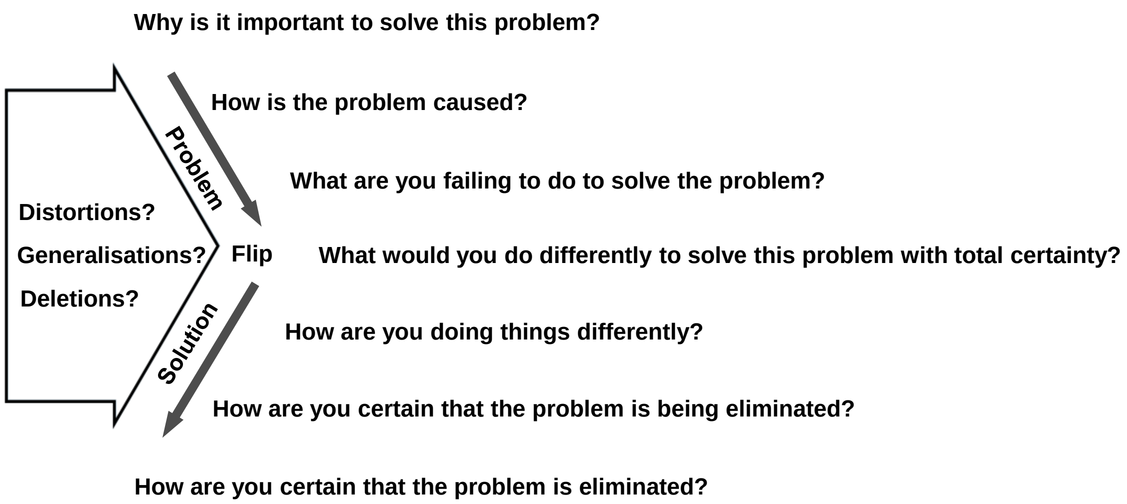

Figure 7.10: Meta Model III Generic Structure

First, the problem is unbundled to determine the importance, cause and nature of failure to correct the cause. The flip question inverts perception from problem to solution and is most effective if expressed as an extreme, which injects confusion and necessitates the client to interrogate and challenge their internal representation, i.e. mental model. For example, "If you had all the resources and authority you need but absolutely no excuses for failure what would you do to be totally certain of success?" This is not reasonable but it is plausible.

Solution related questions, expressed in the present tense, then associate the client with the solution which, importantly, they have created themselves and therefore assume ownership; thus wording of the flip question. The response to each question is challenged using Meta Model II in order to ensure that responses are well-formed at all three levels of learning. The process is undertaken quickly at a pace which ensures that responses are derived at an unconscious level, where a client's cognition of the deep structure, mental model, resides. Importantly in context of the new value theory, the Meta Model III is an instance of the why-how-what frame and can be mapped against the V-Model structure of the Value Power Framework, as Figure 7.11 shows in the context of a vision.

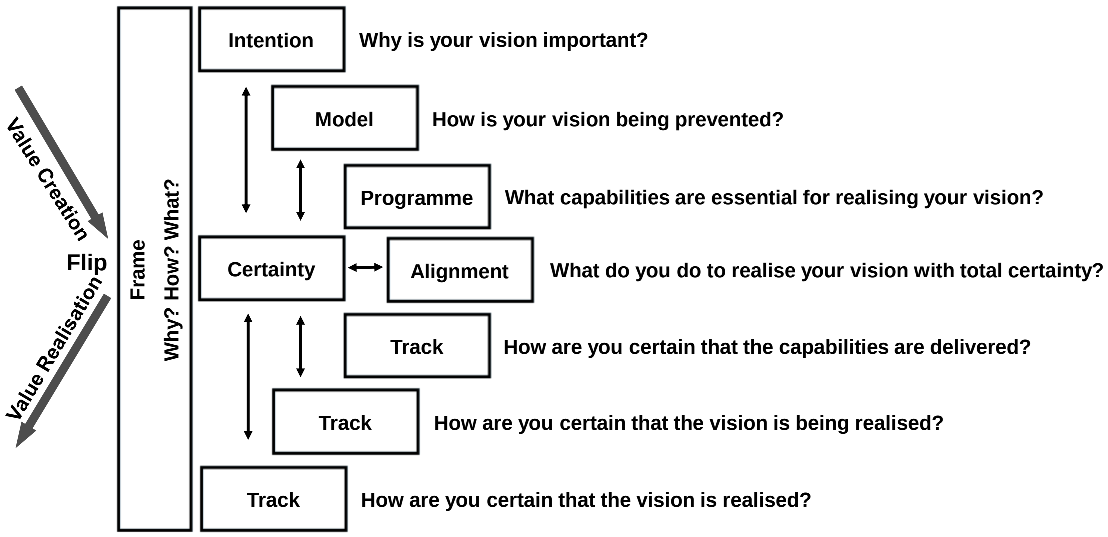

Figure 7.11: Step 7 Directed Questions Mapped to V-Model

Another important property of the Meta Model III structure is that is inherently fractal and can be applied at any level and time in the process. This flexibility can prove critical when applying the approach where it is common for a change programme to be presented in terms of the proposed deliverable functional capabilities, i.e. value inversion, a contextual position from which a client often experiences great difficulty in moving.

Therefore, instead of forcing a shift in the client perspective, the directed question structure can be pivoted to start from the client's world view. For example, if focused on the Programme phase concerned with capabilities, the directed questions can be effectively inverted as shown in Figure 7.12. The important point is that the entire framework is still encompassed by the structure so that the why-how-what frame is respected. Equally, an operations-oriented client may want to begin with tactical performance drivers, which involves starting the process in the Track phase. Any starting point and sequence is acceptable as long as the contextual level is defined and the entire framework is covered. This an application of equifinality (Morgan, 1997, p. 41), a property of open systems offering multiple ways of arriving at a given end point.

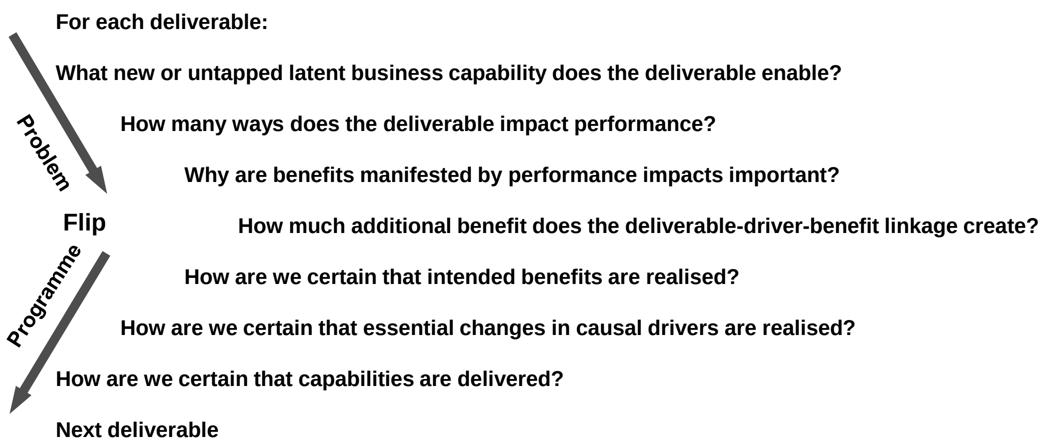

Figure 7.12: Directed Question Stricture Pivoted on Programme Phase

Finally, the Meta Model is generic and applicable across any domain. In particular, this characteristic provides the means to integrate hard and soft factors. For example, suppose that a problem is presented as, “We need to increase productivity.” First, Meta Model I questions are used to challenge the premise and inject specificity, for example, “How is poor productivity a problem?” This qualification often exposes that the perceived problem is not the real issue; low yields could be due to poor quality, an effectiveness rather than efficiency issue.

Having established that productivity is a valid concern, Meta Model III directed questions elicit the importance, cause and nature of failure in relation to the cause, i.e. why-how-what. These problem-focused questions determine the composition of the deep structure in terms of hard and soft measures. For example, it may transpire that poor productivity is due to high levels of machine downtime or inefficient scheduling, hard factors. Conversely, it could be the result of high staff absenteeism, the root cause of which lies in low staff satisfaction emanating from poor engagement; soft factors demanding an entirely different intervention.

There could also be coupling between the hard and soft measures. For example, poor engagement is manifested in machine breakdowns, leading to burnout and sub-optimum engagement, requiring interventions which address both hard and soft factors. Meta Model II is used throughout to ensure that the goal and associated causal factors are well formed. For example, what specific level of productivity is necessary to achieve the vision?” This process forms the foundation for Precise Simplicity discussed in Chapter 11.

7.10 Complete Value Power Framework Structure

Steps 1 to 7 form the essential framework comprising six IMPACT phases: Intention, Model, Programme, Alignment, Certainty and Track. These phases are encapsulated as a V-Model extended to include all learning levels in a why-how-what structure within the first phase, Frame, as shown in Figure 7.13. This structure forms the template for any assignment context and application is validated across three diverse cross-sectional case studies in Chapter 9.

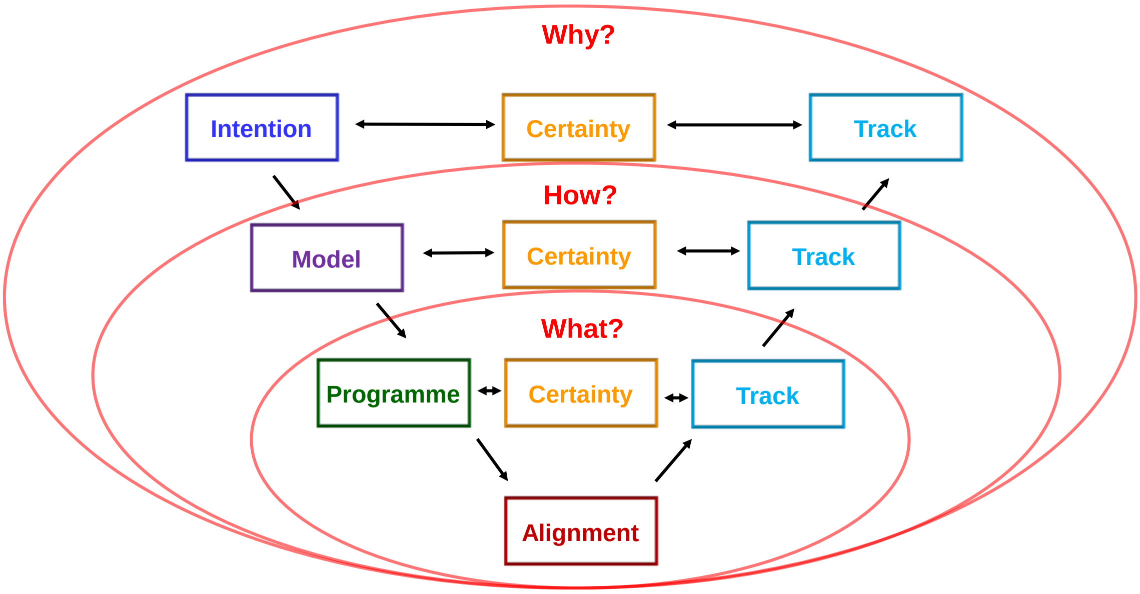

Figure 7.13: Value Power Framework Summary

7.11 Essence

This chapter constructed the Value Power Framework comprising seven phases designed to orchestrate value principles with the aim of optimising stakeholder value. The principles and phases within the framework are integrated and mapped explicitly to the repeating problem patterns with the aim of providing a coherent learning structure, summarised in Table 7.2.

Table 7.2: Problem-Principle-Phase Mapping

Problem Pattern	Value Principle	Framework Phase
Value Inversion: Solution before purpose	Value Frame: Do the right things then do things right	Frame
Value Imbalance: Conflict of intention	Value Intention: Specify mutual stakeholder intentions	**I**ntention
Value Mismatch: Event without cause	Value Model: Align value causality	**M**odel
Value Uncoupling: Cause without capability	Value Programme: Eliminate waste and respect essential redundancy	**P**rogramme
Value Fragility: Function over value	Value Alignment: Optimise value resilience in magnitude and time	**A**lignment
Value Exposure: Defined to fail	Value Certainty: Integrate intuition and analysis	**C**ertainty
Value Erosion: Lost in transition	Value Track: Combine right first time with feedback	**T**rack

PART IV DEVELOPMENT AND VALIDATION

Part I concluded with three mutually reinforcing perquisite capabilities for effective deployment of the new value theory and framework formulated in Part III: Agile Learning, Causal Precision and Causal Certainty. Part IV develops and tests solutions for these capabilities through a longitudinal case study then validates the entire Value Power Framework using three diverse cross-sectional cases.

8 Developmental Case Study

8.1 Introduction

This chapter describes a longitudinal case study, conducted over five years between January 2014 and December 2018. The assignment involved development and real application of a simulation model covering customer engagement in the UK Current Account (CA) market, Market Dynamics Model (MDM), for Bacs Payment Systems Limited (Bacs). The significant investment by Bacs, around £750K of which over £500K is attributable to the Author's company Impact Dynamics, reflects the importance of this programme. Bacs is responsible for Direct Debit, Bacs Direct Credit, the Current Account Switch Service (CASS), and the Cash ISA Transfer Service (Bacs, 2016a). The work integrated research with development and application of the MDM and the duration facilitated validation through examination and appraisal of real outcomes (Institute for Work and Health, 2015).

Background to Bacs and the UK CA market landscape is introduced. The purpose of the work is then specified from two perspectives, business imperatives and academic research. Development relating to specific objectives for the three imperative capabilities, Agile Learning, Causal Precision and Causal Certainty, is described. Much of the chapter is devoted to modelling using Causal Loop Diagrams (CLD) and dynamic simulation using System Dynamics (SD) and Agent Based Modelling (ABM). The significant detail provided is deemed necessary as evidence that a CAS can be modelled effectively, populated quantitatively and insights deployed to create value. To this end, methods used are included as appropriate.

8.1.1 Declaration of Attribution

For full clarity of attribution, the Author designed and directed all aspects of research design and implementation. The work invoked advice, specialist expertise and support drawn from Bacs, University of Bristol (UoB), payment providers and associates of the Author's company, Impact Dynamics Limited (IDL). The Author covered all aspects of conceptual design and SD modelling, together with associated data definition and collection.

Initial training in ABM was provided by external specialists who also worked with the Author in implementing the proof of concept ABM to the Author's conceptual overall design. Subsequently, coding was covered by Rich Harding, an IDL associate, to the Author's conceptual design detailed formally in the Causal Tracing Document (Davies, 2018). Helen Tracy, recently awarded a PhD with the UoB, defined archetypal Learning Power profiles used as a second level of customer segmentation in the MDM.

The UoB covered aspects of data sourcing and transformation, verification and validation and exploration of causal inference. Guidance on research design and implementation was provided by the Author’s supervisor, Professor Colin Taylor, who also chaired Bacs client reviews. The Author was also totally accountable for delivery of both the consultancy and research work streams, requiring the management of resources, necessitating reconciliation of any potential conflict of interest, achieved through transparency.

8.2 Assignment Purpose

The work with Bacs represents a synthesis of consultancy, managed by the Author and academic input provided through the Author’s doctorial research, of which this case study forms a core methodological component, involving contractual partnership between Bacs and the UoB. Therefore, it is appropriate to consider the case study from both industry and academic perspectives.

8.2.1 Business Imperatives

For Bacs the purpose and consequential direction of the MDM development matured and changed during the five year duration of the case study as shown in the Figure 8.1:

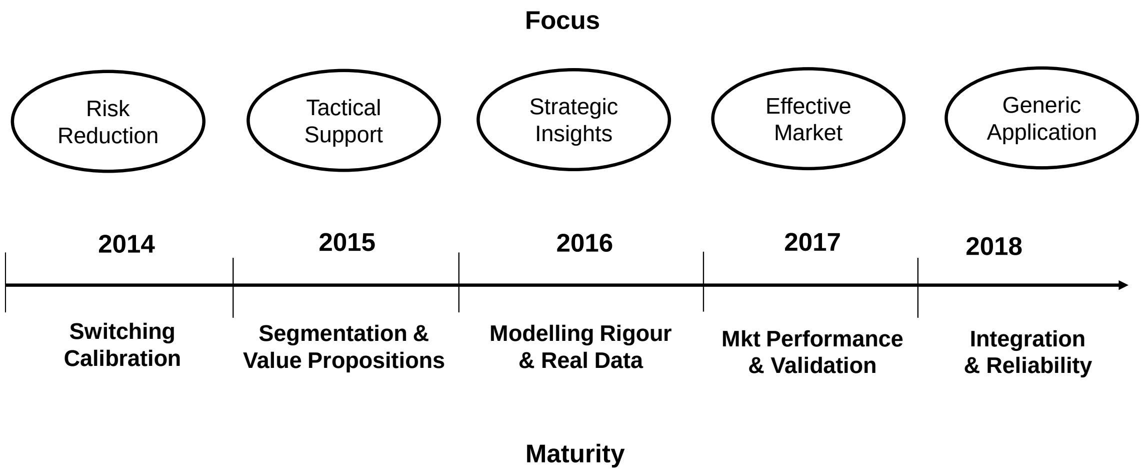

Figure 8.1: Bacs Case Study Maturity Timeline

Each development enhanced previous applications and extended functionality to meet new requirements. For example, the MDM provided increasingly precise and dependable switching level predictions, upon which Bacs placed greater reliance for planning and budgeting purposes, in parallel with other functional capabilities including strategic insights and market performance. Outcomes for these imperatives from the case study are covered in Appendix B1.

8.2.2 Research Objectives

MDM development provided the longitudinal case work to develop prerequisite capabilities needed to support the new theory and framework. The research method combined Action Research and Case Studies using Rapid Prototyping centred on causal mapping and dynamics modelling of CAS environments. The research objectives, together with associated success criteria and evidence are as defined in Chapter 5 and restated in Table 8.1.

Table 8.1: Research Objectives and Success Criteria

Research Objective	Success Criteria	Evidence
C1 Agile Learning: Capability to specify purpose and translate into performance with speed and certainty		
O1.1 Direct Learning: Structure value creation as a Learning Journey	Stakeholder value creation can be modelled as a generic Learning Journey process	Stakeholder Learning Journey simulated dynamically
O1.2 Power Learning: Measure and apply means to increase value creative learning	Learning Power is incorporated within the Learning Journey	Learning Power modelled within stakeholder Learning Journey
C2 Causal Precision: Capability to model the causal translation of purpose into performance		
O2.1 Model CAS: Model all relevant causal relationships within a CAS	CAS can be modelled dynamically	Dynamic value causality within a CAS traced and interpreted
O2.2 Direct Value: Apply model to support value specification and realisation	Sufficient accuracy of calibration and prediction to facilitate intended value creation within a CAS	Dynamics model applied to inform decision making
C3 Causal Certainty: Capability to define, source, transform, validate and apply measures to reduce uncertainty in causal translation of purpose into performance		
O3.1 Define Measures: Define Metadata for all value driver and outcome measures	Hard and soft measures are specified precisely	Hard and soft factors simulated interactively
O3.2 Quantify Measures: Populate model with all input measure values	Data is sourced, transformed, validated and applied in the causal model to create value	Hard and soft measure values and relationships proved valid

Objectives for each prerequisite capability are summarised below and detailed in subsequent sections.

Agile Learning

The switching process is framed as a Customer Journey from awareness of need to achievement, manifested as a current account which most closely matches that need. The principles of Learning Power to inject precision into customer behaviour is incorporated using an archetypal approach.

Causal Modelling

Systems Thinking principles are applied to causal mapping and dynamics modelling techniques, which are combined to define and quantify value drivers and outcomes, together with causal relationships within a CAS. The causal models are used with real data to provide a framework for analysing and directing value creation in a CAS.

Causal Certainty

Measures for the causal model are defined using Metadata. Data is sourced, transformed and validated with which to populate measures in the model, in order to inject a level of certainty needed to realise the model purpose.

8.3 O1.1 Direct Learning

The switching process is framed as a customer Learning Journey from awareness of need to achievement in the form of a service most closely matching that need, based on the work of Crick (2017) in relation to infrastructure.

8.3.1 Framing Change as a Learning Journey

A Learning Journey is usefully framed as the process of transition from an intentionally selected purpose to manifestation of that purpose through performance. In the context of realising purposeful outcomes for users of infrastructure, financial services being an important instance, the process is structured into a Customer Journey. Four key steps within the customer journey were identified through the modelling process: awareness of need and selection of purpose, action through consideration of options and decision, evaluation of choice in relation to purpose, reassessment of need and purpose. For the MDM, these steps were incorporated explicitly as follows:

Awareness of Need and Selection of Purpose

Through experiencing events, customers grow their cognition, defined as awareness of the gap between current service provision and purposeful needs, quantified as their ideal value proposition, together with awareness of opportunities to redress the gap.

Action through Consideration and Decision

Agency, the capacity to act (Van Lier, 2008) grows with cognition and is enabled through provision of the capability to switch using CASS, which leads to consideration of options and decision whether to switch providers or stay put.

Evaluation of Choice in Relation to Purpose

During the course of consideration, customers make a switch decision by comparing a selected subset of providers, named consideration set, with their ideal value proposition. This is moderated with their emotional attitude towards those providers, built through experience over time as a score, to ensure that emotional, as well as rational, considerations are included in the choice.

Reassessment of Need and Purpose

Post the switch decision, which may be to stay put, customers continue building cognition by experiencing the value proposition of their latest provider, with reference to life events, Word of Mouth (WoM) and market events, and reassess this experience with their ideal value proposition, which also changes over time to reflect shifting expectations from the market.

These four steps map closely to the Deming Cycle: Plan-Do-Check-Act (PDCA), which not only provides a powerful learning process for individuals, or groups such as customers, but also change programmes. The framing of a Learning Journey as a Deming Cycle, discussed in Section 3.6, is corroborated through subject expert interviews (Tracy, 2018; Huang, 2018b) and is also the direction of travel for application development by the principal academic authority (Deakin Crick *et al.*, 2017a).

It follows that the Learning Journey frame provides a generic learning framework for a change programme as an entity, integral with the learning of individuals engaged in the programme to create greater potential capability of programme deliverables, which can then be utilised more effectively by customers to create value. In other words, the Learning Journey frame provides a means of creating value for all stakeholders of a change programme. The Customer Journey is now mapped against essential dynamics of the market.

8.3.2 Essential Market Dynamics

The essential dynamics of the CA market driven by feedback loops relating to Trust and Inertia, as shown systemically in Figure 8.2.

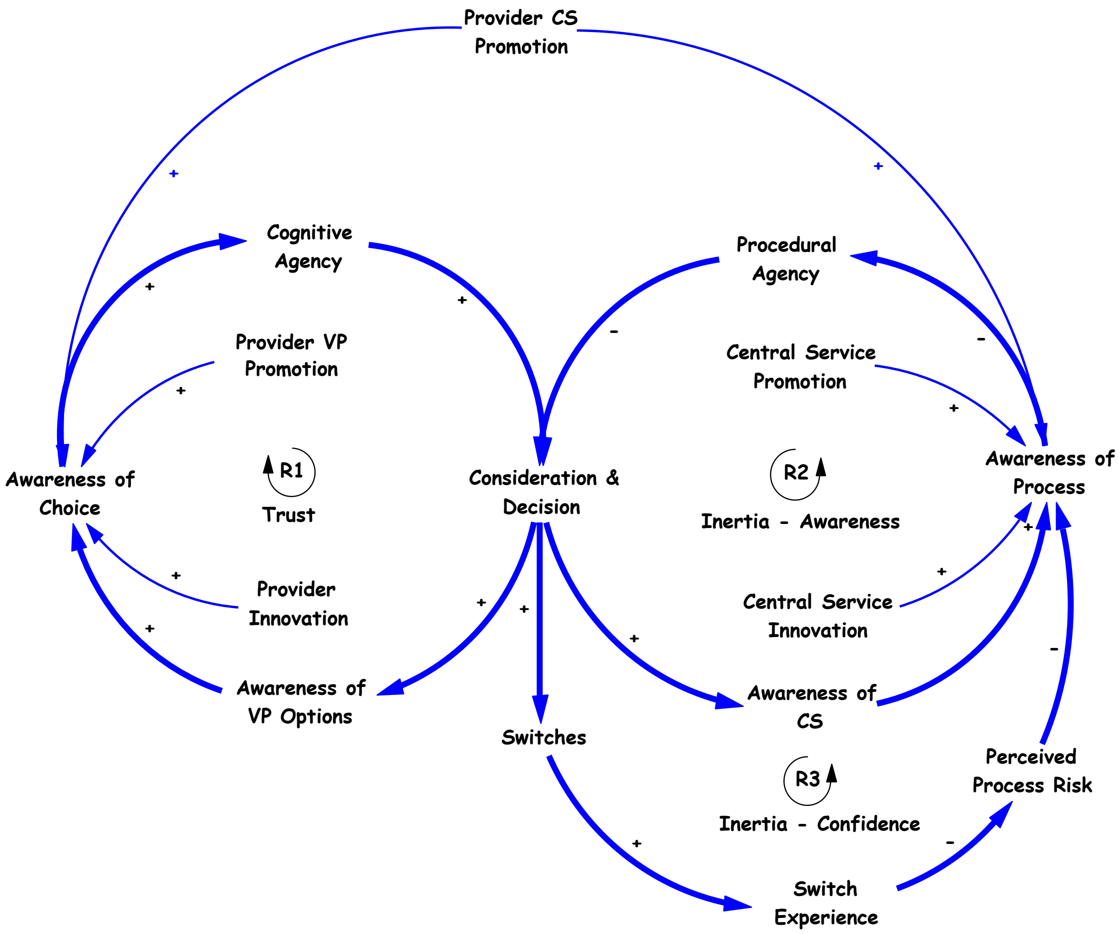

Figure 8.2: Essential Market Dynamics

The Trust and Inertia loops are reinforcing, both defaulting to constrain switching. In the case of R1 Trust, all else remaining equal, customers are exposed to promotion and experience mainly or entirely from their current provider. Consequently, customers remain largely unaware either of any need to change or options available, thereby building trust in their current provider, whether it is warranted or not. This increases perceived value of the relationship, negating incentive to change, which is manifested as loyalty. The problem with the Trust loop is that this loyalty may be misplaced or that the customer simply stays with 'the devil they know'.

For R2 Inertia - Awareness, all else being equal, customers remain unaware of Central Services (CS), for the CA market CASS, and do not cognate CS promotion. This means that customers neither consider options nor receive earned promotion messages, for example through Price Comparison Websites (PCW). For R3 Inertia - Confidence, all else remaining equal, customers associate large effort and high risk with the switching process, which discourages consideration and switching. This reluctance is reinforced over time. The problem with the Inertia loops is that providers, particularly large ones, can actually gain from customers' reluctance; delivering a poor service in the knowledge that it is unlikely to cause customers to switch. Consequently, there is little incentive for providers to make switching easier, and tend to do so only when forced by regulatory action or need to 'buy' wealthy customers to whom they can cross and up-sell other products and service.

The important point is that the influence of reinforcing loops can act in either a positive or negative direction. In the case of the CA market, it can potentially increase active engagement in the market given the right inputs. For example, in the case of the Trust loop, increased awareness of a need and options for addressing the need results in greater agency to consider and make switching decisions, which enhances awareness. For the Inertia loops, increased awareness of the switching process reduces inertia, thereby increasing the propensity to consider and potentially switch. The former increases awareness, the latter, anticipating a positive switching experience, reduces perceived risk, both leading to further reductions in Inertia.

A key to addressing the Trust loop R1 in Figure 8.2 is achieving two things. First, increase customer awareness that a gap exists between what they need and what they are currently experiencing, together with awareness that alternative providers can potentially satisfy this gap. This customer awareness is assigned Cognition Level. Secondly, increase the propensity for a customer to act upon this awareness to consider and make a switching decision; which may be to stay with their current provider. The capacity to act responsibly and interdependently with others against a self-initiated purpose in a learning context is agency (Van Lier, 2008). Therefore, cognition informs agency. The primary requirement for breaking the Inertia loops is to increase awareness of Central Services (CS) R2 and build confidence in CS by reducing the perception of effort and risk in the switching process R3.

What is needed to break the reinforcing loops, operating as vicious cycles against engagement, or better still transform them into virtuous cycles, is the presence of a balancing loop with sufficient influence. Balancing loops generally migrate towards a goal, either chosen with a defined intention or imposed by the system. The key balancing loop in this case is Customer Journey, which is an instance of a Learning Journey and example of learning as correction of error (Argyris, 1976).

In systemic terms, a Learning Journey is a balancing loop in which the gap between a defined purpose (goal) and manifested performance in relation to that purpose is closed, i.e. performance converges towards purpose. The goal for the customer journey is satisfaction of need, defined as the ideal value proposition for a customer. Performance is how a customer actually experiences the value proposition delivered by their current product, modelled as customer perception of the product value proposition. The gap is defined as the difference between what the customer perceives rationally as their ideal value proposition and their perceived experience of service from their current provider. The Customer Journey is overlaid onto the essential market dynamics as the balancing loop B1 in Figure 8.3.

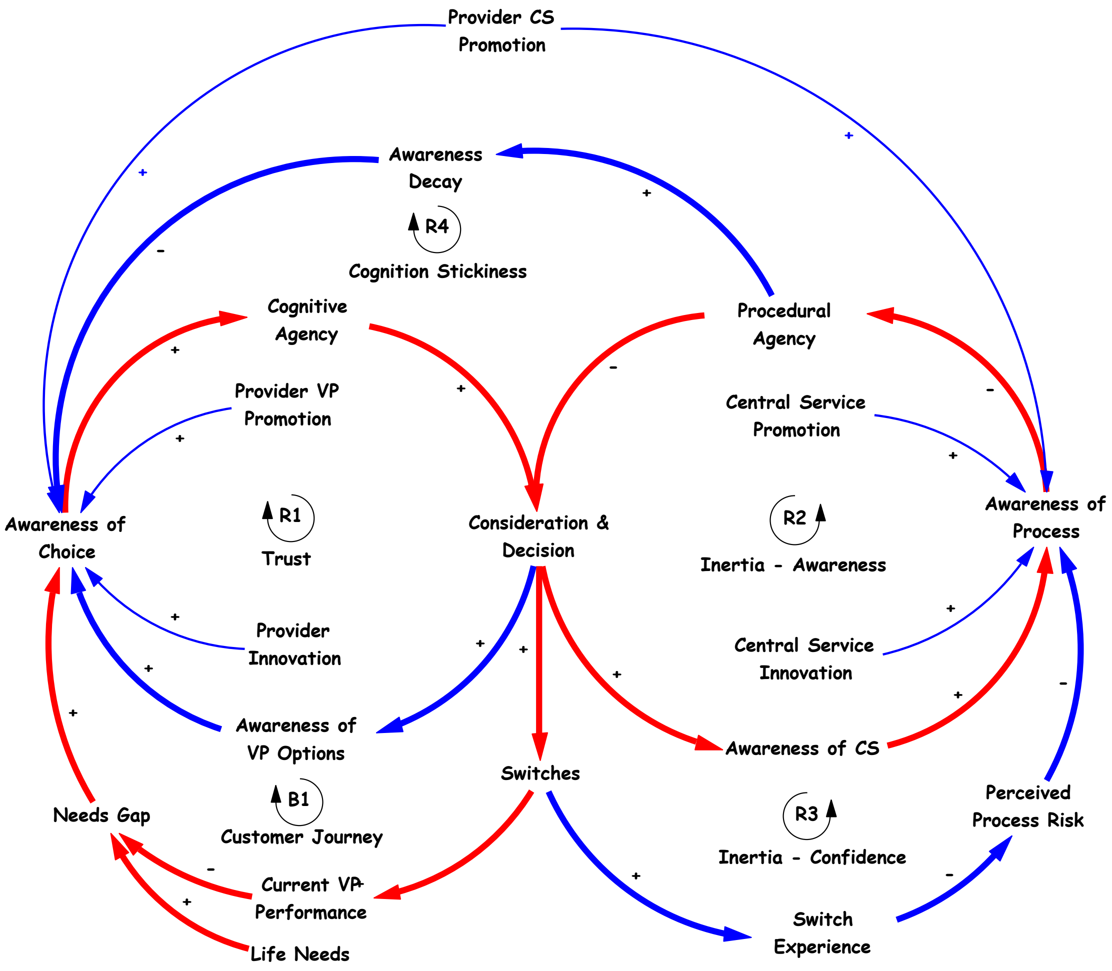

Figure 8.3: Essential Market Dynamics with Customer Journey

Under the Customer Journey balancing loop B1, perceived Life Needs is the goal which is targeted through customers migrating to products with a value proposition that most closely matches this need, which may be their current product. A crucial hypothesis is that perceived need is driven primarily by the contextual power of life status, such as affluence, profession, age etc., and specific contextual events, such as entering higher education, buying a house or retiring. This balancing loop impacts the Trust and Inertia loops by driving consideration and switching decisions, leading to reduced Inertia. Awareness of Choice is constrained by Cognition Decay R4, the tendency for awareness to decay over time; the ‘out of sight out of mind’ effect.

A key aspect of causal maps is that they provide direction for targeting effective interventions. For the Trust loop, interventions include provision and promotion of value propositions by providers in relation to real needs of customers, in order to increase awareness of ***need*** and options for change. For the Inertia loops, interventions involve provision and promotion of the central switching service, with the aim of increasing awareness of the ***means*** by which the needs can be met more easily through switching. In Section 8.5 a systemic map (story) of the entire market is proposed which captures the interactive nature of factors at play in driving market behaviour. 'Storylines' representing important causal threads are then highlighted in red within the overall map. For example, the Customer Journey is a key storyline routed through the systemic map of the entire Current Account market in Figure 8.9.

8.4 O1.2 Power Learning

8.4.1 Incorporating Learning Power in Learning Journeys

Whereas a Learning Journey is the process for transcending purpose into performance, Learning Power is the dispositional capability and energy needed to navigate the journey successfully. Potentially, Learning Power offers three insights. First, it provides a measure of learning disposition at a given time. Secondly, the measure, consolidated from seven dimensions (Deakin Crick *et al.*, 2015) shown in Figure 8.4, can inform which specific aspects of learning need to be strengthened in order for the learning entity, which could include a human individual or group, programme or machine, to realise a defined purpose. Thirdly, the measure can direct the most effective intervention to increase Learning Power in the context of defined purpose. Combined with other aspects of empowering learning, such as learning preferences (McCarthy *et al.*, 2005) and range (Epstein, 2019), this can accelerate the rate of learning and translation of the leaning into value.

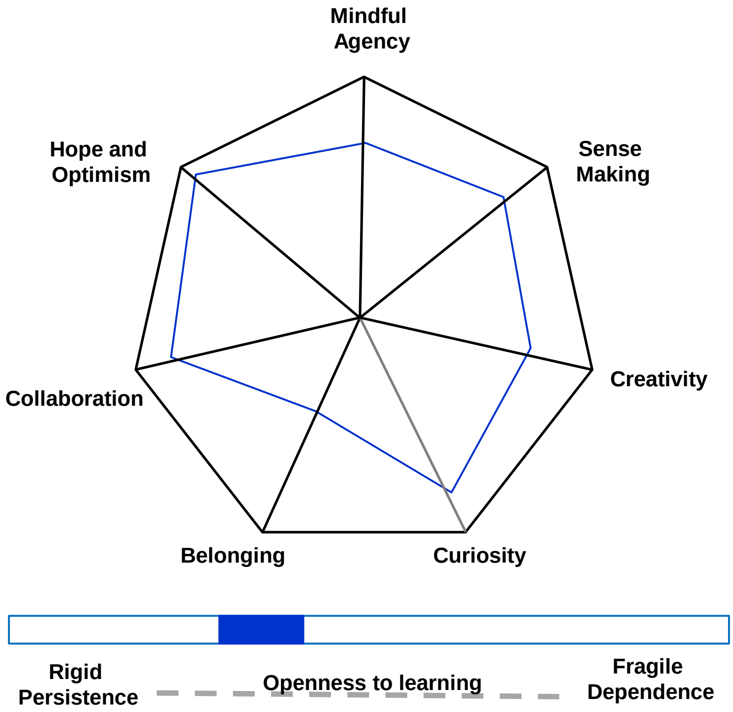

Figure 8.4: Learning Power Profile

Learning Power is incorporated within the MDM in the form of probability modifiers to the first level of customer segmentation in order to test how the concept can increase precision in future projection of switching levels and other key lead measures, such as consideration, which can inform strategies promoting a well–functioning market. Therefore, in context of the model, Learning Power is effectively a second level of customer segmentation, the first being Money Advice Service (2016) financial dispositions shown in Figure 8.5. For example, Squeezed Younger Adults are assigned a probability of considering switching, for a given cognition level, based on survey data and known characteristics concerning that segment. This probability is then modified by their Learning Power archetype, discussed next.

The rationale is that Learning Power offers a potential means to migrate to higher financial dispositions through learning. An important corollary is that value directed learning, powered to transcend purpose into performance by a stakeholder, provides a potential route for ensuring that capabilities afforded by change programme deliverables are translated into value for that stakeholder in a virtuous feedback loop.

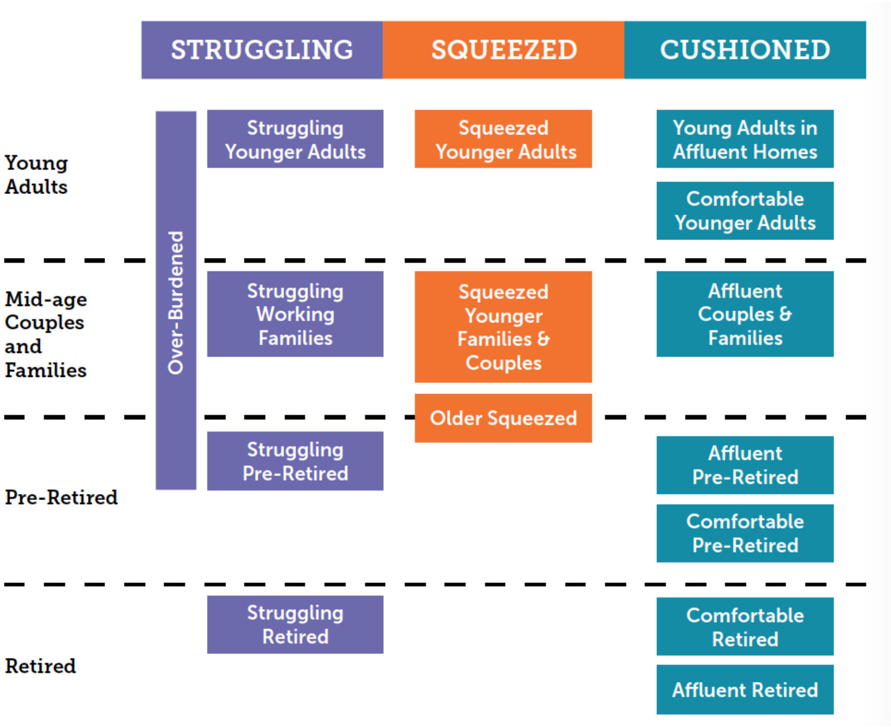

Figure 8.5: MAS Financial Dispositions – First Level Customer Segmentation

For practical purposes the variation of Learning Power dispositions was simplified through the use of archetypal profiles which can be logically linked to the financial disposition segments. Each of the fifteen MAS segments was assigned three Learning Power archetypes, examples of which are shown in Figure 8.6. The archetypes were defined by Helen Tracy, in the capacity of IDL associate and subject matter expert in Learning Journey and Learning Power theory and practice, interviewed for this research (Tracy, 2018). The Author's role from a research perspective was defining the conceptual context.

Learning Power offers the potential to both predict and influence behaviour. In this case, the inclusion of Learning Power demonstrates the potential effectiveness of a second level of customer segmentation based on mental disposition, to supplement financial state. However, it is stressed that this implementation is exploratory Proof of Concept (PoC) and requires significant further work before this potential can be proved and applied with certainty.

Struggling Younger Adults **Struggling Working Families** **Struggling Pre-retired**

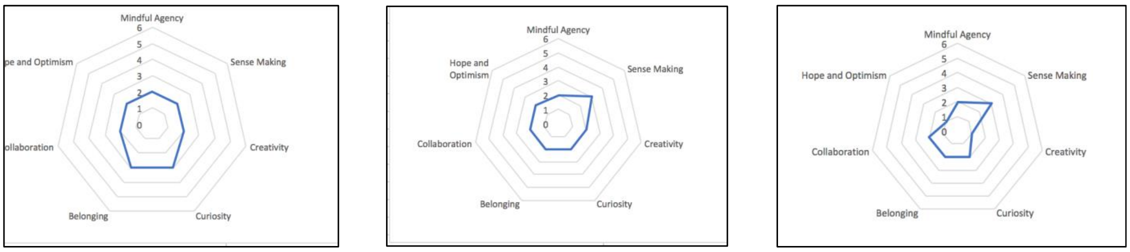

Figure 8.6: Learning Power Profiles – Second Level Customer Segmentation

8.5 O2.1 Model CAS

CAS modelling is conducted under robust Systems Engineering Verification and Validation discipline (V&V) (INCOSE, 2010, p. 27) adapting the model proposed by Sargent (2013, p. 12) as shown in Figure 8.7. Sargent defines verification as ensuring that the computer code of the computerised (physical) model and its implementation are correct and validation the substantiation that a model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model. This distinction can be summarised as: validation concerns doing the right things, whereas verification is about doing things right. CAS Modelling comprises two aspects, causal mapping and dynamics modelling.

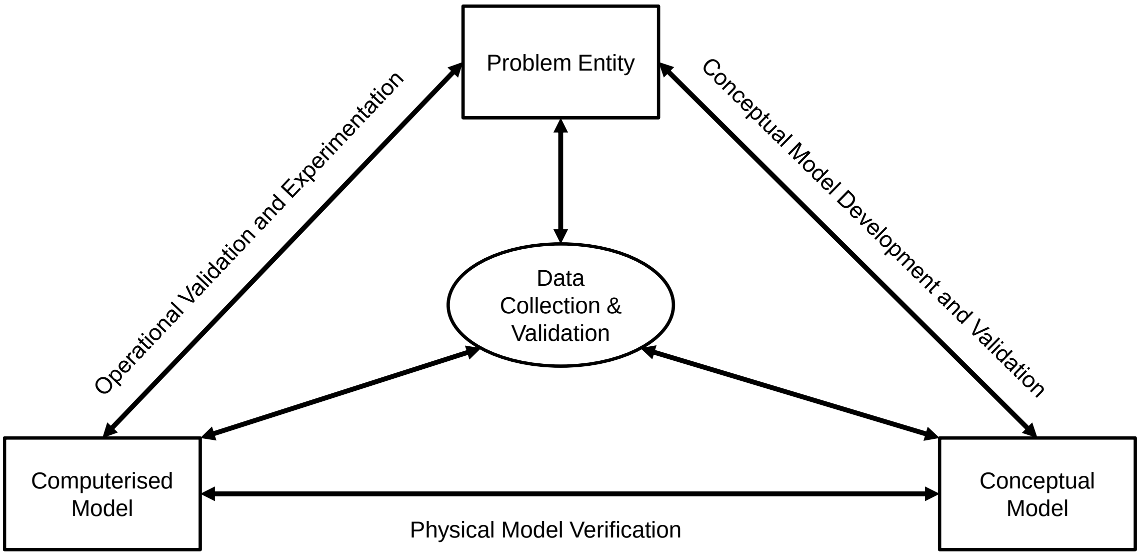

Figure 8.7: Modelling Architecture

8.5.1 Causal Mapping

The entire CA market is modelled conceptually using Causal Loop Diagrams (CLD) as shown in Figure 8.8. from a combination of literature research, discussed more fully in Appendix B1, market expertise within Bacs derived through interviews (Core *et al.*, 2018) and insights from the SD proof of concept modelling covered in Section 8.5.2. The conceptual model is used both to define all key relationships and provide the principal control for development of the MDM agent-based simulation model, through the Causal Tracing Document (CTD) (Davies, 2018). Figure 8.8 describes the functioning of the market as a CAS, from which any cause and effect threads (storylines) can be traced to both the Real World and Physical Model. The structure works equally in representing an individual customer and the customer population as a whole.

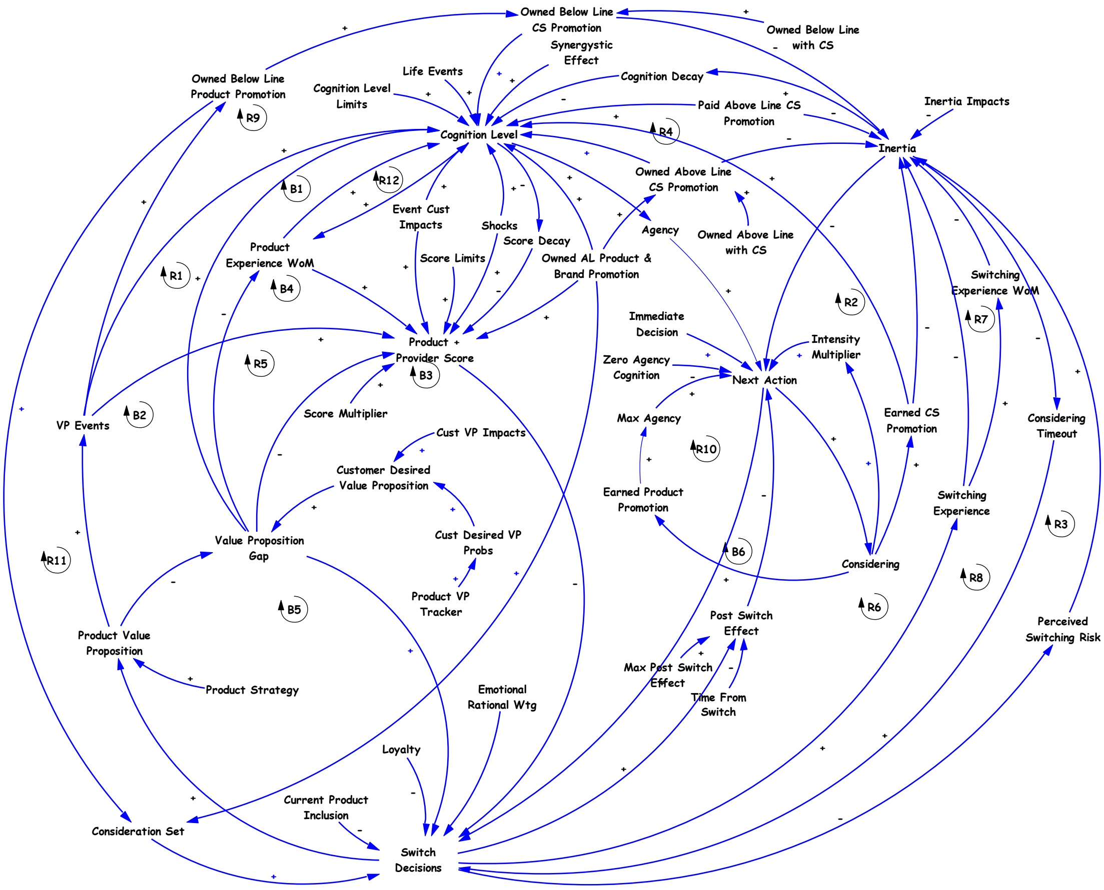

Figure 8.8: CAS Overview from Customer Perspective

Causal Storylines

Causal Storylines are causal threads of enquiry in order to answer one of two questions:

- **Causal Origin**: How is a change in one or more parameters caused?
- **Causal Use:** How does a change in one parameter cause changes in others?

Storylines can be open with a sequential start and finish, for example when considering causal feeds into a specific node, such as Cognition Level or Inertia. However, the most insightful use of this approach concerns the explicit routing of reinforcing and balancing feedback loops, which account for the emergent, non-linear dynamics behaviour of a CAS. The CTD contains 28 threads of which 18 are feedback loops. Each thread serves two key functions with reference to the Sargent model: validation in relation to the Real World and verification with the Physical Model. Figure 8.9 shows the storyline for B1 Customer Journey, previously discussed and shown simplified in Section 8.3.2, a balancing loop driving market effectiveness through customer willingness to consider alternative product value propositions and switch to the best option**.** Other key storylines are shown in Appendix B1.

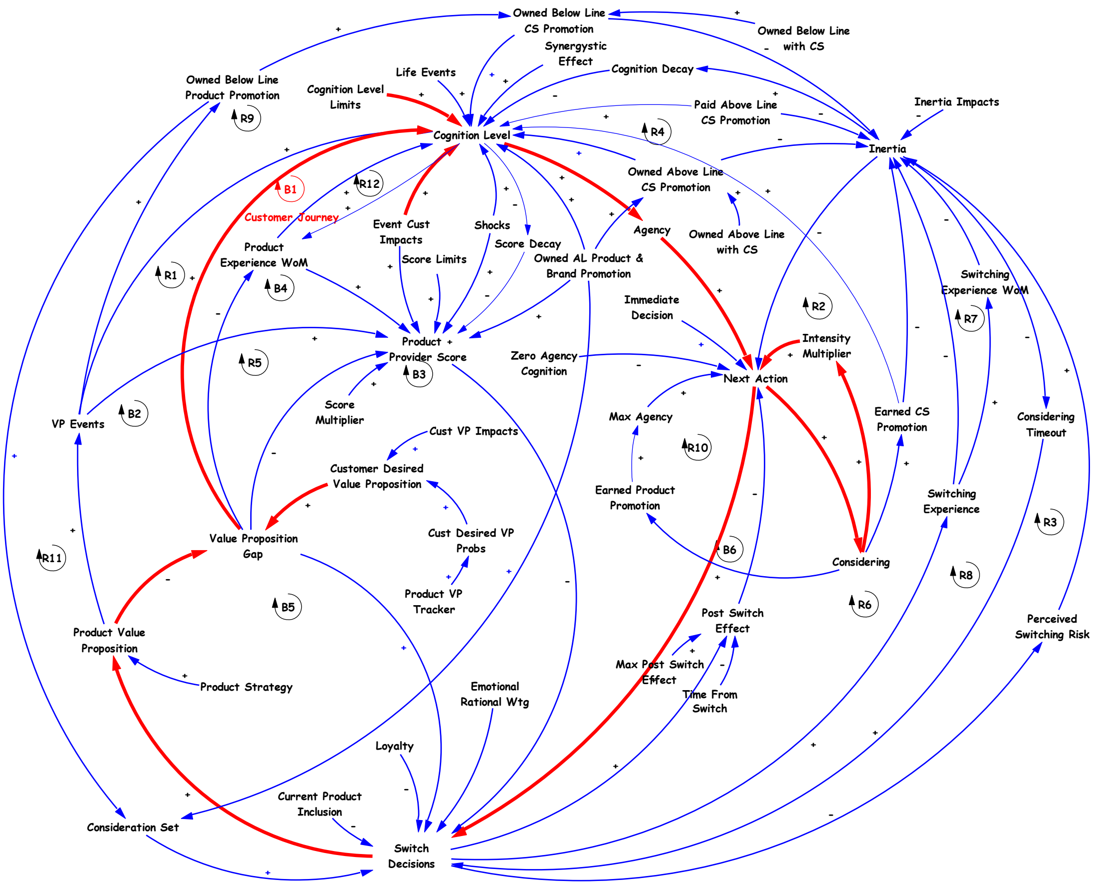

Figure 8.9: B1 Customer Journey

8.5.2 Dynamics Modelling

There are three primary challenges with the validation of any model, simplifying the real world without losing essential reality, and bias. These issues are especially pertinent for PoC models, which render the results vulnerable to challenge of credibility. First, PoC models are inherently high level with significant simplifying assumptions and indicative data. This can lead to the criticism that a model is simplistic and reductionist. Secondly, concerning bias there is a risk that the model simply reflects our expectations without validating the findings, an instance of confirmation bias. Thirdly, the model at PoC stage significantly simplifies reality, thereby limiting the potential for unforeseen effects to be modelled and involving simplified data sets.

This section describes how development of the physical computer model addressed these and other challenges, including validation and verification. Two PoC models were developed; the first using System Dynamics, the second an Agent-based Model subsequently evolved into the operational model.

System Dynamics PoC Model

This section provides an overview of the method, applied to all models, together with outputs and results for the SD PoC model, covered in greater depth in Appendix B1.The method comprises four steps drawn from several experts in dynamics modelling, notably (Sterman, 2000; Richmond, 2001; Warren, 2008; Borshchev, 2013; Brailsford *et al.*, 2014). The SD model was designed and developed entirely by the Author.

- Step 1: Define the Purpose
- Step 2: Develop the Hypothesis
- Step 4: Build and Test the Model
- Step 4: Calibrate and Run Scenarios

Step 1: Define the Purpose

The purpose is to provide robust predictions of future switching for budgeting and insights with which to direct strategic interventions, such as innovation and promotion. There is wide agreement across systemic modellers in the value of encapsulating the purpose in a Reference Behaviour Pattern (RBP). The RBP is normally a graphical representation of the dynamic behaviour to be reproduced and influenced through intervention informed by insights from the modelling. The RBP in this case, annualised switching volumes, is shown in Figure 8.10. The Author also always insists on defining specific scenarios which answer three precisely worded questions in relation to the stated purpose: What additional value must unique insights from the model enable? How much value? Does this value warrant investment in the modelling?

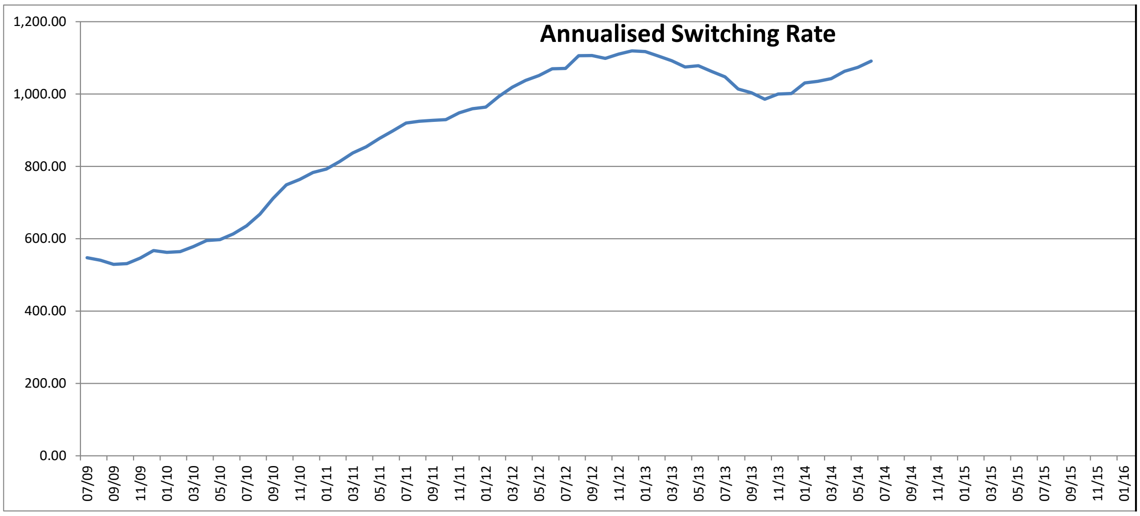

Figure 8.10: Reference Behaviour Pattern

Step 2: Develop the Hypothesis

The RBP is used to propose the causal hypothesis, a plausible explanation of underlying dynamics. This can be assisted through the use of causal archetypes, such as ‘limits to growth’ and ‘success to the successful’ (Senge, 1990), often associated with predictable characteristic behaviour patterns. The hypothesis is often in diagram form, informed by the conceptual model, which can be translated into the computerised SD model, as shown in Figure 8.11.

The structure comprises two main chains of states and transitions; in SD parlance stocks and flows. This structure is called a “co-flow” and is used extensively in SD to simulate the interaction between two or more parameters over time (Sterman, 2000, p. 510). The essential hypothesis, based on Learning Journey theory applied to infrastructures (Deakin Crick *et al.*, 2017b), is that experience informs learning and learning ‘pulls’ behaviour, creating a reinforcing loop driving switching levels which grow over time to a maximum determined by market equilibrium. The concept of market equilibrium is contentious (Arthur, 1990; Arthur, 1999) and discarded in the subsequent agent-based model, in favour of genuine emergence.

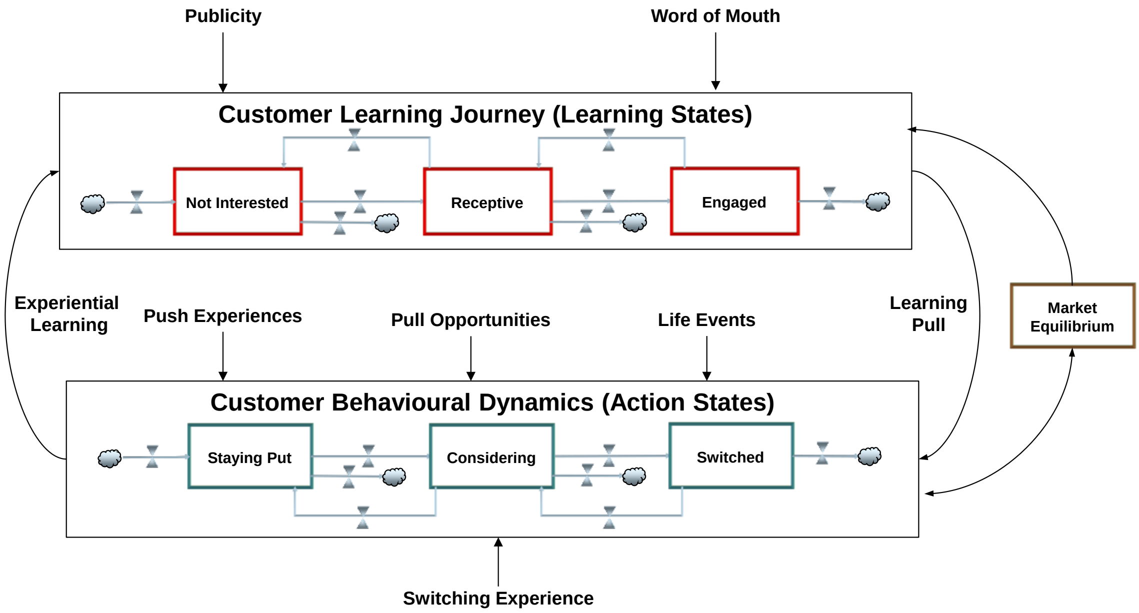

Figure 8.11: System Dynamics PoC Conceptual Model

Step 3: Build and Test the Model

The PoC computerised model is shown in Figure 8.12, which incorporates the diagrammatical hypothesis. The two key modelling challenges, sufficient representation of reality without manipulative bias, were addressed through structured interviews, interactive workshops and rigorous reviews with a team comprising participants from Bacs, Member providers, i.e. market participants funding CASS, and UoB. Whilst there is no pretence that the PoC model provides a robust prediction, the client deemed the performance sufficient to warrant development to the next level of precision.

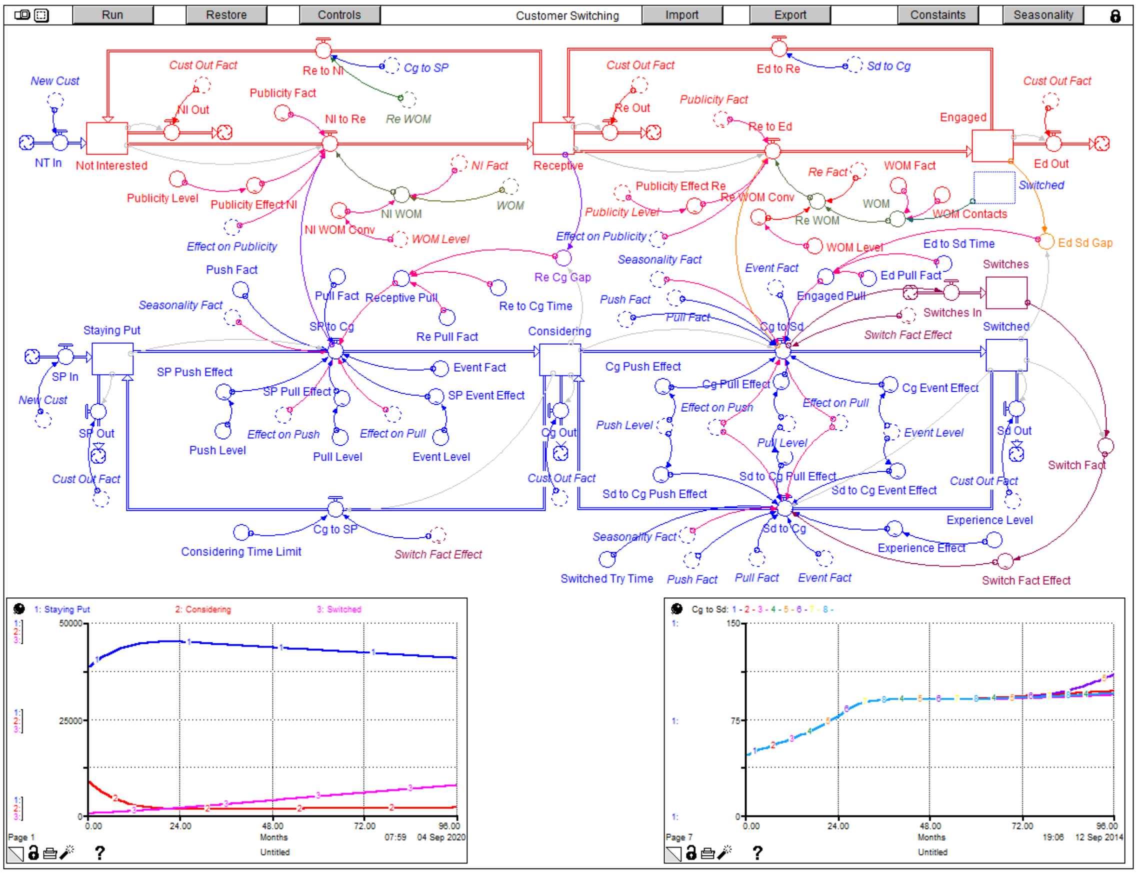

Figure 8.12: System Dynamics PoC Physical Model

Step 4: Calibrate and Run Scenarios

Calibration is shown in Figure 8.13. The Baseline output from the PoC, demonstrated feasibility of the model to reproduce the RBP, together with full traceability of the underlying causal relationships. Several scenarios were run in workshops, for example, innovation and promotion.

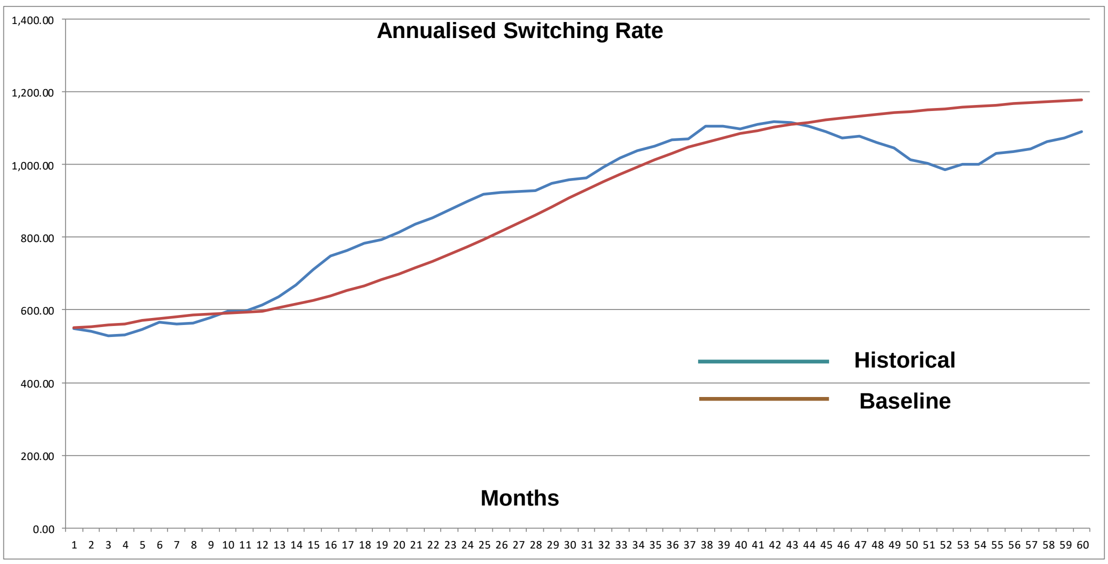

Figure 8.13: Calibration for System Dynamics PoC Model

Agent-based PoC Model

Two major limitations of the SD PoC model in meeting the purpose, to provide robust predictions of future switching, concerned: inability to replicate changes of direction present in the RBP and absence of customer segmentation or differentiation in individual behaviour. Although technically possible to correct both these limitations by enhancing the SD model, the ensuing complexity can render SD models dealing with large variety clumsy and impractical.

The modelling paradigm most suited to large populations of customers with different behavioural characteristics, influenced by interaction between them, is Agent-based Modelling (ABM). An ABM developed around the customer agent structured as a Learning Journey is shown in Figure 8.14. The model was enhanced over a number of releases, defined in the CTD, leading to the Operational Model, covered in the next section. All business logic was developed by the Author, assisted by an operational research consultancy, decisionLab in the form of ABM training in the proprietary application used, AnyLogic, and model specific coding in Java.

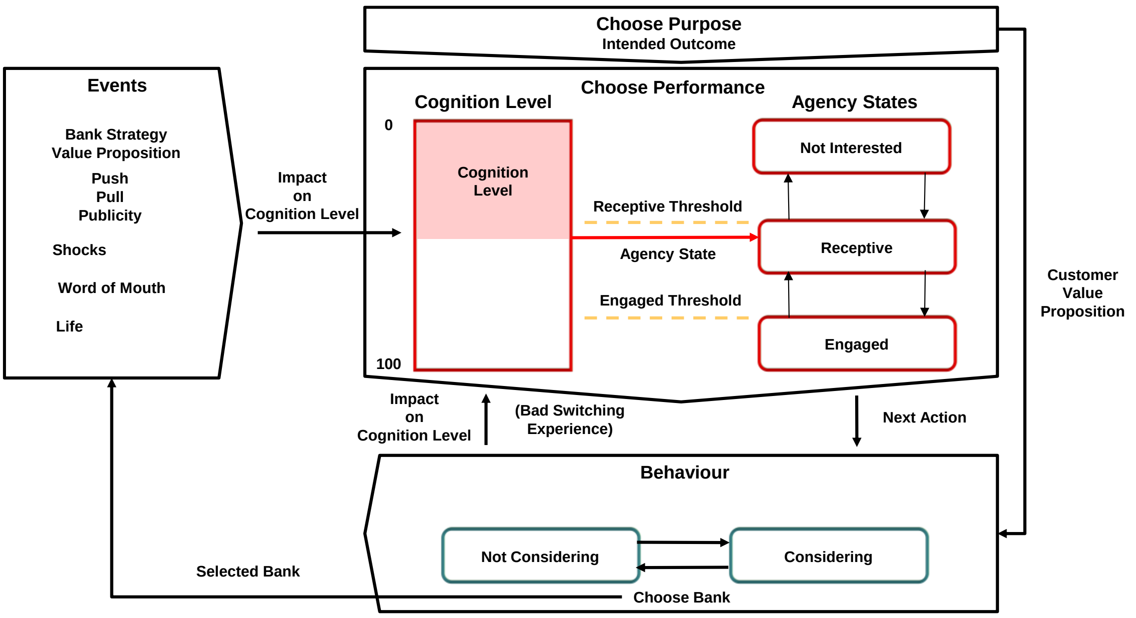

Figure 8.14: Agent-based PoC Model

The ABM PoC model reproduced the RBP more precisely and simulated the change in direction of the annualised switch rate as shown in Figure 8.15. The directional shift was achieved by treating the announcement of CASS as a market shock in which providers reduced promotion of PCA products until after CASS was launched in 2013. This had the effect of reducing customer cognition level and consequential propensity to consider and switch until providers increased PCA promotion after CASS launch. Subsequent development of the Operational Model simulated changes in switching levels more precisely using first principles based on inertia. The increase in precision of both causal relationships and calibrated output provided the justification for Bacs to sanction transition to an Operational Model. The hump in Historical, not followed, is one-off case where low value Lloyds customers were switched to TSB.

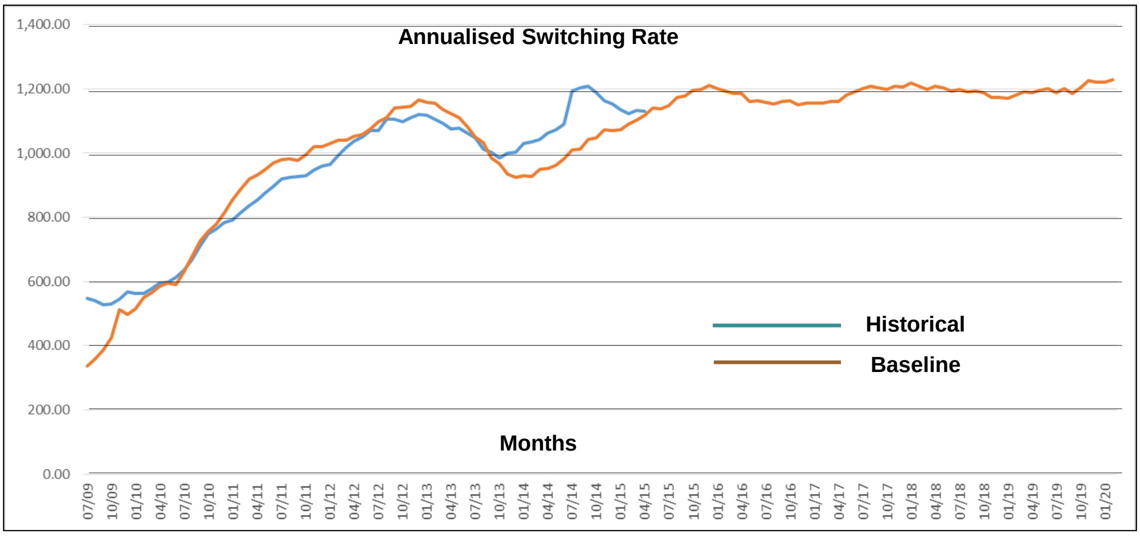

Figure 8.15: Calibration for Agent-based PoC Model

8.5.3 Operational Model

From January 2016 development of the model architecture and coding was undertaken by Rich Harding, a member of the MDM development team on behalf of, and under overall direction by, the Author as design authority, in the transition from PoC to operational status. The primary control artefact for model development was the CTD produced and maintained entirely by the Author as part of the research (Davies, 2018). Navigation of the model development through the transition from PoC to operational is covered in detail through the interview (Harding, 2018) in Appendix A1. However, five disciplines injected into development and which contributed significantly to the rigor and success of the model warrant summary: Object Orientated Programming, 3-Tier Architecture, Test Driven Development, Multiple Random Seeded Runs and Verification and Validation.

Object-Orientated Programming

Historically, a program has been viewed as a logical procedure which takes input data, processes it, and produces output data (Rouse, 2008). Object-oriented programming (OOP) is a programming language model organised around objects rather than actions, and data rather than logic. OOP's power lies in the precise specification of real-world objects, properties, and relationships, i.e. methods, for which reason it is particularly appropriate for dynamics modelling. It is worth noting that the first object-oriented language, Simula, was created specifically to support computer simulations of real world processes (Taylor, 1998, p. 16). Harding applies a highly disciplined form of OOP to the model code, Java.

3-Tier Architecture

3-Tier Architecture refers to clear separation and management of three levels of capability, Presentation, Application and Data. Servers are robot-like programs that exchange information with remote users, whilst clients are programs that exchange information with servers. In 3-tier architecture, clients correspond with the presentation layer and servers encompass the application and database layers (Kelley School of Business, 2014). The presentation tier is also called the client layer, business logic layer also means application tier and database and data layer are equivalent terms (SMT, 2017).

Test Driven Development

Test Driven Development (TDD) creates software in very short iterations and involves writing automated tests of a program's individual units; the smallest possible testable software components (Janzen *et al.*, 2005). TDD is the discipline of creating production and test code simultaneously to ensure synchronisation between them (Janzen *et al.*, 2005; Reid, 2018). Beck (2003, p. 207, p. 211) applies Systems Thinking using CLDs and fractals using Fibonacci series to achieve rapid response to small changes and cohesion. TDD applies Fail Fast principles (ArrkGroup, 2015) adopted throughout the research. Importantly, TDD principles are applied to the Value Power Framework, in which outcomes and success criteria are specified simultaneously for each phase, as is demonstrated in Chapter 9 and Appendix B2.

Multiple Random Seeded Runs

The MDM has 9600 customer agents, each representing 500 customers. Switching rates are between 1% and 2% per year, with the implication that very small variances in key parameters result in large variation in results. Consequently, validity of outputs are vulnerable to small errors, some of which relate to soft factors, inherently difficult to quantify. In order to counter this risk, all scenarios simulated using ten multiple seeded runs and outputs averaged.

Verification and Validation

The Author ensured perpetual verification and validation discipline throughout development, documented formally in the CTD. Bacs used insights from the MDM to inform strategy and advice to key agents in the industry, including regulators and Bank of England. Consequently, it was crucial that outputs from the model commanded sufficient credibility. To this end, Bacs commissioned the UoB to undertake independent and rigorous validation and thorough review of verification, conducted on behalf of Impact Dynamics Limited by Jackson (2018). A comprehensive description of the V&V is covered under the interview with Huang (2018b), the UoB academic researcher responsible for this work, in Appendix A1. Validity of the Conceptual Model, as the CTD, was also reviewed independently by the UoB (Stuijfzand, 2018).

Summarising the final report (Huang, 2018c), Professor Taylor, in capacity of Academic Authority, concluded concerning verification, "The ABM model verification process conducted by

Impact Dynamics Ltd, with support from Bacs, was shown to be done with appropriate rigour." For validation, he states "Extensive numerical simulations, albeit using the limited empirical data sets that are currently available, led to an effective model calibration process. If applied correctly, the process can lead to a model that achieves an error of +/-15% on forecasts up to at least 12 months beyond the calibration data period." (Taylor, 2018); a full transcript is included in Appendix B1.

8.6 O2.2 Direct Value

Having modelled the CAS, it is necessary to trace causality through the chains of relationships for two fundamental purposes: diagnosis and analysis, then directing policy, strategy and interventions.

8.6.1 Diagnosis and Analysis

For diagnosing and analysing the cause of a problem or behaviour, relationships are traced back from the focus of interest in what is termed a 'Causes Tree', which Vensim software used to produce the CTD can create automatically. The Causes Tree for Switch Decisions, derived directly from the CTD, is shown in Figure 8.16:

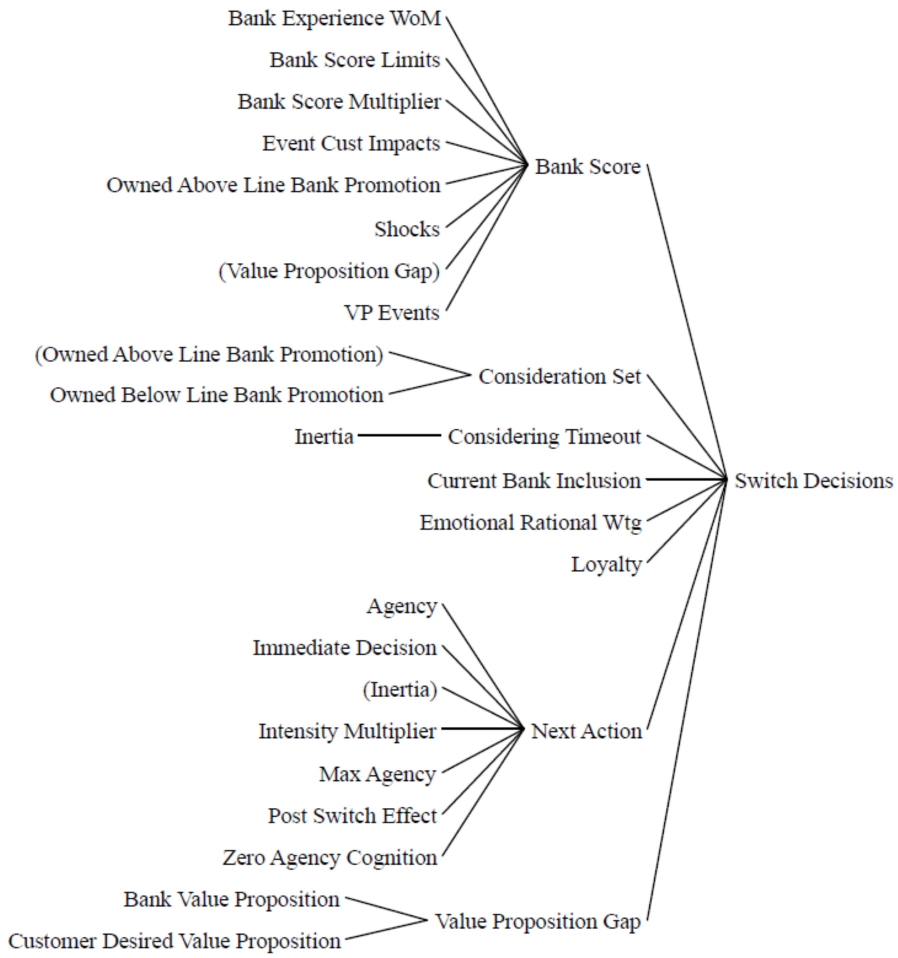

Figure 8.16: Causal Tracing for Switching Decisions

8.6.2 Market Performance Framework

With the aim of facilitating performance management, the CLD representation, shown previously in Figure 8.3: Essential Market Dynamics with Customer Journey, is translated into a more management-orientated Market Performance Framework as shown indicatively in Figure 8.17. This aspect of the work is detailed in Appendix B1.

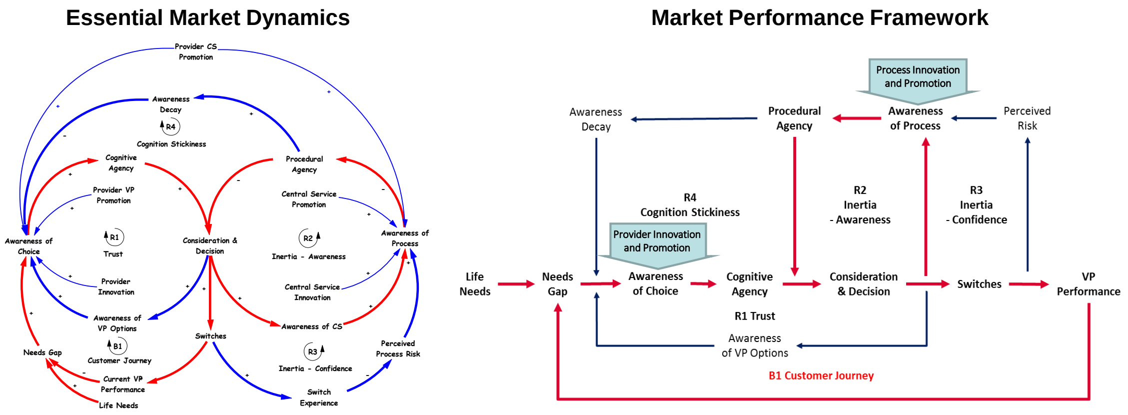

Figure 8.17: Market Performance Analysis

8.6.3 Directing Policy, Strategy and Interventions

The second key application of causal tracing is directing effective policies, strategies and interventions to influence system behaviour and value outcomes. To examine how a proposed action causes changes to problem or behaviour, relationships are traced forward from the intervention in what is termed a ‘Uses Tree’. For example, the Uses Tree for Paid Above Line CS Promotion, mass-media advertising, is shown in Figure 8.18.

The purpose of this representation is to explore the potential impact of specific interventions more readily by rendering the causal traceability easier. It is crucial to recognise that the tree view maintains the integrity of loops; it is a different perspective of the same information. Another advantage of the tree view of a systemic map is that it provides the basis for integration with causal inference (Pearl, 2010; Pearl *et al.*, 2018), which is applied in Econometric Modelling; discussed in Section 8.8.5.

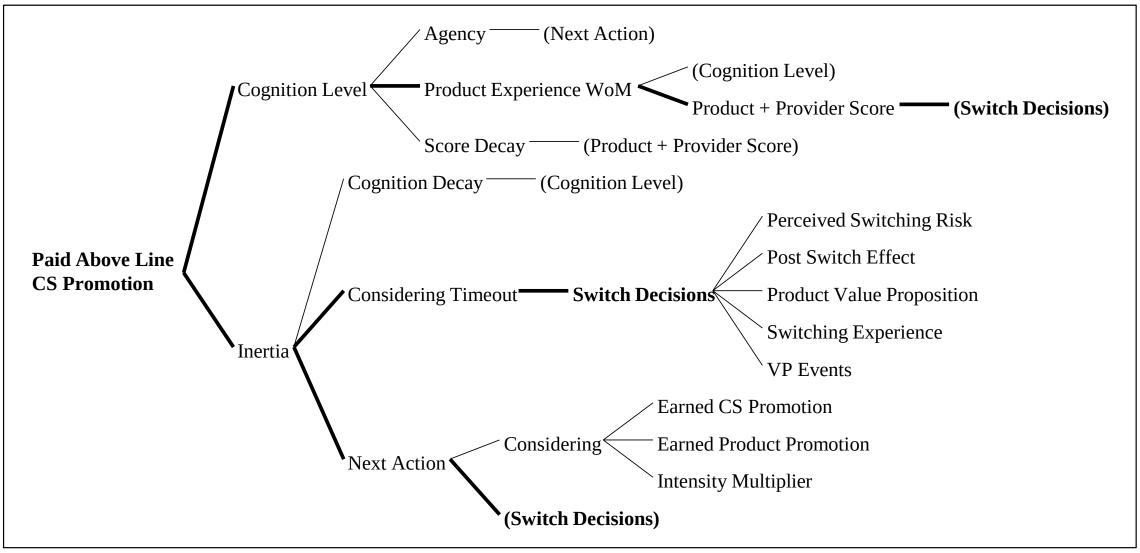

Figure 8.18: Uses Tree for Paid Above Line CS Promotion

8.7 O3.1 Define Measures

8.7.1 Value of Certainty

Causal certainty concerns reduction in the inherent level of uncertainty within a CAS to enable realisation of purpose. In this respect, focus is directed on measurement of value drivers and outcomes, together with the relationships between them, used in models. Sargent (2013) stresses that the focus on verification and validation is increasing level of confidence in the model in the context of its intended use. To this end, Sargent illustrates graphically that significant increase in confidence can be achieved for modest cost but that further confidence comes only with disproportionately high cost (Sargent, 2013, p. 13). This is consistent with Hubbard (2014, p. 160) in the context of the value of increased certainty using his definition of risk as the likelihood of negative outcomes as a result uncertainty (Hubbard, 2009, p. 80). The concept of 'Value for Certainty', operation within the optimum range in a given context, as shown in Figure 8.19, is applied in the proposed approach to Value Management through Precise Simplicity, covered in Chapter 11.

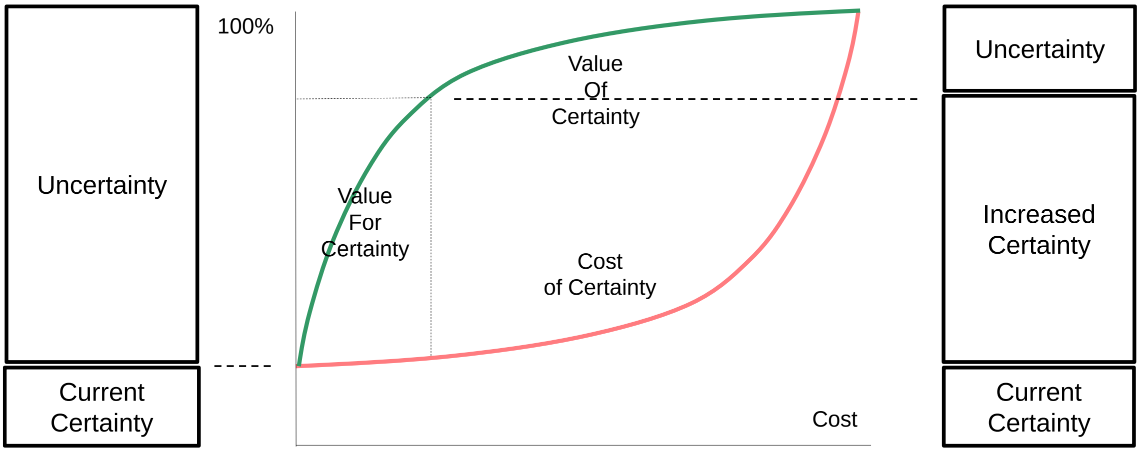

Figure 8.19: Value of Increasing Certainty

There are two imperatives for data with respect to the model, defining the correct measures and populating them with complete, consistent and valid data, covered separately under measure definitions and measure quantities. A fuller description of data, sourcing, transformation and validation for MDM development by is covered in Appendix A1 through the interview with Huang (2018b) who conducted most of these aspects.

8.7.2 Measure Definition using Metadata

It is essential to differentiate between the structure and properties of a data item and the quantitative value assigned to the data. The former is referred to as Metadata, data about data, (Sen, 2004), whilst the latter is generally what people take to mean by the term 'data'. Whereas data quantities can vary in quality, for example completeness, consistency and accuracy, metadata provides a stable specification of the nature of that data.
As Sen asserts, metadata has often been treated as the "second-class citizen" but is increasingly used in Business Intelligence (BI) (Fletcher, 2018), most notably Extract, Transform and Load (ETL) processes for building Data Warehouses (Kimball *et al.*, 2004; El-Sappagh *et al.*, 2011).

Whilst quality of data was limited for the MDM, particularly during the PoC stages, model parameters and units were specified precisely, together with strict unit consistency, from the development of the first PoC SD model, as shown in Figure 8.20. Sargent (2013, p. 19) acknowledges the difficulty in availability of sufficient data and corroborates Richmond (2001) in advocating graphical relationships, particularly for intangibles; used extensively throughout MDM development and demonstrated in Section 9.4.

Data Defintions and Values				
Measure	Measure Definition	Units of Measure	Value	Rationale
Initial Customer Volume and States				
Init Customers	Number of customers with a current account	K Customers	48,000	Market research and provider data
Init Staying Put Fact	Proportion of customers at start in Staying Put state	%	81	Annual Report values
Init Considering Fact	Proportion of customers at start in Considering state	%	18	Annual Report values
Init Switched Fact	Proportion of customers at start in Swiched state	%	1	Annual Report values
Init Not Interested Fact	Proportion of customers at start in Not Interested state	%	81	Annual Report values
Init Receptive Fact	Proportion of customers at start in Receptive state	%	18	Annual Report values
Init Engaged Fact	Proportion of customers at start in Engaged state	%	1	Annual Report values
Customers Entering and Exiting Market				
Cust in Fact	Proportion of new customers entering the market per month	% / Month	0.23	850K 16 yr olds, 500K Immigtation
Cust Out Fact	Proportion of new customers leaving the market per month	% / Month	0.17	300K Emigration, 700K Deaths

Figure 8.20: Data Definition for PoC SD Model

8.8 O3.2 Quantify Measures

Quantification of measures with numerical values involves five prerequisites in relation to data: sourcing, transformation, validation, integrating hard and soft measures and integrating systemic and econometric modelling.

8.8.1 Data Sourcing

During the early PoC stages of model development, input data was largely derived through estimates provided by industry experts, rigour being injected through multiple perspectives, captured through interviews, workshops and reviews. From the start of transition from PoC to operational status, significant time, cost and resource was invested to acquire real data with which to quantify model parameters. Data sourcing was greatly helped by precise data definitions which enabled specification of data requirements sourced from third parties. For the Operational Model data sourcing was led by the UoB and described in the interview with Huang (2018b) in Appendix A1.

8.8.2 Data Transformation

A further challenge when dealing with real data is that it is rarely available in the form needed and must undergo a data transformation process to render it suitable for model parameters; in populating the metadata. The first transformation process, developed by the Author, involved decomposition of model parameters into metadata components which could be mapped against real raw data and reconstructed into the parameters, in some cases applying Bayesian principles (Stone, 2013; Lambert, 2018). Excel was deployed initially and later enhanced by Huang (2018b) who developed Bayesian inversion methods and converted the transformation into R code which provided a more scalable and robust solution.

8.8.3 Data Validation

Validation proved to be the most difficult aspect of data for the MDM, which involved both quality and quantity. Concerning quality, the challenge lay in sourcing available real data with which to populate model parameters, after due transformation. In many cases it was necessary to use surrogate data. For example, Cognition Level is a core model parameter, defined as recognition of a gap between a customer's need and current service provision and options for redressing the gap, on a scale of 0 to 100. Data to populate Cognition Level, was derived by inverting customer survey data elicited through the question, "How likely are you to remain with your current PCA provider for the next year?" (Harding, 2018). By focusing on most critical data it proved possible to achieve an acceptable level of validity for the purpose (Taylor, 2018).

8.8.4 Integrating Hard and Soft Measures

The way in which the MDM integrates hard and soft measures is explained through the most fundamental data used; the two types of measure relating to events which drive the customer journey. The first concerns probability that a customer is subject to a particular event, for example, a bad experience on visiting a branch, website or contact centre through unhelpful provider staff, which is designated a 'Relationship Push' event. This is considered by the Author as 'hard' data because there are ways to capture verifiable objective information through observation, complaints and recorded conversations etc., all of which are becoming increasingly automated. Similarly, customer life events, such as education, marriage and retirement, are available through national statistics.

The second data type relates to impact on the customer as a result of the experience, reflected as increase in cognition which drives propensity to consider and switch, and perception, i.e. score, relating to the associated provider, which influences a switch decision. This information is 'soft', on the grounds that it is subjective and not directly verifiable. It is captured for the model mainly through customer survey questionnaires and duly transformed. However, the MDM focuses on customer behaviour and both data types are essential. They are integrated through their incorporation within the value proposition structure in the Customer Journey; a balancing loop as shown in Figure 8.9.

8.8.5 Integrating Systemic and Econometric Modelling

Two apparently diametrically opposite approaches to modelling complex systems are systemic and econometric models. Both have the same aim, quantifying causal relationships which explain behaviour, enabling meaningful prediction of future outcomes and capability to cause desired outcomes intentionally through policies, strategies and interventions. Systemic techniques, such as CLDs and associated quantitative simulation using System Dynamics (SD) and Agent-based Modelling (ABM), inject causal precision by capturing many relationships, albeit often populated with imprecise data. Conversely, econometrics uses mathematical equations to model relationships using causal inference (Pearl *et al.*, 2016; Pearl *et al.*, 2018). Precision is achieved by tackling the 'problem of endogeneity' (Stouli, 2018), arising from the impossibility of accounting for every influence. A common response, potentially important but unobservable factors are omitted, can render regression techniques causally flawed.

Econometrics provides mathematical and statistical rigor and enjoys a high level of credibility through wide application by economists, which affords a perception of being scientific. However, this rigour comes at a price; lack of intuitive simplicity and rapid scalability. The approach tends to be bottom up, combining small subsets into the overall system, such as the economy. Conversely, systemic approaches enable rapid top-down modelling of CAS through storytelling and translation into a quantitative simulation, as demonstrated through this case study. The main weakness of this approach lies in the difficulty of populating models with real valid data. Necessary high level abstractions, estimations and assumptions render the approach vulnerable to challenge of credibility.

The key conclusion is that respective strengths can be combined and weaknesses neutralised by integrating systemic and econometric modelling through the common thread, causal inference. Causal inference refers to a set of techniques for modelling relationships using diagrammatic archetypal structures (Pearl *et al.*, 2018). A team member and Economist from the UoB, Sami Stouli, was commissioned to explore how systemic and econometric approaches related to each other and how they can be integrated to enable intentional value creation.

The report (Stouli, 2018) concluded using a real example, that the precision and credibility of systemic models can be greatly enhanced by applying causal inference techniques. The specific linkage is achieved by applying causal inference to the most critical and sensitive nodes in the systemic model, as shown conceptually in Figure 8.21. Stouli was also interviewed for this research as a subject expert in both economics and causal modelling (Stouli, 2017a; Stouli, 2017b).

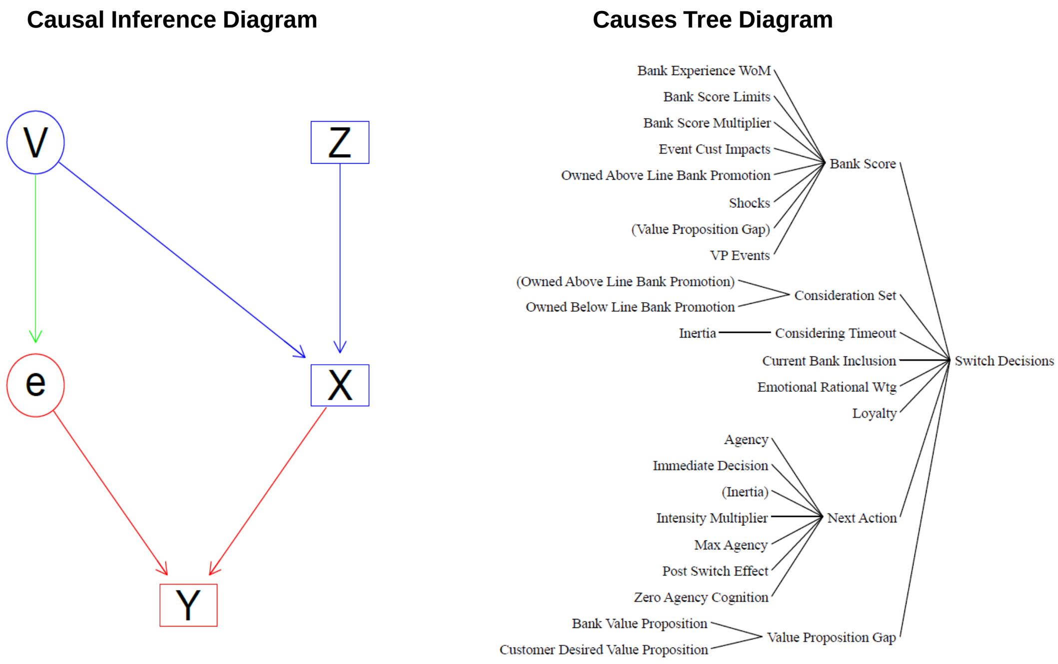

Figure 8.21: Relationship between Econometrics and Systems Thinking

8.9 Essence

Overall, it proved feasible to achieve the three prerequisite capabilities, Agile Learning, Causal Precision and Causal Certainty, as evidenced by independent Verification and Validation. Agile Learning transforms purpose into performance through a Learning Journey process, invigorated by Learning Power and diverse perspectives. Causal Precision involves modelling CAS dynamically and applying insights to direct value creation, supported by Causal Certainty through precise measure definition and rigorous quantification. However, it is also crucial that deployment of the new theory and framework, enabled by capabilities developed in this chapter, are applicable across contexts. To address this imperative, the next chapter provides evidence of successful deployment across three diverse validation case studies.

9 Validation Case Studies

9.1 Introduction

Chapter 8 developed prerequisite capabilities, concluded in Part I, deemed to be essential for deploying the Value Power Framework constructed in Chapter 7, reshown in Figure 9.1. Focus is now shifted to framework validation, in which context it is important to preframe the chapter and outline the common structure used across all cases.

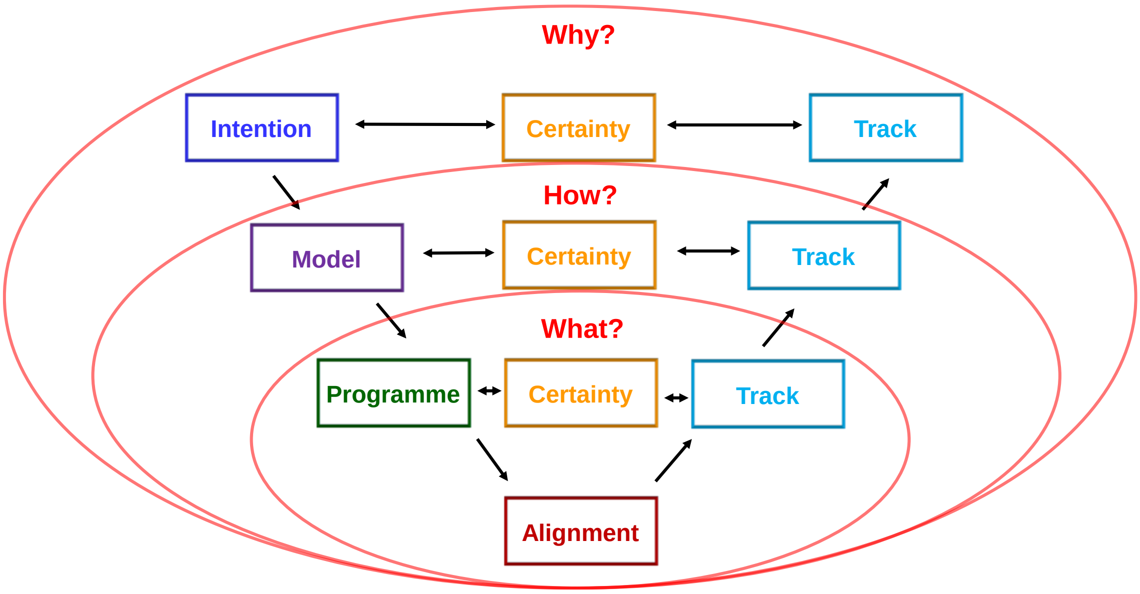

Figure 9.1: Value Power Framework

9.1.1 Preframe

- Focus is on validation, not critique or development, to which end evidence is provided that all aspects of the framework were deployed successfully. Issues experienced and opportunities for improvement are evaluated against success criteria and evidence in Chapter10.
- Emphasis is directed on evidence of generic application across different contexts, using three case studies. Therefore, whilst it is important to demonstrate success as a result of deploying the approach, it is not necessary that all aspects of case specific content, presented as evidence, are understood in detail. Consequently, descriptions deemed sufficient to serve this purpose are presented.
- Respecting Popper's distinction between verification and falsification, applied in Chapter 6, cases are designed to subject the approach to potential extremes, actively exposing the approach to potential failure.

- The Author possessed no prior knowledge of, or experience in, either the subject domain or environment for any of the case studies; providing further evidence that process and thinking afforded by the framework accounted for repeatable success.
- In a similar vein, the purpose of this validation is not proof of contribution by the Author to research, design and innovation relating to the case content, but evidence of integrating resources to create stakeholder value, and transferring the knowledge of the approach to replicate success.
- The three case studies were carefully selected to provide a highly diverse platform for demonstrating that, whilst specific content and techniques can be completely different, the thinking processes invoked overall and at each phase are conceptually identical.
- Although application of each specific Value Principle is not described explicitly, it is evidenced through declaration of content, results and client feedback.
- Evidence of efficacy is provided in three ways: actual content produced at each framework phase, outcomes with overarching feedback from clients and detailed before and after questionnaires completed by each client, the latter shown in Appendix B2.
- All the clients, io oil and gas, KWMC and System Eyes, reviewed and provided written approval to publish all materials used in this thesis, duly anonymised where requested.

9.1.2 Common Case Structure

Each case is described using the following common structure:

Assignment Background

Outline of purpose, context and learning environment for the assignment (More detail is provided in Appendix B2):

Value Power Framework

Population of the entire framework with case specific content, presented in the order:

- Frame
- Intention, Intention Certainty, Intention Track (Why?)
- Model, Model Certainty, Model Track (How?)
- Programme, Programme Certainty, Programme Track (What?)
- Alignment

Each Why-How-What thread is an instance of mapping between Critical Realism (Bhaskar, 2008) and the Sargent (2013) model: Actual (Real world entity), Real (Conceptual Model) and Empirical (Computerised Model) described in Section 5.6.4.

Outcomes

Statement of actual outcomes, incorporating client feedback as corroborative evidence of successful deployment. Full statements and before and after client feedback in Chapter 10.

9.2 io oil and gas Case Study: Brown Field Gas Reservoir

9.2.1 Assignment Background

Purpose

This case study was conducted between November 2015 and March 2016 with io oil and gas consulting (io), a joint venture between GE Oil & Gas and McDermott. Their mission is to transform the upstream oil & gas industry by helping to bring more projects to sanction by delivering greater certainty, disrupting traditional thinking and bringing higher decision quality into the front-end. The purpose of this assignment was to assess technical and commercial viability of extending the life of Brown Field (anonymised name) gas reservoir. The end client (Client), a global oil company, commissioned io to develop a model for evaluating alternative scenarios for selection more rapidly than conventional practice. These necessitate multiple expensive models, created and operating separately, requiring costly and time consuming iterations. io proposed System Dynamics (SD) as the modelling paradigm and, needing expertise, engaged the Author to lead model development with the io team.

Context

The Brown Field gas production fields are important assets to the Client and represent some 17% of Client production and 55% of production for that location. Production from Brown Field is anticipated to decline in the medium term. It is proposed to incorporate gas compression to deliver increased production and maintain output plateau rates will delay the decline. The Brown Field production system operated by the Client supplies domestic gas and income to the local area which is reflected in the commercial dynamics involving various royalties and taxes, in addition to provision of gas. More generically, this model addresses the imperative, driven by collapse in oil price, to develop more agile approaches for selection of options during early programmes stages.

Learning Environment

This assignment provided an ideal learning environment for exercising the interactive Value Breakthrough approach on a continuous basis. The Author was allocated a dedicated conference room for the entire four months, equipped with flipcharts and a large electronic screen enabling interactive model building and experiment. Engagement involved the entire team of participants with specific skills. The greatest challenge was drawing out and integrating causal process ‘stories’ from specialists who otherwise worked largely independently. In this regard, the Author's experience in defence and aerospace industries, which use strong System Engineering disciplines, proved vital.

9.2.2 Value Power Framework

Frame

Life extensions to Brown Field have been considered previously. A total of 49 compression concepts were studied for offshore compression and one of the platforms was selected in 2010. However, this option was halted due to high investment cost, marginal economics and the perceived availability of other production options. Gas compression facilities have been installed for other fields. Currently, the Client has a concept selection short list of five options where the base reference is a hub bridging separate compression platforms. The Client is also constructing a detailed reservoir and flow assurance model covering Brown Field. However, this detailed approach is not appropriate for the rapid screening of a large range of compression options. Consequently, it is intended that the SD model will provide this rapid screening capability framed as shown in Figure 9.2.

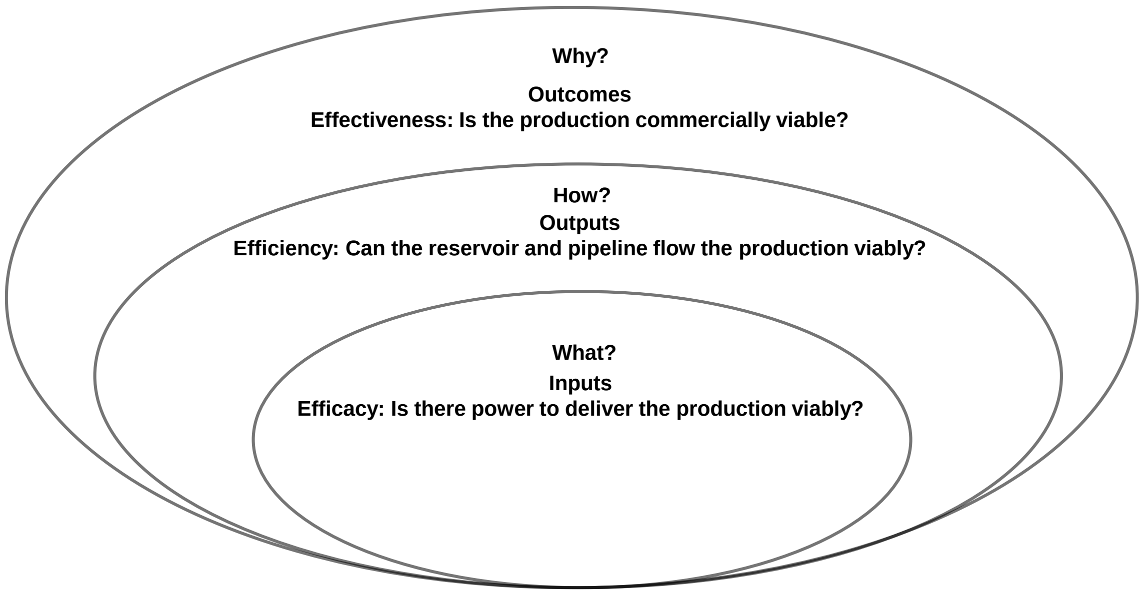

Figure 9.2: Frame

The Why-How-What frame for Brown Field can be summarised in three key questions mapped onto the Value Power Framework as shown in Figure 9.3, which provides a roadmap for the assignment.

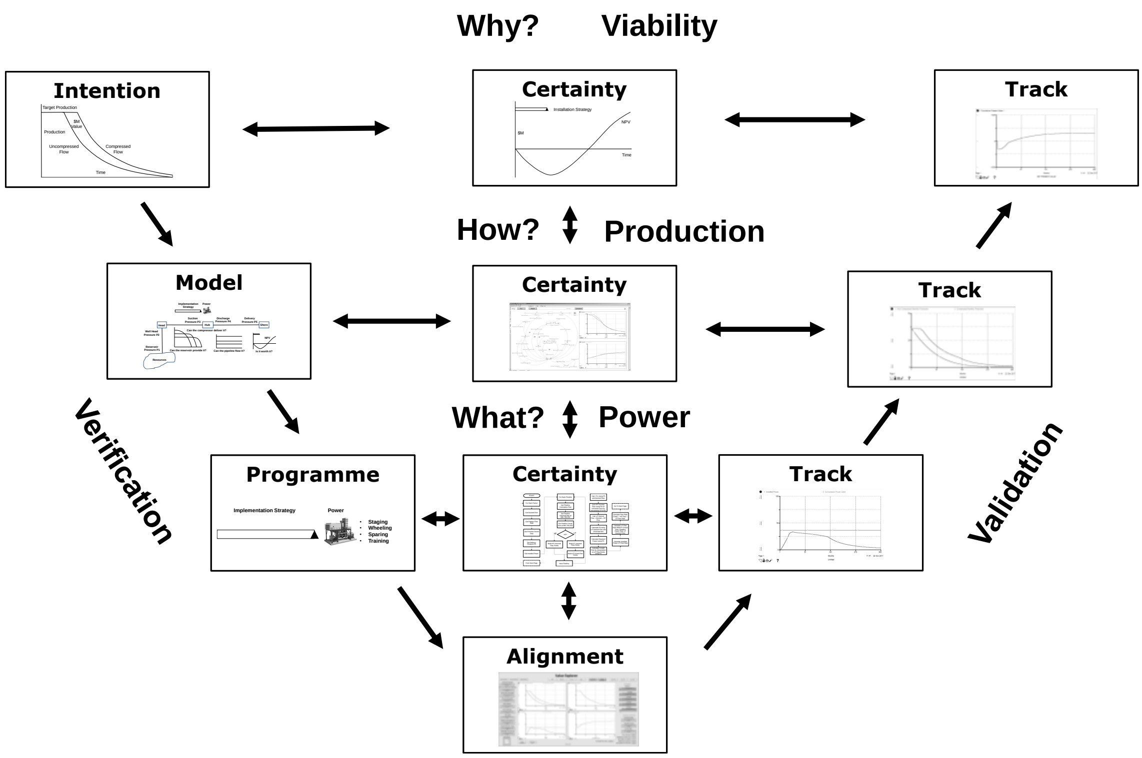

Figure 9.3: Value Management Framework Roadmap

Intention

This phase is concerned with specifying the purpose in terms of intended stakeholder outcomes, of which there are two related elements measured as Net Present Value (NPV). The first imperative is to determine commercial viability of extending the production life of Brown Field for the Client, after distributing due taxes and royalties to other stakeholders; principally governmental bodies owning the territorial waters in which the field is located.

The second part is to specify the preferred Implementation Strategy in terms of the power configuration and phasing for compression which provides optimum, sustainable return across stakeholders. In system modelling terms, the core issue in this case is generating stakeholder value by extending the field production. This represents the Causal Hypothesis which is most effectively shown graphically as the reference behaviour pattern (RBP) (Richmond, 2001, p. 175). Figure 9.4 shows the RBP for this case as the difference in decline in gas production, before and post compression.

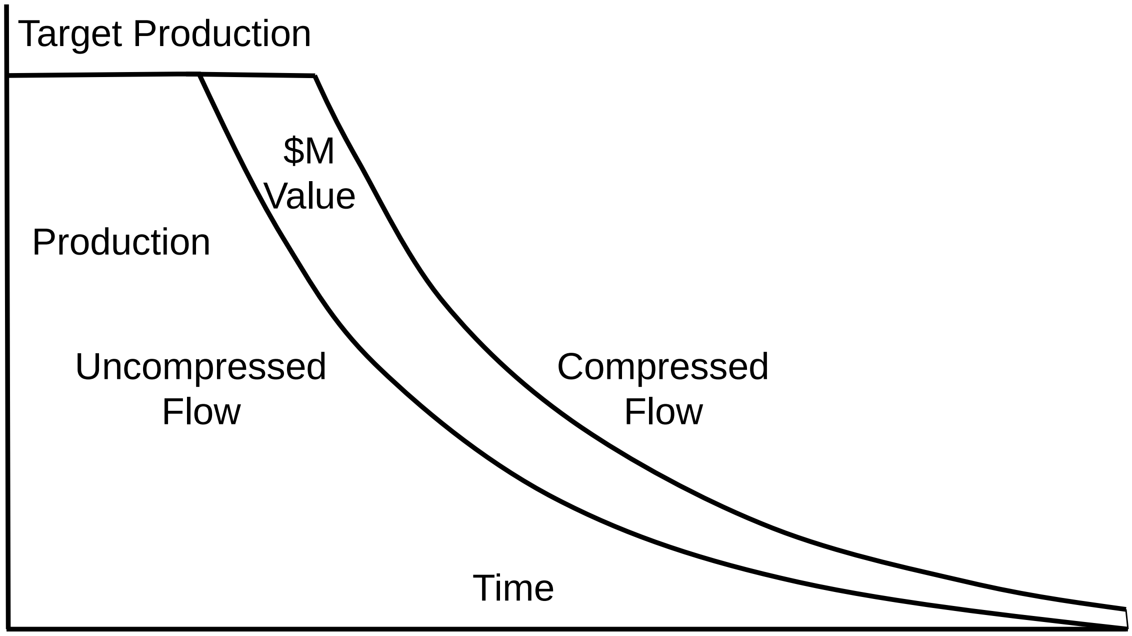

Figure 9.4: Intention - Production Profile

Intention Certainty

At each level in the Value Power Framework, it is necessary to define the criteria for determining how success will be, and is, realised. Figure 9.5 illustrates how the commercial viability for the Client will be evaluated as NPV, which after accounting for reservoir and pipework capacity is determined by the Implementation Strategy for compressor installation.

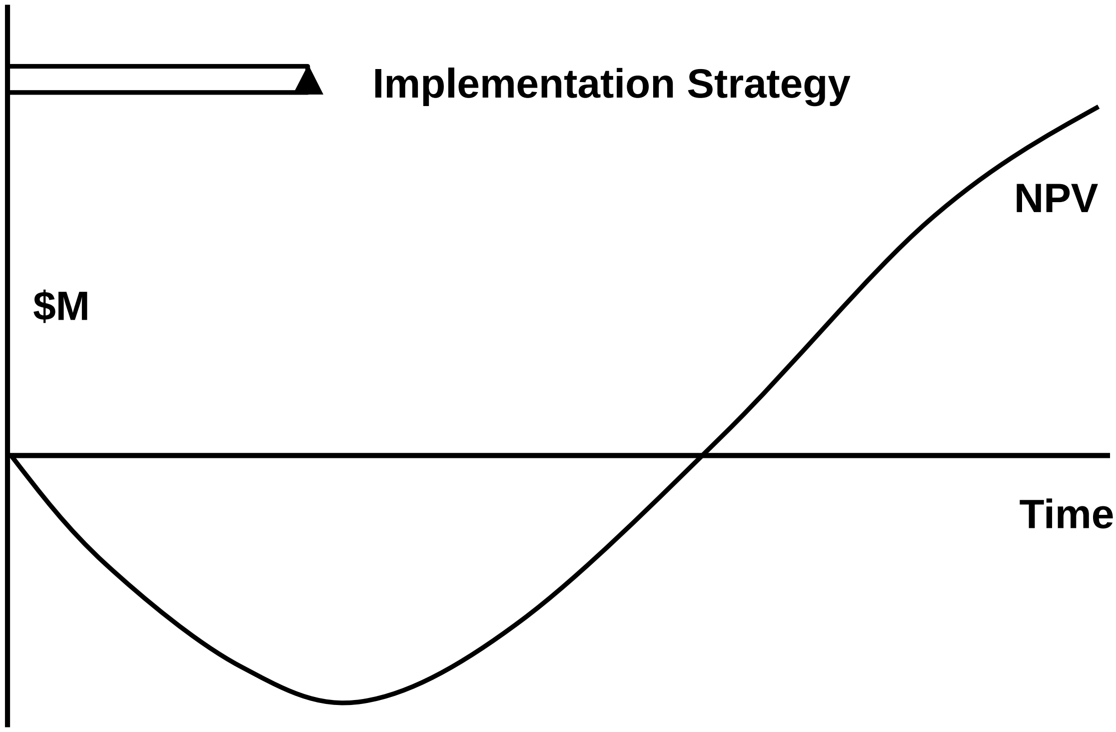

Figure 9.5: Intention Certainty - Commercial Viability

Intention Track

Intention Track is related to purpose, a commercially viable programme for the Client after taxes and royalties are distributed to other stakeholders. This is assessed using Discounted Cash Flow (DCF) analysis and plotted as NPV, which is cumulative Present Value (PV) for the number of years constituting the programme life, using the SD model as shown in Figure 9.6.

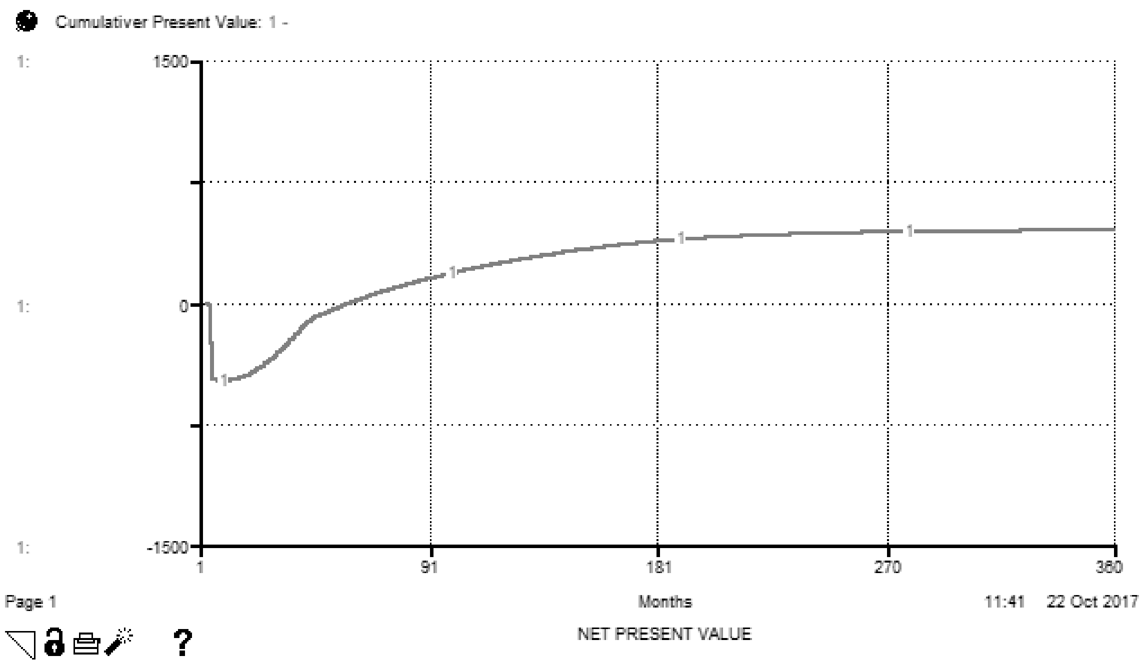

Figure 9.6: Intention Track – Net Present Value

Model

For the gas reservoir system, sufficient energy must be concentrated per unit time, i.e. power, in order to propel a level of additional gas production which, after taxes and royalties to local stakeholders, provides a commercially viable return to the Client. Previous experience and analyses resulted in the selection of compression as the means to deliver this power. A dynamic simulation model, which the SD model is an example, comprises three representations which provide the basis for ensuring verification and validation: real world problem entity, conceptual model and computerised model (Sargent, 2013). A high level representation of the real world is shown in Figure 9.7.

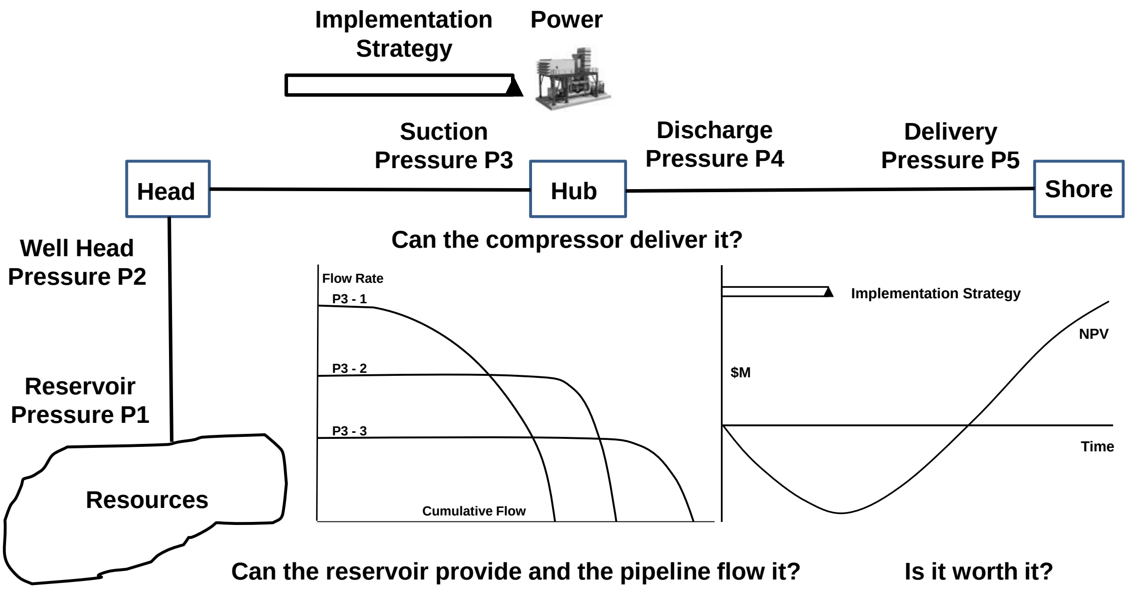

Figure 9.7: Model - Real World Problem Entity

Energy driving flow is provided through pressure. In a gas delivery system incorporating compression there are five key pressures which must be considered holistically with reservoir and pipeline constraints to determine production performance. P1 is the natural pressure at the reservoir below ground and P2 the pressure at the well head on the surface The compressor, located at the hub, creates a differential between the inlet pressure, P3, and outlet pressure, P4, with the effect of reducing the backpressure upstream, thereby allowing more flow for the same reservoir pressure P1.

As the reservoir resources deplete, P1 reduces with consequential deterioration in flow. For an impellor compressor, flow has a greater influence on power than pressure. Therefore, as the flow rate declines the power demanded to deliver the highest production allowed by the system also reduces. It is possible through detailed analysis to determine the relationship between flow rate and overall cumulative flow possible from the well at various values of P3. These plots provide the means to derive the power needed over time using a process of iteration.

Model Certainty

Certainty for a dynamic simulation is provided by a conceptual model which captures the essential causal factors and relationships, such that a change in any one or more parameters can be traced through explicit cause and effect linkage to the impact on intended outcomes. Consequently, the Author refers to this approach as Causal Tracing. The conceptual map is then translated into a computerised model. A series of Causal Loop Diagrams (CLD) captured the essential feedback loops, constituting the conceptual model, and a SD prototype computerised model which was able to reproduce the reference behavioural pattern. This is shown in Figure 9.8. The learning and common causal understanding of the system, led to the development of a simpler SD model, which satisfied the need for greater precision. This version imported specific inputs from, and provided output in the same structure and format as, specialist analyses, thereby facilitating calibration and validation.

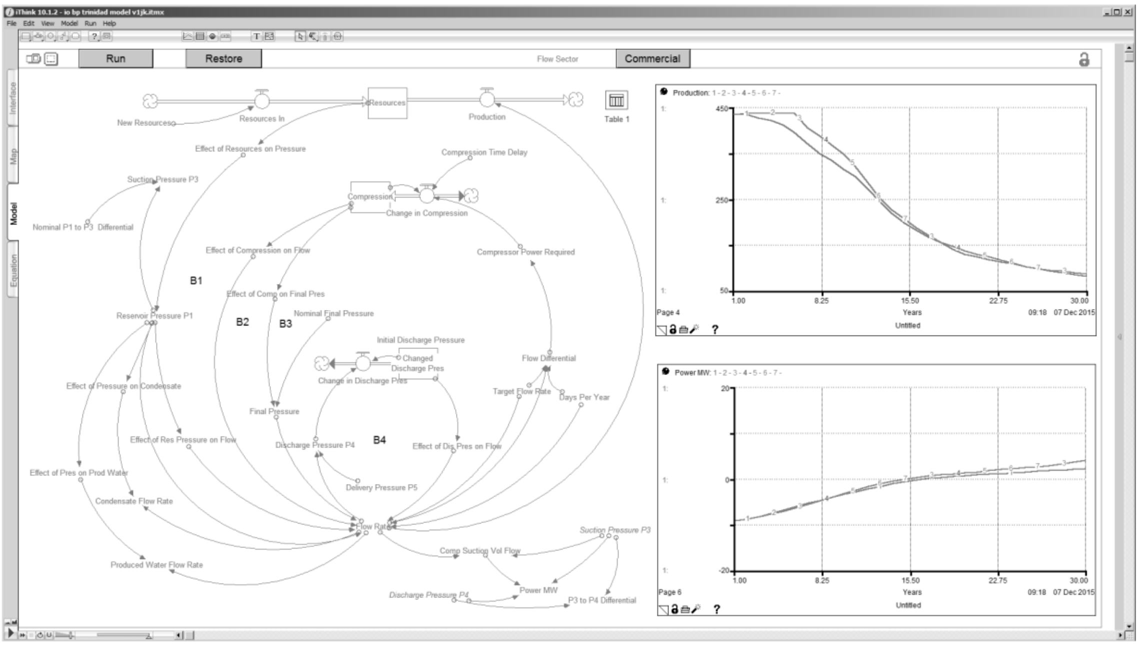

Figure 9.8: Model Certainty - Prototype Conceptual and Computerised Models

Model Track

Track relating to the Model phase focuses on delivery of key outputs, which in the case of Brown Field is production delivered over time, as shown in Figure 9.9. It is crucial that the model reflects what actually happens in the real world in order to close validation in the Sargent (2013) model. Whilst this validation can only be confirmed after implementation over time, by reproducing the RBP of the causal hypothesis, the impact of various scenarios can be simulated by the model in real-time by varying the input parameters.

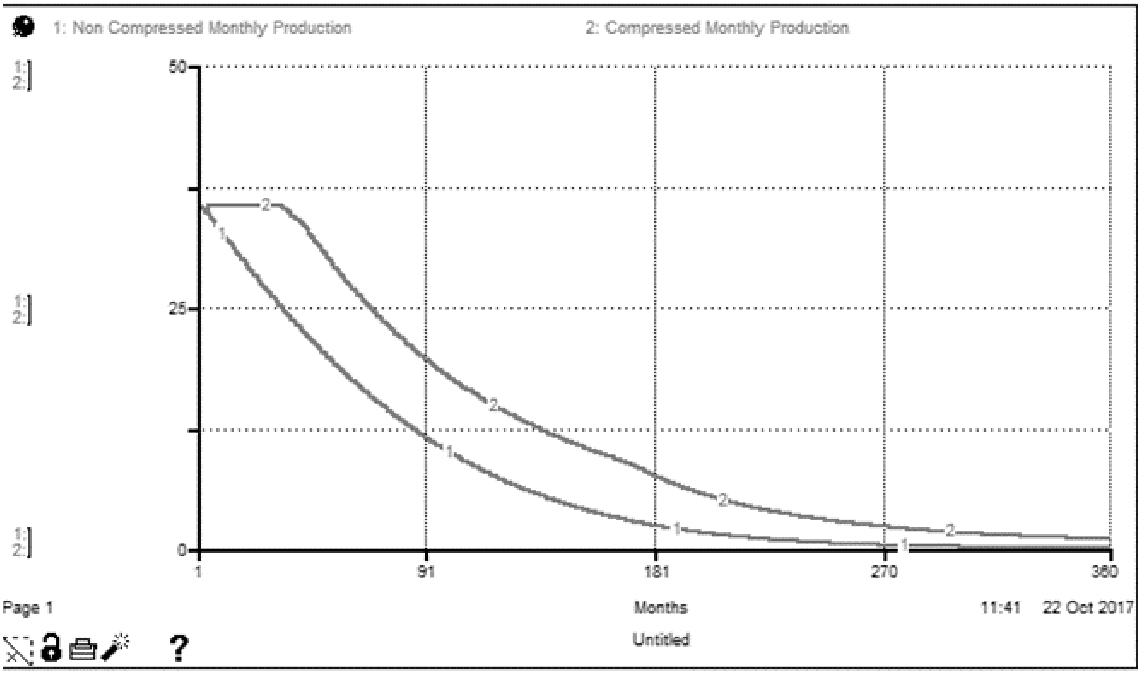

Figure 9.9: Model Track - Production

Programme

The Programme phase specifies interventions which cause changes to real world drivers of value, which through the chains of causal relationships defined in the Model phase, result in outputs and consequential outcomes. For Brown Field, the output is gas production and key value driver the pressure differential between P3 and P4 through compression, the chosen intervention. There are essentially four considerations relating to installation strategy, the phasing of which determine the magnitude and timing of available compression power, as shown in Figure 9.10.

- Staging: Number of compression units
- Wheeling: Number of impellers
- Sparing: Provision of spares to assure availability
- Training: Skilling the workforce

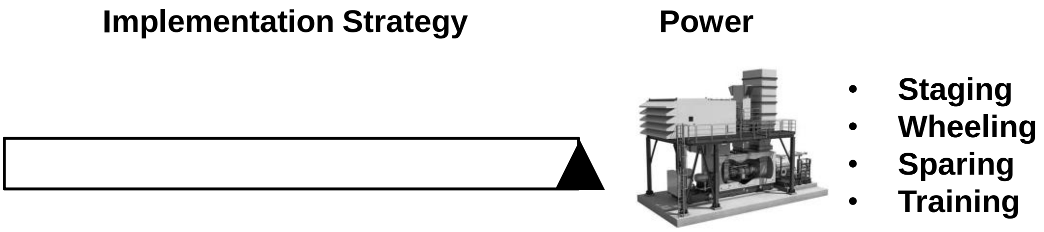

Figure 9.10: Programme - Implementation Strategy

Programme Certainty

A major challenge was to simplify the SD model sufficiently to enable real-time simulation of changes in one or more input parameters, whilst providing the level of precision needed for results to be credible and useable. There were two challenges, first replicating the complicated logic of conventional analyses, the second sourcing and incorporating the large datasets used by conventional tools. These challenges were compounded by the fragmented nature of specialisms, all tending to develop and employ their own, often informal, tools with little or no integration between them, together with the requirement for multiple flowlines which added significant computational complexity.

To solve the logic issue it was necessary to model each step in the processes used by the pipeline and compressor power specialists. The technique for capturing their methods was simple logic flow diagrams which proved very effective. The logic modelling took several weeks and involved much iteration but eventually every step was incorporated explicitly within the SD simulation with full verification traceability in both directions. Figure 9.11 shows part of the logic flow diagram, anonymised in order to respect confidentiality. In addition, the power specialist built a spreadsheet Power Model which served two critical purposes. First, the Power Model provided necessary pipeline flow datasets in a format that could be imported semi-automatically into the SD model. Secondly, results from the power and SD models could be compared directly, which facilitated robust calibration and validation; they converged within two decimal places.

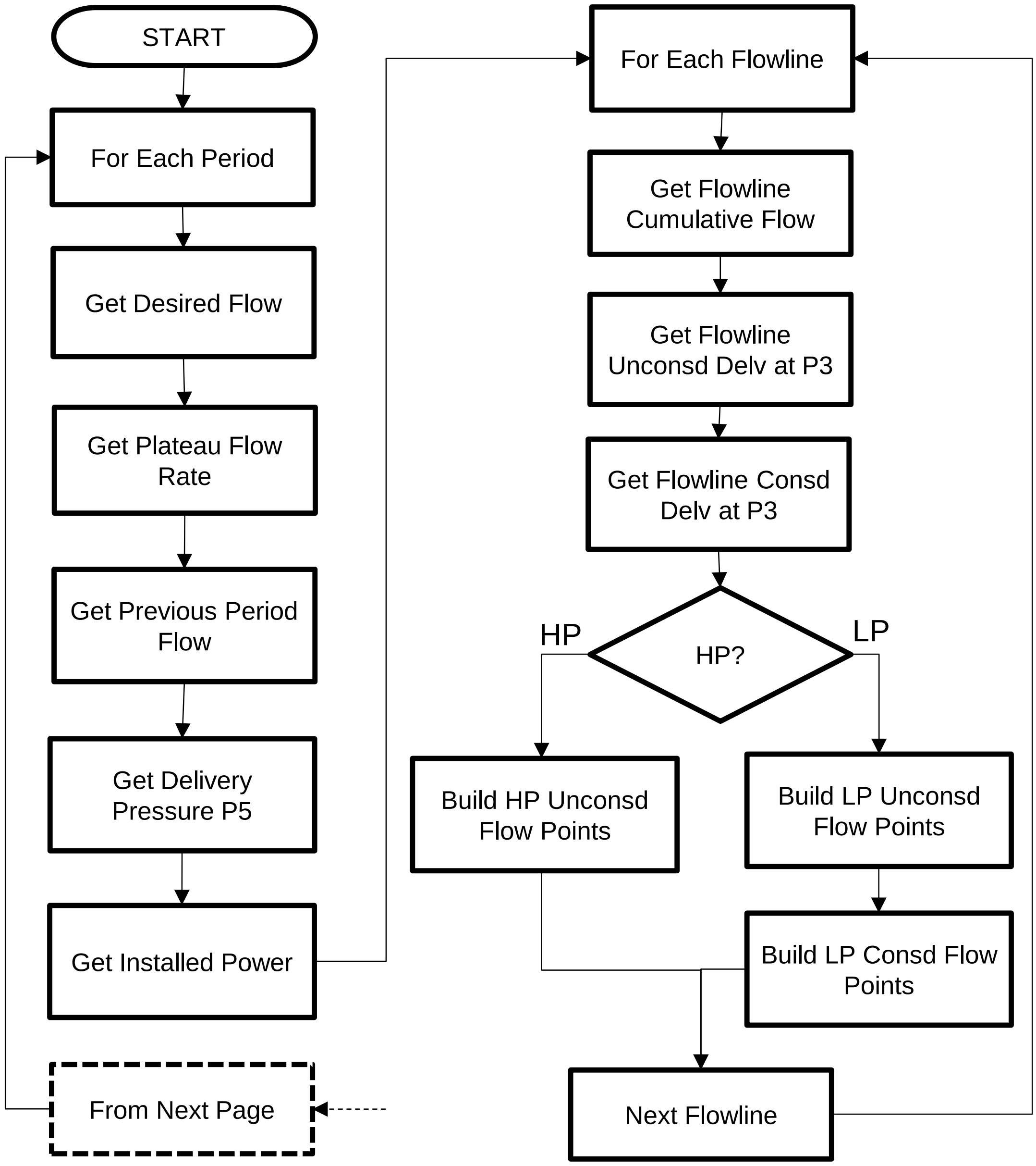

Figure 9.11: Programme Certainty - Logic Diagram for Flow

Track Programme

Tracking the programme is essentially concerned with delivery of capabilities which enable the necessary changes in outputs to realise purpose manifested as outcomes. For Brown Field, the capability is power input to the system through compression over time. The power peaks at the furthest point at which the target production is maintained, after which the depleted flow reduces the power demanded from the compressor. There are two important plots, installed power and power used by the system in order to output production, as shown in Figure 9.12.

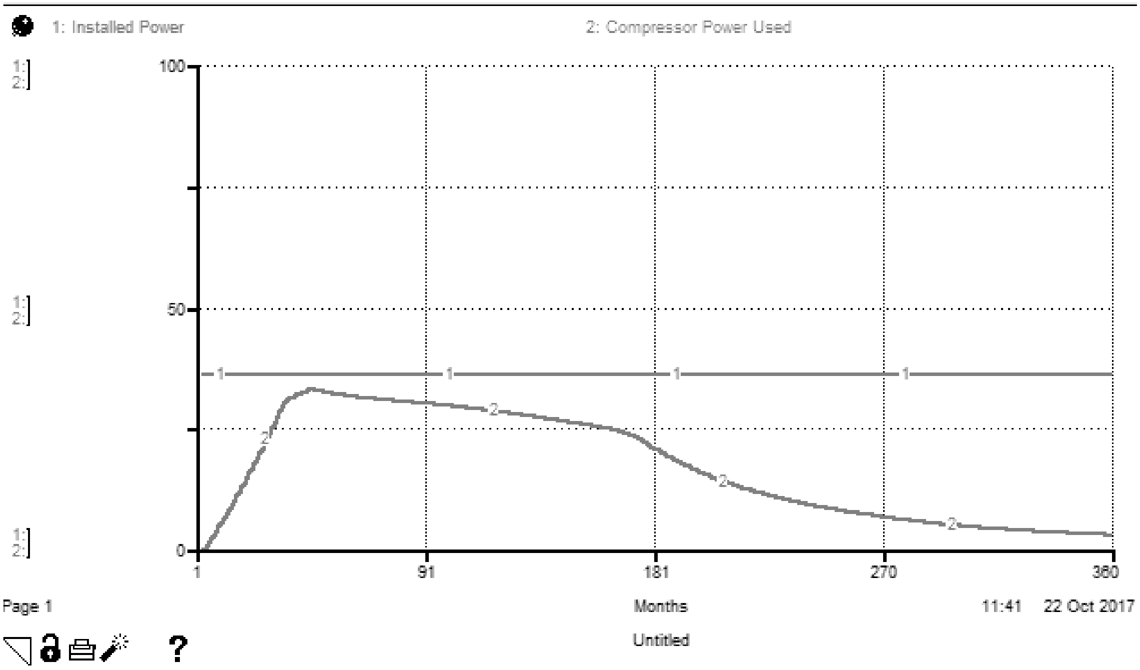

Figure 9.12: Programme Track - Power

Alignment

Alignment is a core tenet of Value Management (Davies *et al.*, 2011). This phase is concerned with aligned action to deliver optimal stakeholder value with speed and certainty, taking into account leverage, coherence, timing and risk. These translate into target, align and prioritise (TAP). First, we need to develop a Value Model which delivers greatest potential value across stakeholders. Secondly, we must protect the value by injecting the greatest practical level of certainty. The Author calls the former Value Optimisation and the latter Value Resilience.

Value Optimisation

There are three interactive components associated with alignment which must be integrated for interventions to optimise stakeholder value. First, it is necessary to target interventions on precise points in the system which results in the greatest positive leverage, applied and amplified through the causal chains to value outcomes. Targeting essentially concerns magnitude of benefits.

Secondly, interventions must be aligned with the entire system, ensuring that improvements are mutually supportive, creating coherent causal value flows. In this respect, it is particularly important that improvement in one area is not at the expense of the overall performance and purpose of the system, avoiding a silo effect (Tett, 2015). Alignment provides cohesion.

Thirdly, interventions are phased to reflect prioritisation by value, taking into account any logical dependence. Prioritisation concerns timing of value by balancing cost, benefit and risk. In practice, targeting, alignment and prioritisation operate interactively. Value Optimisation is concerned with integrating the components by considering the system holistically.

The final SD model provides the capability to simulate all three alignment components, operating individually and in combination, with graphical results shown in real-time through a single screen control panel. The Controls screen is shown for the baseline case in Figure 9.13

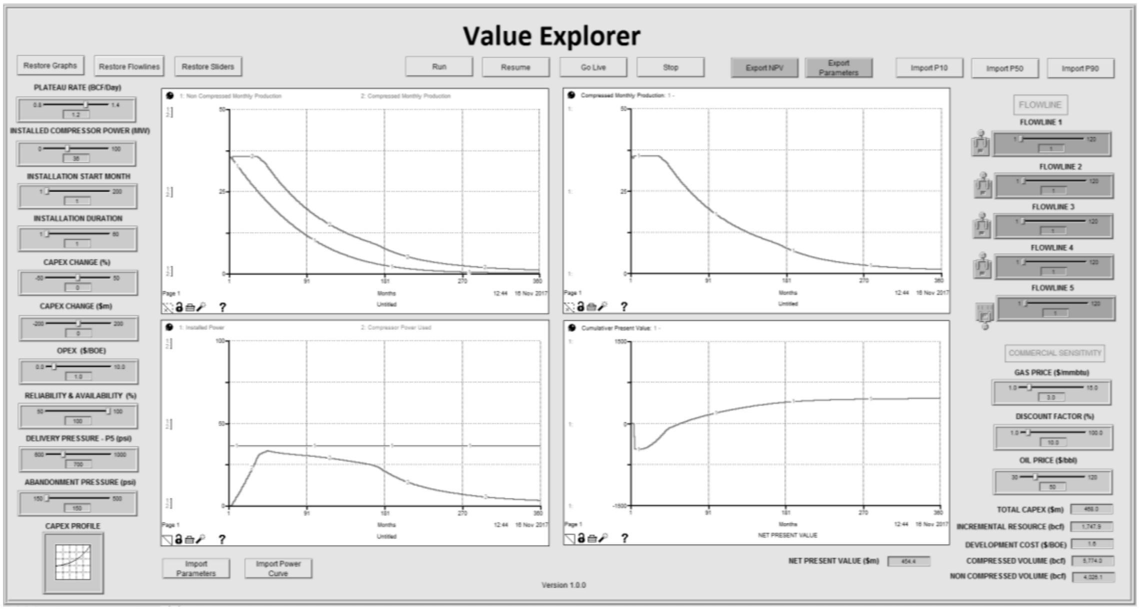

Figure 9.13: Alignment Optimisation - Final System Dynamics Model

With respect to targeting, a number of key parameters, spanning flowlines, compression power and commercials, can be varied using slider bars. The model covers multiple flowlines, with the facility to select each or a combination. In addition, the model contains non-linear graphic relationships. One particularly key relationship, CAPEX Profile, proportion of investment cost spent over the installation duration, can also be changed from the control panel.

Concerning alignment, all input parameters and output results are fully traceable through the conceptual map, accessible within the SD model, to provide full verification. It is possible, through more detailed analysis to analyse the impact of any input parameter with any other in the chain of cause and effect defined in the conceptual model.

Prioritisation is facilitated through provision to vary the start date and duration of the Implementation Strategy. There is also provision to vary the compression installation dates on each flowline separately.

Value Resilience

Whereas Value Optimisation explores how the greatest stakeholder value can be created most quickly, Value Resilience asks what it would take to destroy programme viability, with the aim of directing effective prevention and mitigation measures to protect the value. Therefore, Value Resilience is the management of certainty. This approach involves the engineering technique of destruction testing (Blokdyk, 2018), by subjecting the value model to extreme variation of input parameters in order to quantify the level of resilience of the programme to risk. By way of illustration, Figure 9.14 and Figure 9.15 show the impact of a 5 year delay and 5 year slip in implementation respectively.

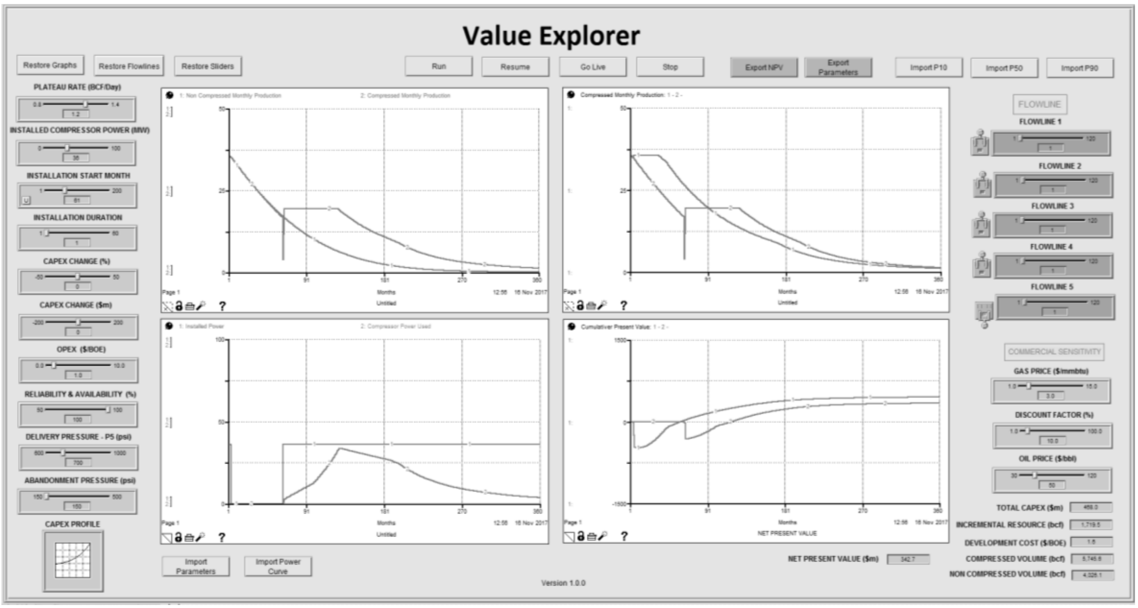

Figure 9.14: Alignment Resilience - 5 year Delay In Implementation

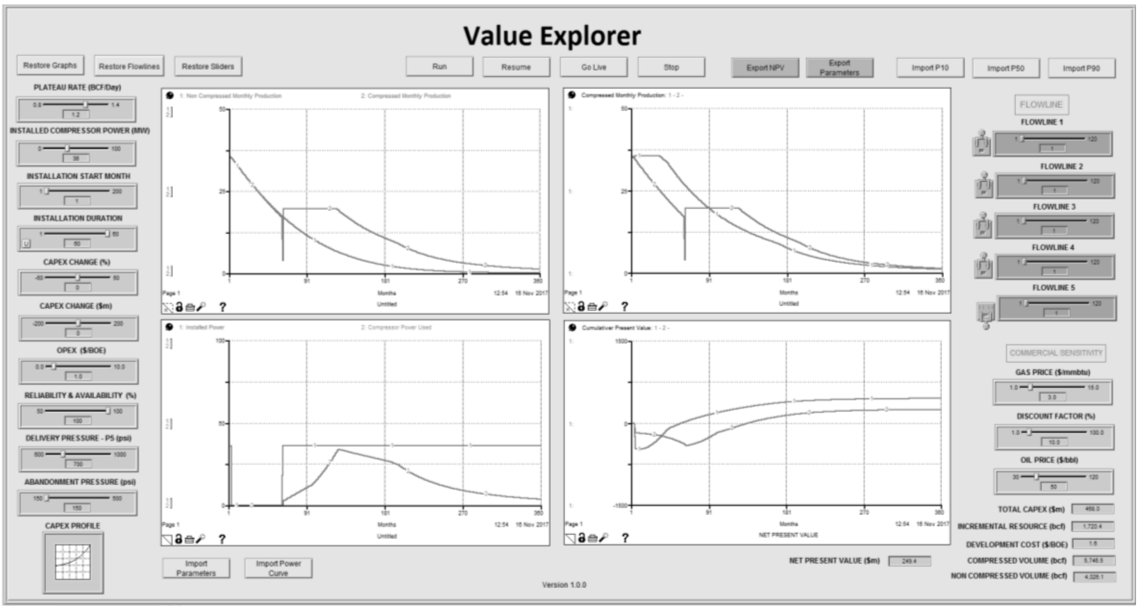

Figure 9.15: Alignment Resilience - 5 Year Slip in Completion

The impact on delivery of power and associated production is identical; the compression goes live at the same time in both cases. However, there is a significant difference in the effect on

NPV (bottom right graph) which is accounted for by the cost dynamics of implementation. A delay means that the same CAPEX cost, assumed to be incurred in one month, and recurring OPEX costs are not applied until year 5. Conversely, the slip scenario results in non-recurring CAPEX implementation costs accumulating over the five year period from the first month. The five year delay reduces the baseline 30 year NPV by 25% and the 5 year slip by 45%, nearly double the impact. This is a typical insight drawn from dynamics modelling, often missed by our own mental models supported by conventional tools, such as spreadsheets (Richmond, 2001, p. 6).

9.2.3 Outcomes

The final model was delivered on schedule to the global oil company Client, who spend two days in London to evaluate functionality and efficacy, commenting after testing the tool “I have never seen such a robust tool in my entire career, tried the most to break it but looks to be working all the time”. Himadri Singh was assigned by io, not only to support the assignment full-time but also learn SD modelling. His statement, “He [the Author] not only helped us to develop the systems model but also coached me and skilled me to develop models of my own”, provides evidential success of the Action Learning approach adopted for engagement. The CEO, Richard Dyson wrote, “The approach was deployed on a study for one of io’s major oil company clients with their VP Global Project Solutions stating, ‘we are seeing real value in their [io’s] expertise’.”

9.3 KWMC Case Study: Citizen-led Housing

9.3.1 Assignment Background

Purpose

The purpose of the assignment is to deliver a Financial Model which quantifies commercial viability of the We Can Make business model for delivery of affordable, citizen-led housing for Knowle West and replication across other local communities under a Community Interest Company (CIC).

Context

We Can Make is a case study as part of the Research Councils and Innovate UK funded Urban ID programme of research led by the University of Bristol Urban ID. The purpose is to explore more effective ways to address critical urban challenges with the aim of creating more resilient, healthy, prosperous and sustainable cities. In this context, KWMC performs as a "living lab", fostering civic innovation by collaborating with residents, artists, cities, business and academia to support positive change and explore new, better ways of living together.

Temporary Transportable Accommodation (TAM) units, which provide the affordable housing solution are an innovation of White Design, an award winning chartered architects practice and sustainability consultancy. As part of the new carbon economy, the company combines pragmatism, affordability and beauty into solutions that allow people to live, work and learn more sustainably.

Learning Environment

The learning environment for this assignment was diametrically opposite to that for io. Almost all work was conducted through informal workshop sessions in the University coffee bar or rooms if available. Combination of urgency for the model and short time slots with which to develop it, dictated the need for fast, highly interactive sessions, which worked very effectively with the clients. As with io, participants responded well to the workshop approach as a result of willingness to engage in the process, suspend judgement and embrace ambiguity.

9.3.2 Value Power Framework

Frame

The We Can Make team have conducted extensive research relating to the market. In addition, their research included interviews with the local community to determine precise housing requirements which elicited dominant hierarchical needs articulated as stories (Mean *et al.*, 2017, pp. 24 - 25). The result is a comprehensive picture of purpose, real world changes and intervention needed to achieve the purpose which provides a robust foundation for developing the Financial Model. As a result of the previous exhaustive research, design and innovation, the big picture provided by the team is very clear and summarised using the Why-How-What structure as shown in Figure 9.16.

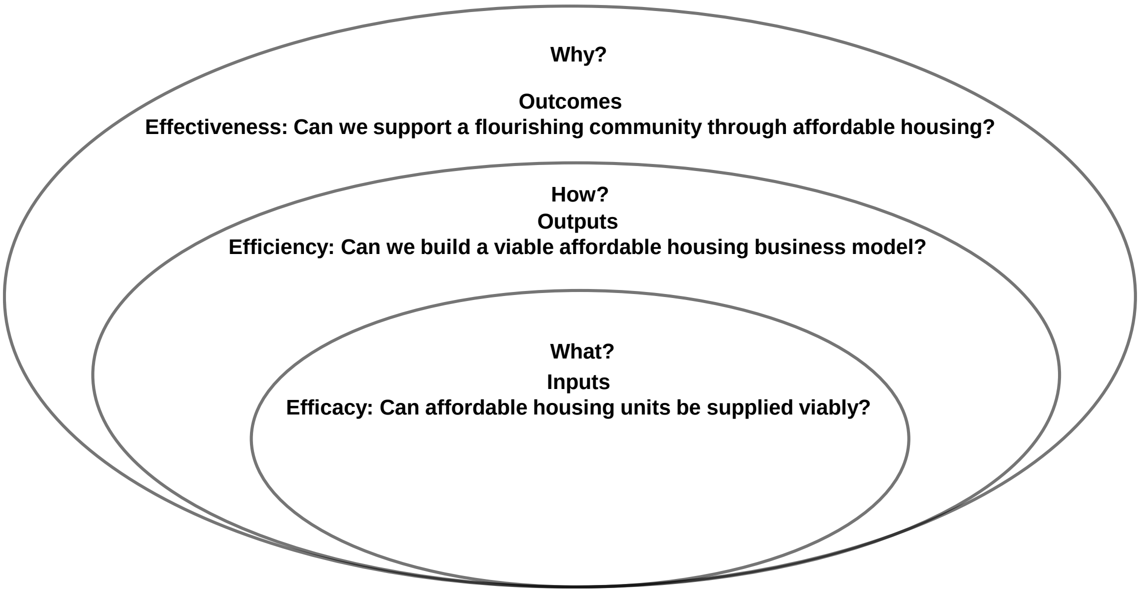

Figure 9.16: Frame - Big Picture

This structure for We Can Make can be mapped onto the Value Power Framework as shown in Figure 9.17.

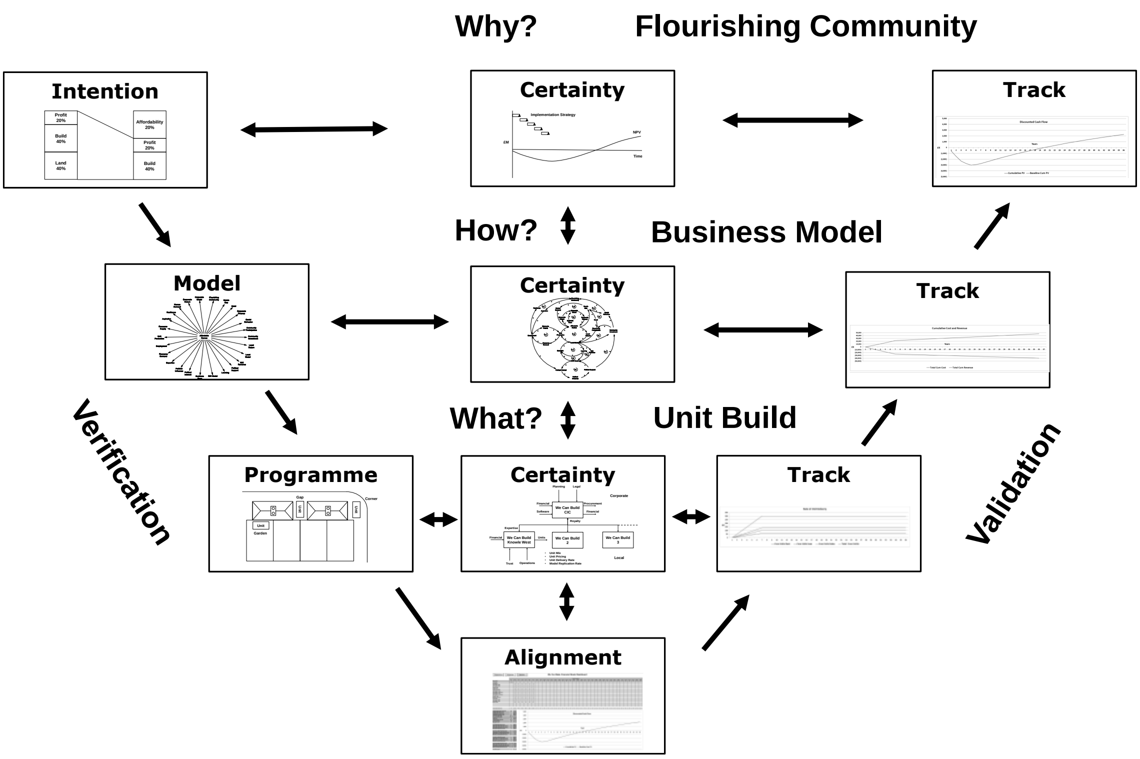

Figure 9.17: Value Management Framework Roadmap

Intention

This phase is concerned with specifying the purpose in terms of intended stakeholder outcomes, of which there are two related elements measured as Net Present Value (NPV). The first imperative is to determine commercial viability of We Can Make from an investor perspective in order to secure the financial resources to deliver units. The second part is to specify the preferred implementation strategy in terms of the commercial mix, pricing, delivery phasing and replication, which provides optimum return across all stakeholders.

In system modelling terms, the core issue, in this case generating stakeholder value by delivering affordable housing units, is the causal hypothesis and is most effectively shown graphically as the RBP. Figure 9.18 shows the RBP as the business model hypothesis in terms of the three main cost components of a residential dwelling, land, build and profit necessary for viable commercial development. The We Can Make business model eliminates the land cost component through a combination of utilising micro-sites, which are not commercially viable for conventional development, and conversion of expensive non-recurring purchase of land into modest recurring ground rent. Under this model, land cost is transformed into affordability.

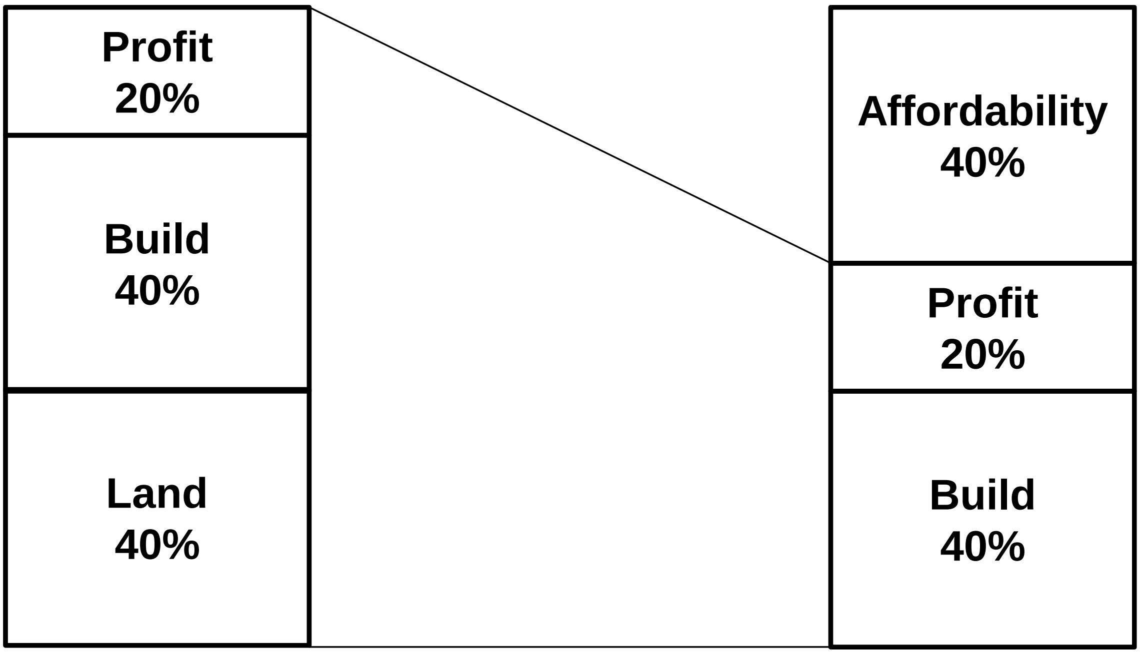

Figure 9.18: Intention – Business Model Hypothesis

Intention Certainty

At each level in the Value Management Framework, it is necessary to define the criteria for determining how success will be, and is, realised. This is also shown as a causal hypothesis. Figure 9.19 illustrates how the commercial viability will be evaluated in terms of NPV in relation to the Implementation Strategy, comprising rollout of units in a number of annual phases.

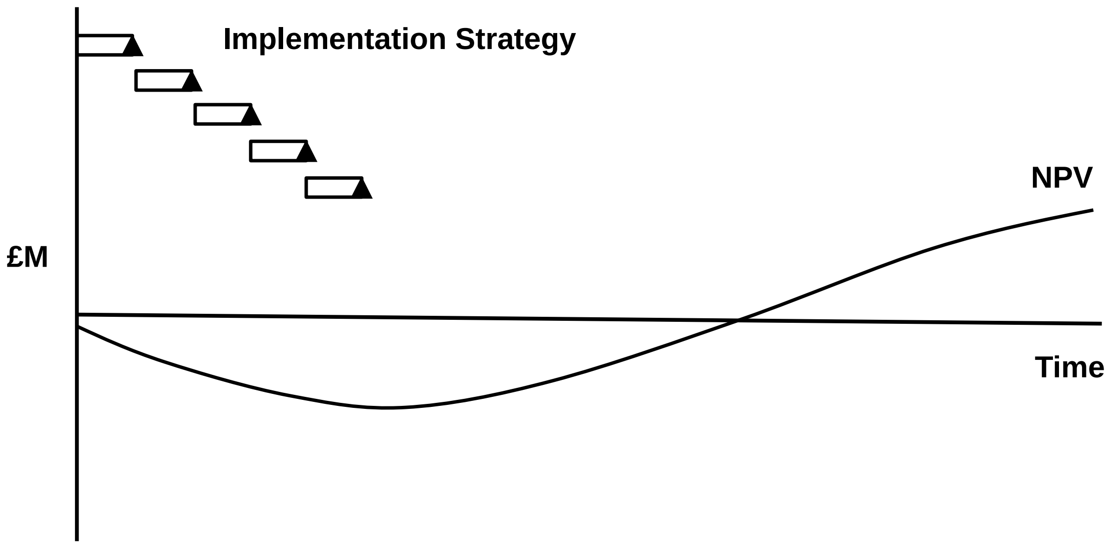

Figure 9.19: Intention Certainty – Net Present Value

Intention Track

Intention Track is related to purpose, a commercially viable programme for investors, affordable housing for occupiers supporting a flourishing community and a viable, replicable business model. The latter is assessed using DCF analysis and plotted as NPV, which is cumulative PV for the 36 year programme life. This is shown in Figure 9.20.

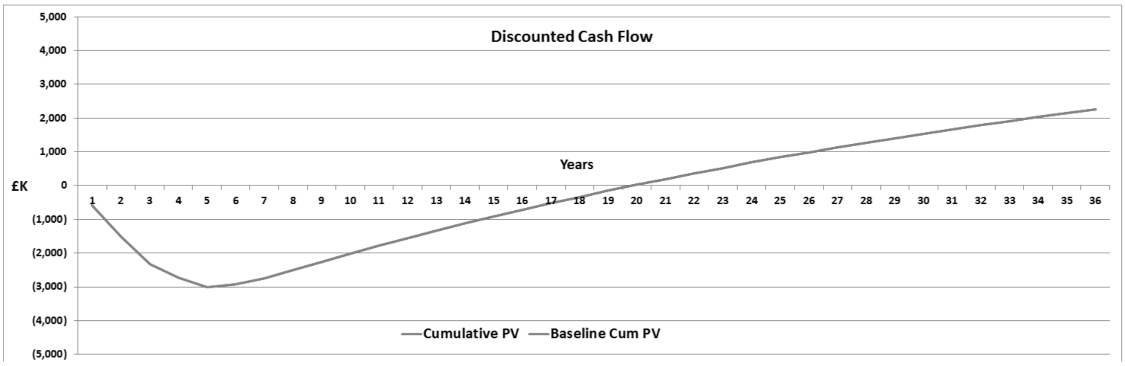

Figure 9.20: Intention Track – Actual vs Baseline NPV

Model

The Model phase focuses on defining and quantifying what must change in the real world for the specified purpose to be realised, taking into account any boundaries and constraints. This means modelling causality. Through extensive research, the We Can Make team already had a clear picture of the key issues and essential changes needed to support a flourishing community through affordable housing, and built the proposed business model to provide a holistic solution (Mean *et al.*, 2017). In order to ensure that the Financial Model combines investor perspective with the broader purpose, it is necessary to elicit all factors to be considered. This was achieved through several informal workshops by working through the

Why-How-What structure. The result is a comprehensive 'laundry list' of factors emanating from the central issue, in this case affordable homes, as shown in Figure 9.21.

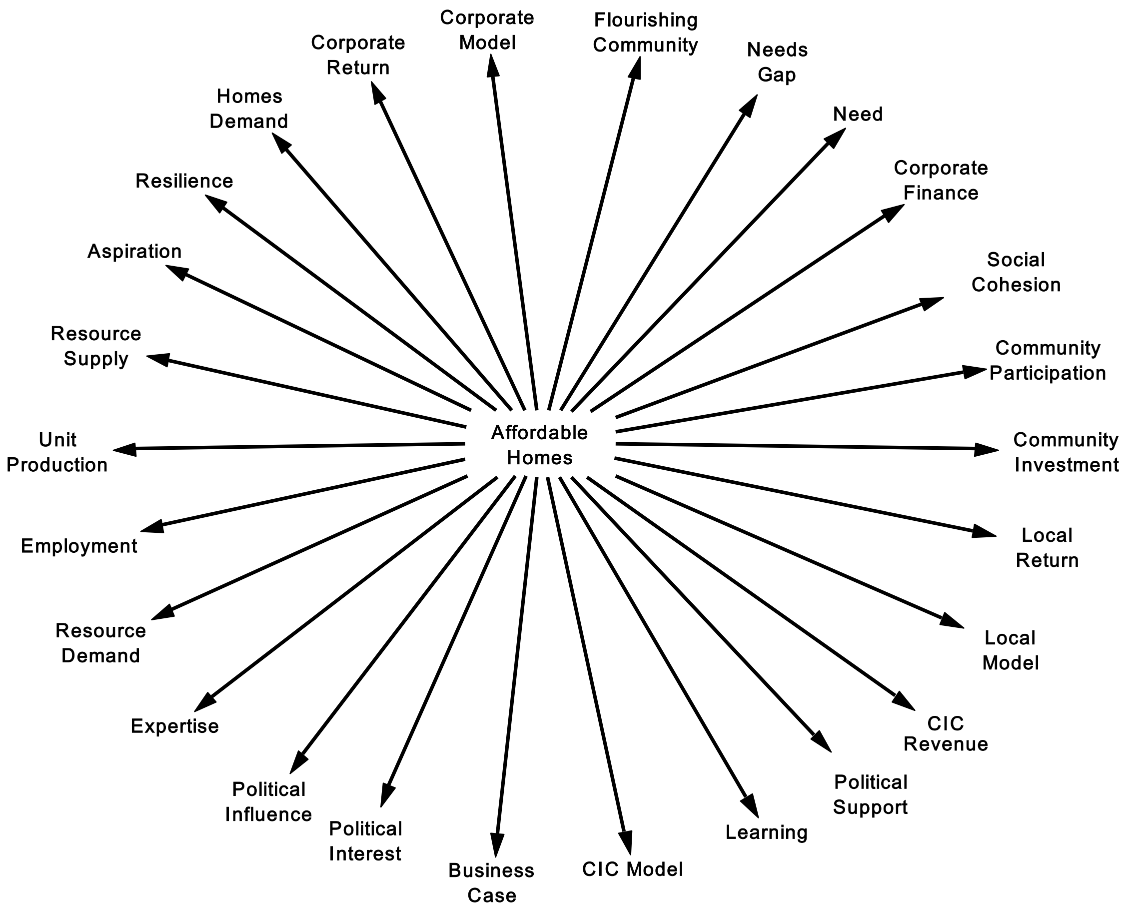

Figure 9.21: Model – Laundry List View

Model Certainty

Certainty for this phase is provided through a conceptual model. All, or essential, elements of this conceptual map are then translated into a computerised model, in this case a spreadsheet Financial Model, which despite its linear nature proved fit for purpose in the context of gaining investment. For verification purposes, it is important that essential aspects of the real world entity are reflected in the conceptual model, which in turn is captured within the Financial Model. This completes compliance between the computerised model and the real world, necessary for validation. For example, it is critical that rollout of TAM units, not only provides adequate return to investors, a key purpose of the Financial Model, but also causally supports the highest purpose of supporting a flourishing community.

The result is a CLD which captures the essential feedback loops, constituting the conceptual model, and demonstrating how investment facilitates realisation of outcomes for other stakeholders in the value ecosystem. This is shown in Figure 9.22 which includes all the factors captured in the laundry list structured into ‘causal stories’ encapsulating key relationships which build into the entire We Can Build value ecosystem. Relationships which are either explicitly included within, or most directly relevant to, the Financial Model are highlighted. However, it is crucial that causal linkage to other stakeholders and the highest purpose are also explicitly defined and connections to the broader ecosystem are also shown.

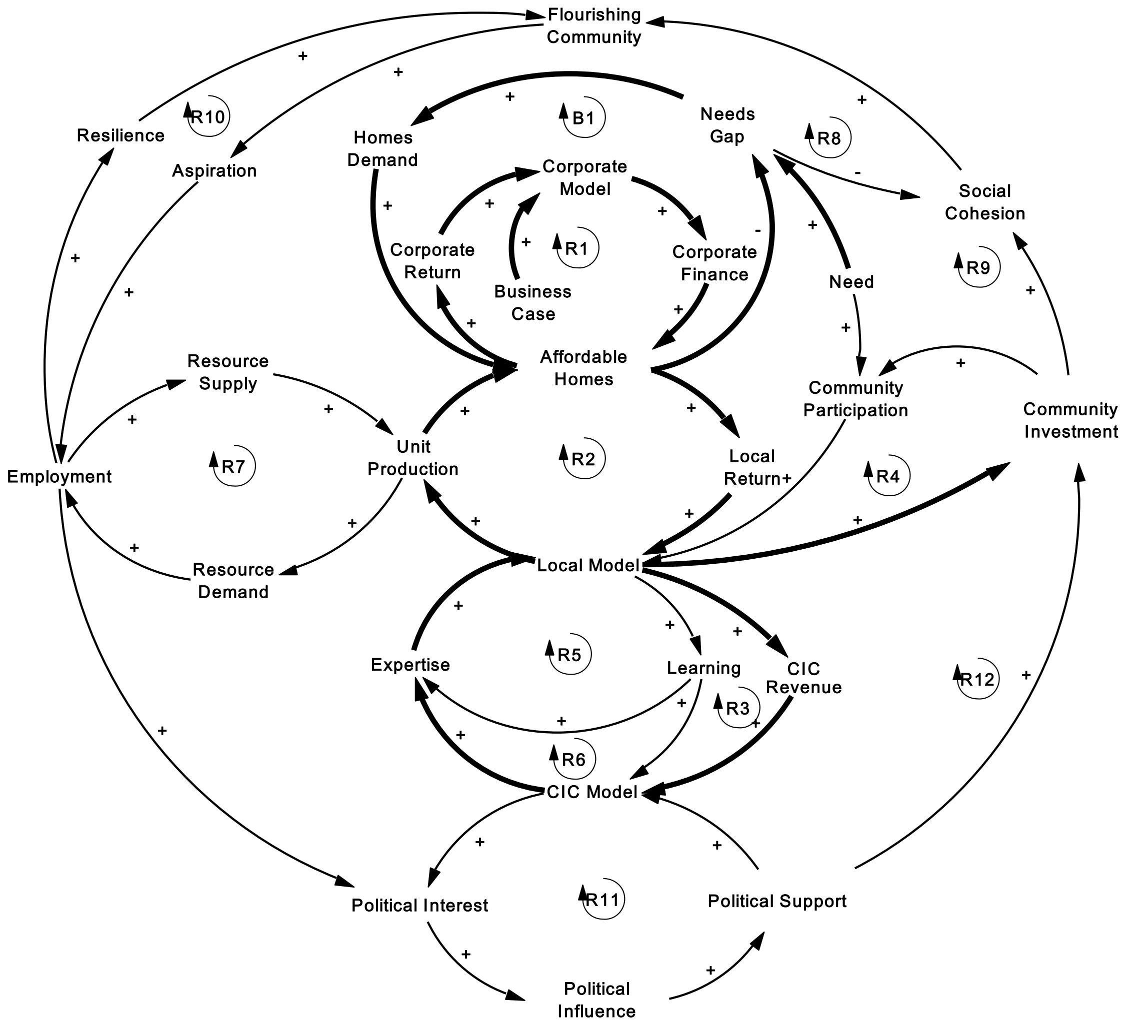

Figure 9.22: Model Certainty – Causal Loop View

The causal loop view can be considered as a set of linked causal stories, like a novel with main plot and subplots. For We Can Make the map comprises one balancing loop B1, representing satisfaction of a goal, in this case provision of affordable housing, and a number of reinforcing loops R1 to R12. The reinforcing loops operate as either vicious or virtuous cycles; currently many are vicious. For example, in R1 it is difficult to secure funding for affordable housing because in the conventional land-driven model, target returns are unachievable at affordable prices. The We Can Make business model can switch this cycle to virtuous, a transformation enabled through the business case quantified in the Financial Model. The causal loop view is intended to be essentially self-explanatory, needing minimal textual clarification, thus providing a coherent overview in a single picture. The specific causal stories are most naturally and effectively structured around the feedback loops, as articulated in the examples below most relevant to the Financial Model:

B1 Need Satisfaction

The wider the difference between Need in relation to Affordable Homes available, the greater is the Needs Gap which the system is intended to close. The greater the Needs Gap the higher is the Homes Demand, which drives the provision of Affordable Homes, subject to Corporate Finance from R1 and Unit Production from R2.

R2 Local We Can Make Model

As more Affordable Homes are delivered profitably, Local Return increases and strengthens the financial health of the Local Model, providing funds for Unit Production which increases Affordable Homes. Increased profit provides increased funding for Community Investment through the community dividend.

R5 Corporate We Can Make Model

As the financial strength of the Local Model improves, CIC Revenue increases in the form of licences and royalties, enhancing the financial status of the CIC Model, some of which is invested in greater Expertise available to support trusts in the Local Model.

Model Track

Model Track focuses on delivery of key outputs, which in the case of We Can Make is occupied affordable housing delivered over time, which from an investment perspective results in planned revenues against budgeted costs, as shown in Figure 9.23.

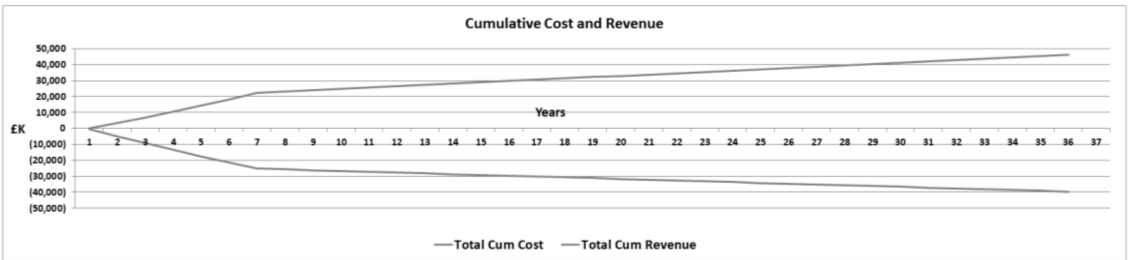

Figure 9.23: Model Track – Cumulative Cost and Revenue

Programme

The Programme phase specifies interventions which cause changes to real world drivers of value, which through the chains of causal relationships defined in the Model phase, result in outputs and consequential stakeholder outcomes. For We Can Make the output is affordable housing through TAM units, the chosen intervention. There are essentially three options for TAM installation using micro-sites (Mean *et al.*, 2017, p. 29), as shown in Figure 9.24.

- Garden: TAM located in the garden of an existing property
- Gap: TAM located in the gap between two adjacent properties
- Corner: TAM located on the space at a corner in the road

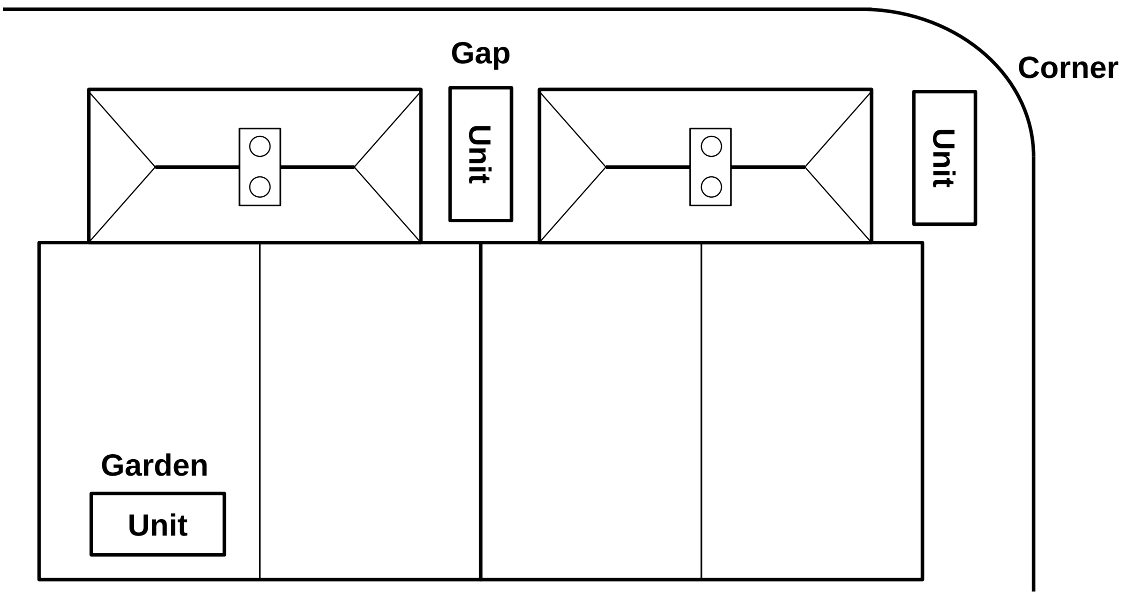

Figure 9.24: Programme – TAM Options

Programme Certainty

A major challenge is to build a business model incorporating the intervention which harnesses causal relationships defined in the Model phase. Research by the We Can Make team converged on a two-tier governance structure comprising local trusts, of which Knowle West is an instance, and a corporate Community Interest Company (CIC) as shown in Figure 9.25.

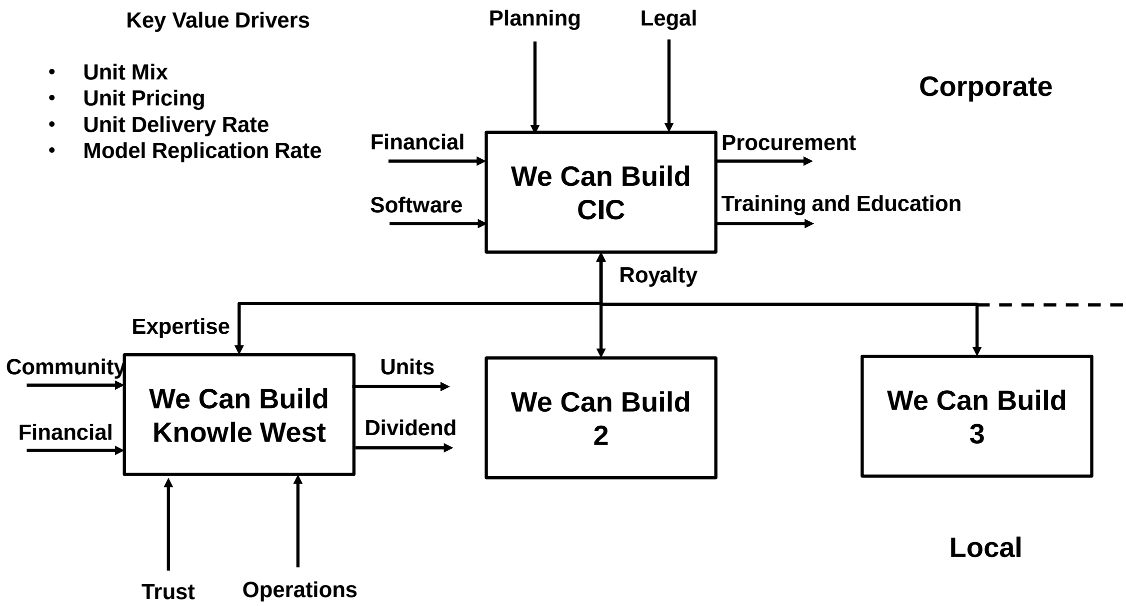

Figure 9.25: Programme Certainty – Business Model Replication

The two-tier We Can Make business model addresses the four major barriers to citizen-led affordable housing cited earlier: planning, finance, expertise, mindset and replication:

Planning

Planning barriers are significantly reduced through the TAM design in two ways. First, the TAM units, incorporating wheels and complete installable modules, are treated as mobile accommodation, which eliminates many of the most obstructive planning process elements. Secondly, the use of micro-sites avoids competition with conventional housing development and most objections which result in applications being rejected by council planning committees.

Finance

The business model addresses the problem of financing at two levels. The CIC deals with strategic business case applications to secure funding for local trusts. Local financial management, under the governance of trusts, then provides agility to deploy funding to specific community needs. Local trusts fund the CIC through licencing and royalties from profit made on the investment. A community dividend is then distributed from remaining surplus to support local initiatives.

Expertise

Technical and procedural expertise, which is particularly essential for successful navigation of planning regulations, is provided through the CIC. This is funded through the licence and royalty revenue streams from local trusts for access to and use of the expertise.

Mindset

The mindset challenge concerns belief on the part of individuals and the local community that through support from We Can Make they have the power to change their own lives and those of their fellow citizens profoundly. KWMC assumes a major role in this regard through their inclusive work within the community. As stated by the founder and Director, trust as a value is a key differentiator in creating the necessary self-belief (Hassan, 2017). Also, community collaboration vastly reduces the level of NIMBY objections.

Replication

The business model is inherently generic and readily applicable to many similar housing estate communities within and beyond Bristol. The two-tier governance from an organisational design perspective is fractal by nature and viable, as defined by Beer’s Viable System Model (Hoverstadt, 2008) which draws on the Law of Requisite Variety (Ashby, 1952; Beer, 1994). Requisite variety refers to the need for a system to possess sufficient flexibility to enable it to exchange energy effectively enough in order to survive, the meaning that Beer assigns to viability in a cybernetic context. It is also necessary for subsystems to possess sufficient autonomous requisite variety through relationships with the higher level system. Figure 9.25 illustrates how the fractal structure provides autonomy. For example, finance is secured through expertise provided by the CIC, whilst each trust exercises it autonomy to deploy the funds as dictated by the variety of needs at the local level. Similarly, procurement operates at both corporate and local levels to match appropriate needs.

There are four key drivers exercised by the business model which determine the magnitude and timing of value: unit mix, pricing, delivery rate and replication.

Unit Mix and Pricing

From a financial investment viewpoint, unit mix and pricing refers to the combination of commercial options and their associated revenue streams. There are three alternatives: rent, loan and sale. For the rent option, ownership of the property is retained by the trust and rented by the tenant; there is no initial revenue component, all income is from rent. In the loan case, ownership is shared equally between the tenant and trust, the latter receiving non-recurring revenue of half the sale value and recurring income from half of the rent. Sale involves purchase of the entire property and all revenue relates to the non-recurring sale price. For each option, rent, loan and sale, there is a further dimension relating to the ability of prospective tenants and owners to pay, categorised as social, affordable and market.

Delivery Rate

This driver refers to the rate at which the units are installed, occupied and commercial arrangements completed.

Replication

Replication concerns growth through ability to scale the business model in other communities within Bristol and across the country.

Programme Track

Programme Track is essentially concerned with delivery of capabilities which enable the necessary changes in outputs to realise purpose, manifested as outcomes. For We Can Make, the capability is affordable housing through delivery of TAM units at a given mix, price, rate and replicability to achieve the purpose, flourishing community, whilst rendering the business case financially viable. Figure 9.26 shows the delivery schedule of each option, rent, loan and sales, together with the unit total.

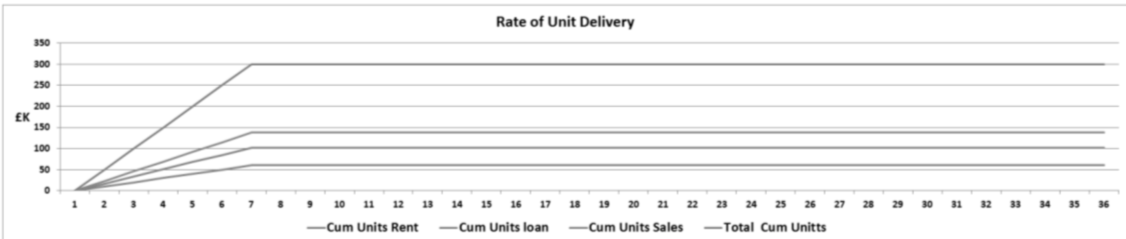

Figure 9.26: Programme Track – Rate of Unit Delivery

Alignment

This phase is concerned with aligned action to deliver optimal stakeholder value with speed and certainty. This translates into target, align and prioritise (TAP). To this end, there are two parts to Alignment. First, we need to develop a Value Model which delivers greatest potential value across stakeholders. Secondly, we must protect the value by injecting the greatest practical level of certainty. We refer to the former as Value Optimisation and the latter Value Resilience.

Value Optimisation

The Financial Model provides the capability to simulate all three alignment components, target, align and prioritise, operating individually and in combination, with graphical results shown in real-time through a single screen dashboard, shown for the baseline case in Figure 9.27. The dashboard comprises three parts. The table at the top of the screen is used to input TAM unit delivery schedule and mix across commercial options. The table to the left covers pricing, costs and other essential variables. The graph plots NPV for the baseline and scenario being modelled.

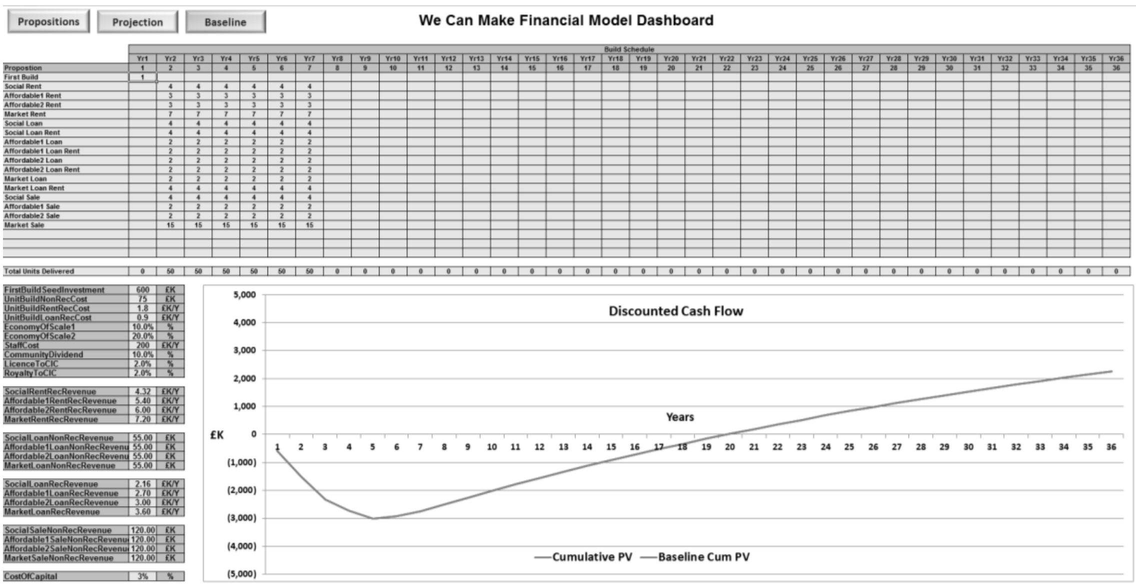

Figure 9.27: Alignment Optimisation - Baseline

A number of key parameters can be varied using the dashboard and output results are fully traceable in the Financial Model through the use of named parameters. This provides total transparency in calculations which can also be related to the Causal Loop View defined in the Model phase. The capability to analyse impacts on NPV of changes in any one or combination of input parameters within the dashboard facilitates scenario modelling, together with risk analysis used for Value Resilience.

Value Resilience

Whereas Value Optimisation explores how the greatest stakeholder value can be created most quickly, Value Resilience asks what it would take to destroy programme viability, with the aim of directing effective prevention and mitigation measures to protect the value. For example, Figure 9.28 and Figure 9.29 show the impact of a 20% reduction in non-recurring sales revenues, except for the Market option, and 20% reduction in recurring revenue through rent respectively.

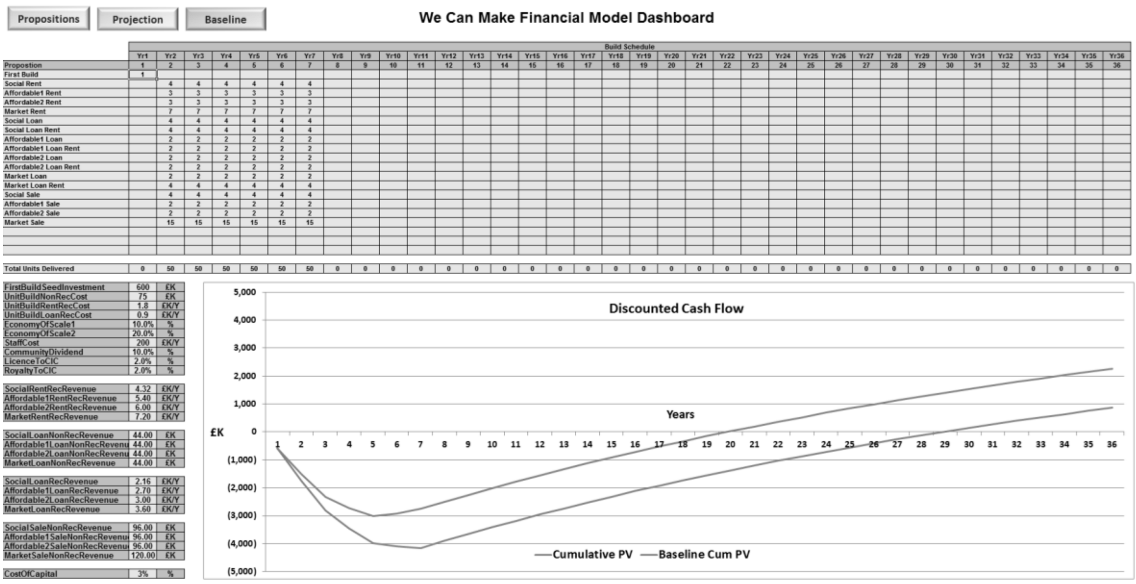

Figure 9.28: Alignment Resilience - Reduce Non-Recurring Revenues 20%

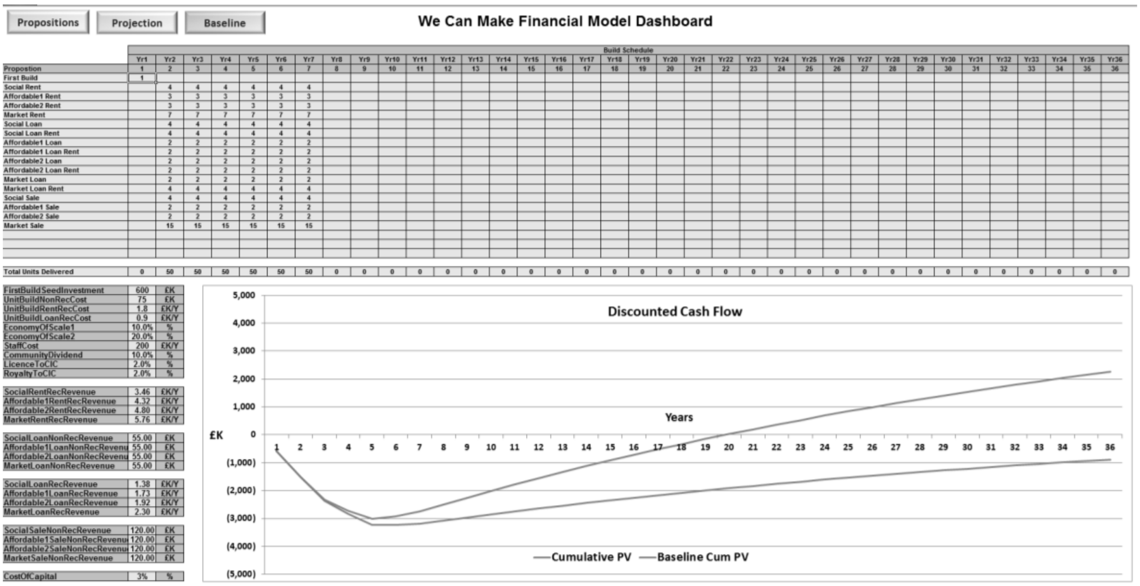

Figure 9.29: Alignment Resilience - Reduce Recurring Revenue 20%

The comparative impact on NPV over the programme life clearly demonstrates key aspects of the value dynamics. For example, in this case the effect of reducing non-recurring sales revenue for all except the Market option is to depress the NPV ‘J-curve’ but not to completely destroy financial viability over the entire life, Figure 9.28. Conversely, Figure 9.29 shows that a reduction in rent-related recurring revenue by a similar amount renders the business case financially unviable over the same programme life. The 20% reduction in non-recurring revenue reduces the baseline 36 year NPV by 62% and the 20% reduction in recurring revenue by 116%, nearly double the impact and taking the financial viability into negative territory.

9.3.3 Outcomes

The financial model was delivered within a very short timeframe and was directly attributed by the client to acquisition of essential commercial funding. The TAM designer, Craig White, stated, “The credibility this has brought to the project is immeasurable, especially when dealing with funding organisations.” The model also provided the basis for future business frameworks, “The model will form a foundation to the wider legal and financial frameworks that will have to be developed to ensure the project proceeds from concept to delivery.” Melissa Mean, the KWMC client, particularly related to the convergence of hard and soft factors, articulating, “We are seeking “a financial animal” who could understand the social heart of the project, and [this] was exactly what we needed.”

9.4 System Eyes Case Study: Building Information Modelling

9.4.1 Assignment Background

Purpose of the Assignment

The purpose of this assignment is to deliver a Proof of Concept (PoC) System Dynamics (SD) model which demonstrates how specific aspects of Building Information Modelling (BIM) and integrated project delivery can be targeted precisely to 'points of power' in key feedback loops in the building process, where greatest influence can be channelled to value creation. Seb Cox, the client, has experience applying Systems Thinking within military aerospace and construction and is interested to explore Impact Dynamics' Value Management approach to Systems Thinking and System Dynamics. It is intended that the PoC model provide some insights for development by System Eyes Consulting of a scenario and sensitivity analysis demonstration for wider industry engagement and learning. The Author's role was to lead model development whilst training the client in SD.

Context

In the UK, BIM is defined as using advanced computer systems to build 3-D models of infrastructure which hold large amounts of information about its design, operation and current condition (HMG, 2015, p. 5). At the planning stage, it enables designers, owners and users to work together to produce the best possible designs and to test them in the computer before they are built. In construction, it enables engineers, contractors and suppliers to integrate complex components, cutting out waste and reducing the risk of errors.

In operation, it provides customers with real-time information about available services and maintainers with accurate assessments of the condition of assets. In 2011 the UK Government Construction Strategy mandated the use of Level 2 BIM on all public sector projects by 2016. This decision has led to Government and the construction industry working together to develop the industry's skills and reduce the cost of infrastructure. This innovative technology is central to the development of new rail projects, like Crossrail and HS2, where it is confirming the UK's leading role in the development of digital technologies for infrastructure and construction.

Learning Environment

The assignment exercised two extremes concerning learning environment. First, all work was conducted remotely using screen sharing functionality of Skype, which facilitated interactive model building without the need for physical co-location. Each session was time-boxed to one hour, which dictated the need for both precise and concise communication. Secondly, the SD model was developed using a high degree of abstraction to test viability of incorporating multiple and interacting soft measures, such as trust and collaboration, in the context of a highly technical domain, in this case BIM, delivering stakeholder value. In the absence of real data, causal relationships were constructed using quantitative scales, for example 0 -100, and populated by eliciting estimates from the client based on client experience.

9.4.2 Value Power Framework

Frame

Cox, the client, and the Author combine their significant experience within defence, aerospace and manufacturing industries, in addition to infrastructure, and share a conviction that human and systems integration, leading to the reduction in waste, are critical elements in delivering greater stakeholder value from building programmes. They contend that advances in BIM offer a potential enabler for this integration if deployed using a systemic approach focusing on stakeholder value. In this context, the big picture is framed as three interlocking Why-How-What questions as shown in Figure 9.30.

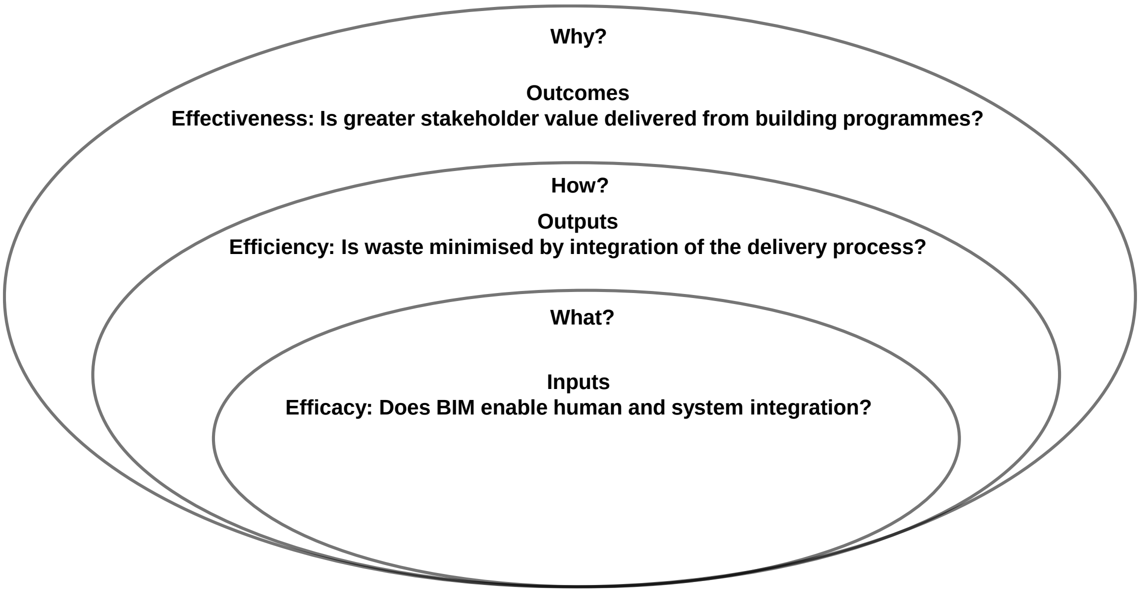

Figure 9.30: Frame – Big Picture

This structure is mapped onto the Value Power Framework as shown in Figure 9.31.

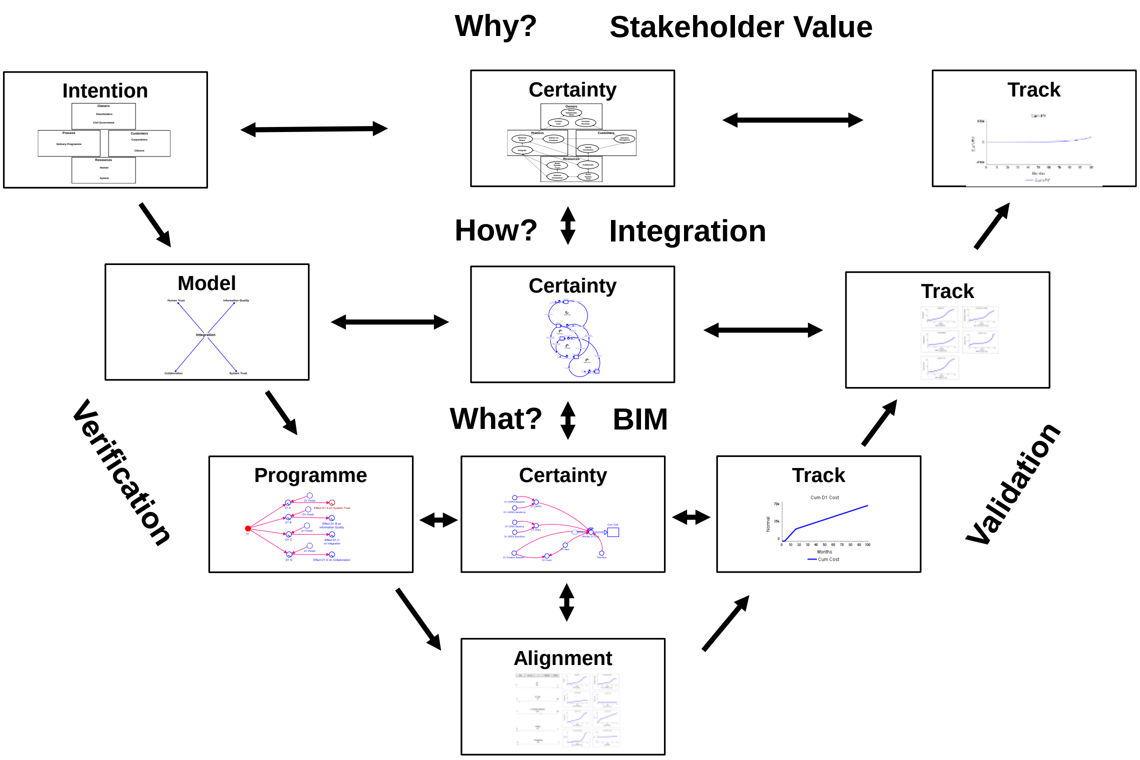

Figure 9.31: Value Management Framework Roadmap

Intention

This phase is concerned with defining key stakeholders, which are grouped under four categories based on the Balanced Scorecard (BSC) (Kaplan *et al.*, 1996), comprising four 'quadrants', as shown in Figure 9.32, which provides a generic frame for linking strategy with performance. Owners include shareholders of construction and building management corporations, in addition to public bodies, such as city civil government. Owners provide economic capital and are necessarily concerned with financial management and return on investment (ROI). Customers are recipients of services provided through buildings delivered from the programme, such as corporations who will maintain and lease office or residential space, and occupants utilising the building for commerce or living. Of particular interest in respect of occupants, are citizens provided with housing. Process comprises the entire programme lifecycle, the output from which is not only the buildings but value delivered to stakeholders as a result of utilising the buildings. Resources enable the building programme lifecycle, from design through aftercare, and comprise two forms, human and systems. Human resources are people engaged in all aspects of the programme lifecycle. System resources include IT and information supporting the lifecycle.

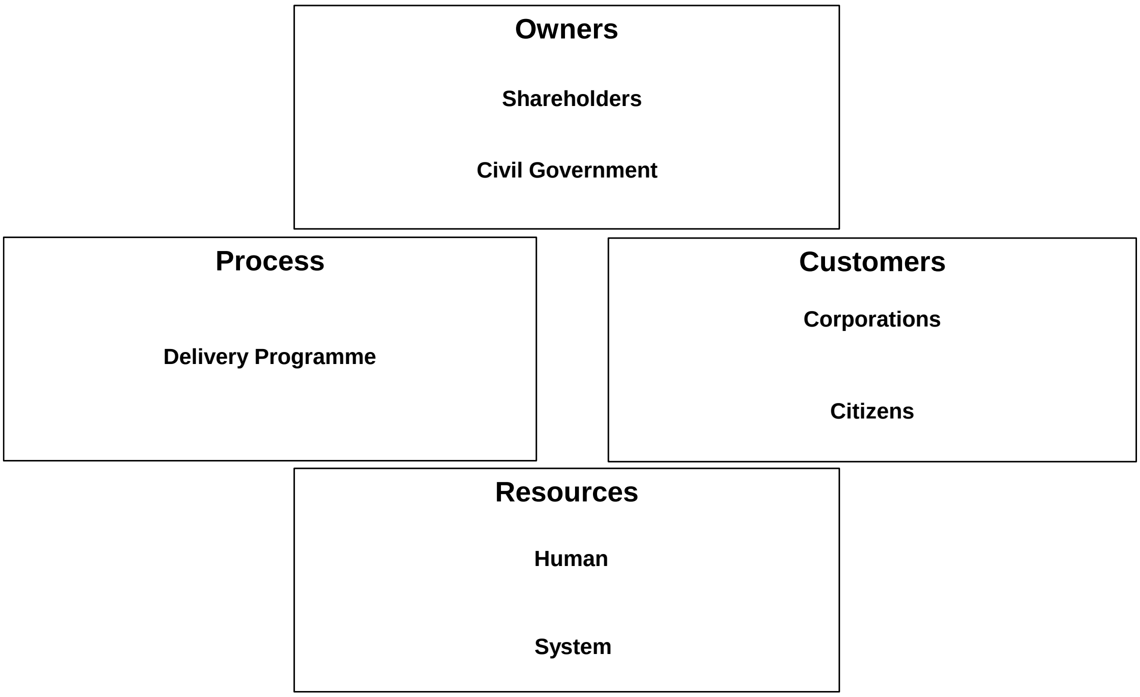

Figure 9.32: Intention - Key Stakeholders

Intention Certainty

A critical principle of the new value theory concerns specifying equitable value, which means balancing the level and flow of value between stakeholders in order to create a self-sustaining and resilient system. This can be facilitated through Strategy Maps (Kaplan *et al.*, 2004) which are used to structure a performance framework, such as but not exclusively a BSC, as causally connected objectives, as shown in Figure 9.33. Included are objectives specific to BIM and project integration aligned with system metrics categories as defined by (Cox, 2019a), namely: Human Trust, Collaboration, Integration, Information Quality and System Trust. Objectives in this context are defined as what must be achieved with given resources in order to realise a defined aim, such as the vision (Business Dictionary, 2015a).

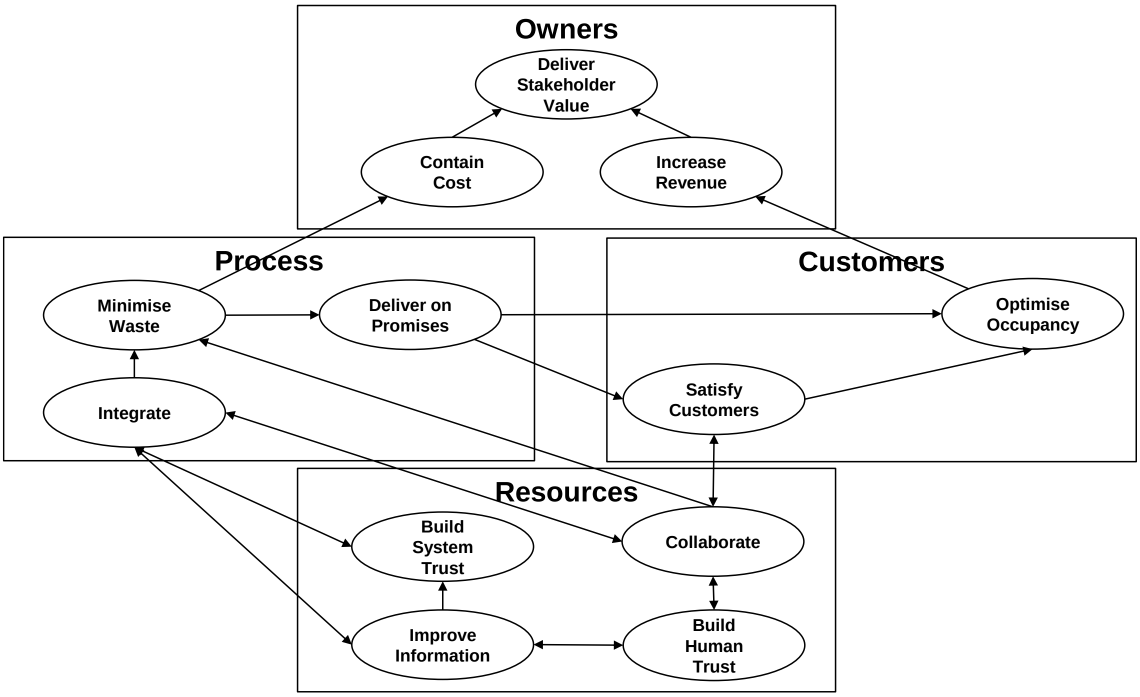

Figure 9.33: Intention Certainty - Strategy Map

Strategy Maps are designed to be as self-explanatory as possible. A major distinction in their construction concerns causal direction. In conventional Strategy Maps, objectives are linked from resources, through process to customers and finally owners, albeit using different names, in causal chains referred to as strategic ‘themes’. The key point is that these themes are unidirectional. For the new value theory, themes are still essential to provide causal line of sight to strategic outcomes. However, it is also critical to include two-way relationships between objectives in order to respect the existence of feedback loops, as shown in Figure 9.33 and which are made explicit later under Model Certainty. The two-way links mirror feedback loops in a systemic view.

It is also important to identify key programme deliverables through the question, “what new or enhanced capabilities are required in order to realise intended outcomes?” Cox (2019a) groups potential deliverables and metrics as shown in Table 9.1.

Table 9.1: Deliverables Groupings and Targeted System Metrics

(Adopted from (Cox, 2019a))

Reference	Deliverables Groupings	Targeted System Metrics
	Learning and Team Building (not modelled)	Human Trust
D1A	Common Data Environment	System Trust
D1B	Information specifications and quality criteria	Information Quality
D1C	Integrated Design Tools and workflows	Integration
D1D	Collaborative contracts / Integrated Project Delivery (IPD)	Collaboration

These deliverables are then mapped to the specific objectives; the points of power where capabilities actually impact the system and initiate or amplify the theme causally, as shown in Figure 9.34.

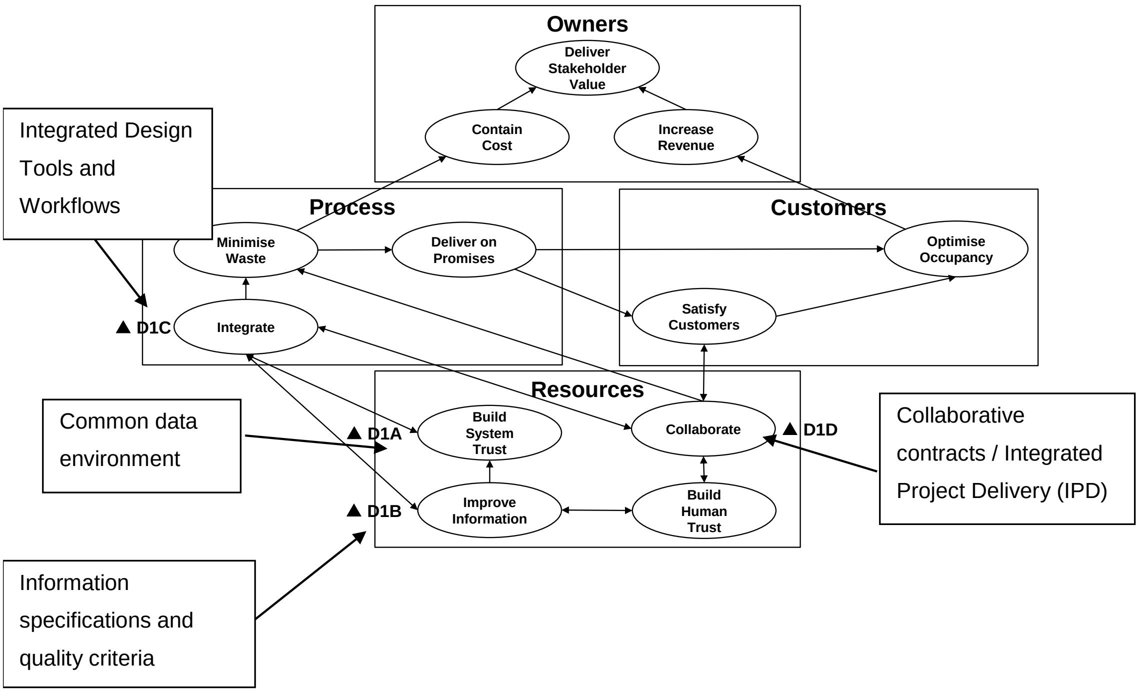

Figure 9.34: Intention Certainty - Deliverables-Objectives Mapping

Track Intention

Whereas certainty specifies criteria for success, track is concerned with assessing the degree to which the criteria are actually met and managing corrective action needed to remain on both performance and purpose. Intention Track focuses on stakeholder outcomes (benefits), notably financial returns for owners, such as shareholders, in the form of NPV, as shown in Figure 9.35. However, it is also essential to capture other stakeholder outcomes, for example housed citizens, who are customers (not shown). The need and means for measuring non-financial benefits is revisited in Chapter 11.

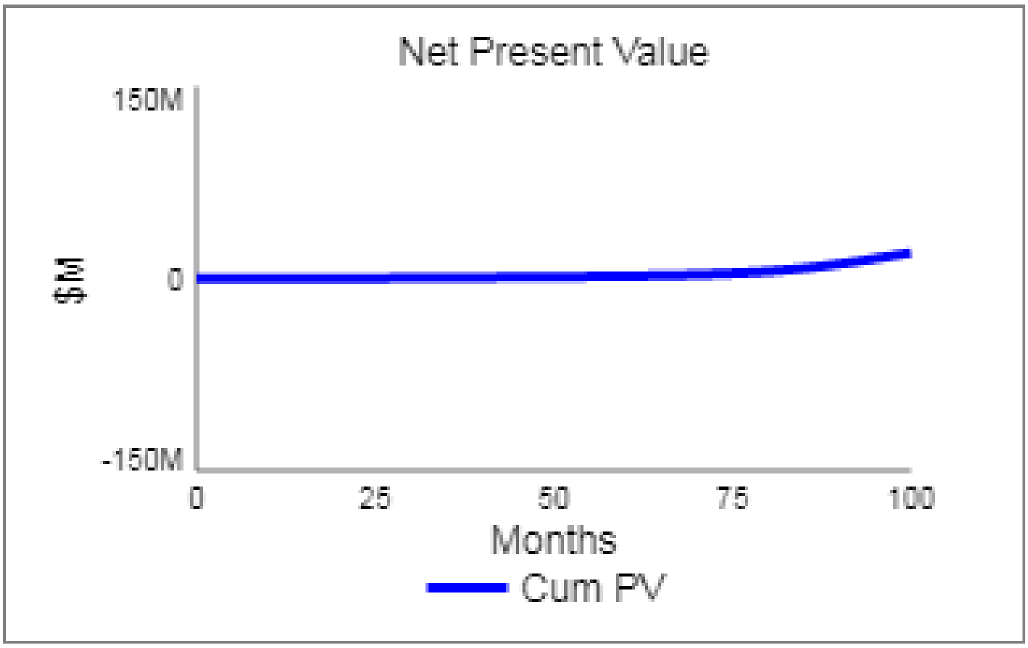

Figure 9.35: Track Intention – Net Present Value

Model

The Model phase focuses on real world factors, drivers, which must change in order to realise the vision through chains of causal relationships leading to intended outcomes, i.e. themes. A common method for capturing key drivers is to start with the core issue, in this case lack of integration, against which to pose the question, “how are we failing to integrate right now?” This linguistic structure reliably returns factors which influence or are influenced by the core issue by placing the recipient in causal thinking. This approach results in what Richmond calls a ‘laundry list” (Richmond, 2001, p. 19) as shown in Figure 9.36. The expected result, as in this case, is consistent with, and corroborated by, the Strategy Map; key issues and objectives are two sides of the same coin. More specifically, the laundry list factors map explicitly with objectives in the BSC Resources quadrant. In the Author’s experience this pattern whilst not universal is typical.

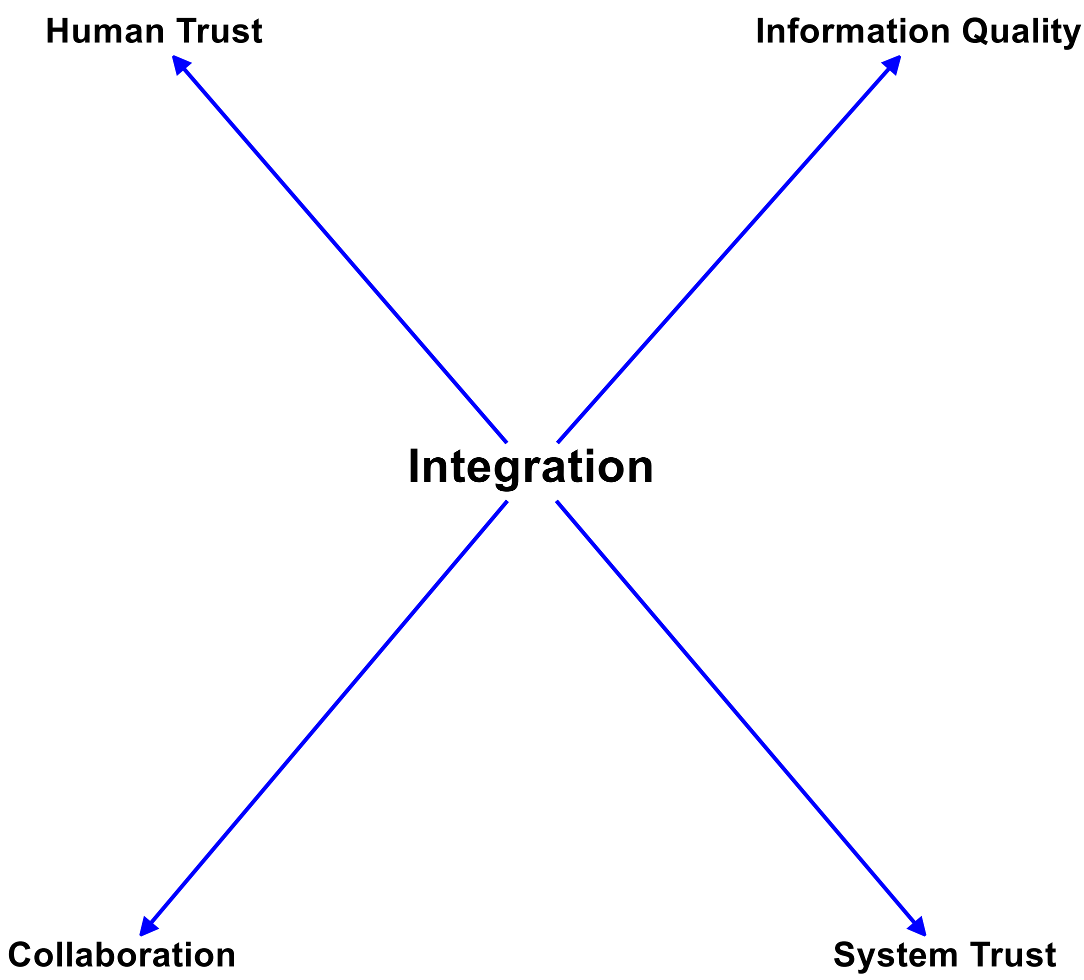

Figure 9.36: Model - Laundry List View

Model Certainty

This phase focuses on causal precision and injecting certainty that the deliverable capabilities result in intended outcomes by mapping them to specific measures which cause necessary change. The laundry list view is simple and intuitive and often used to derive items to include in a performance management framework, such as a BSC, which are assigned weightings to indicate relative importance. However, this approach has a fundamental flaw; it assumes that the factors behave independently and fails to specify the precise causal relationships which exist between the factors. An effective means to correct this limitation is to ask clients to tell the story which explains how factors relate to each other and capture the result in Causal Loop Diagram (CLD) form, as shown in Figure 9.37, or in the form of a Strategy Map. It is important that integrity of mapping with deliverable capabilities is maintained.

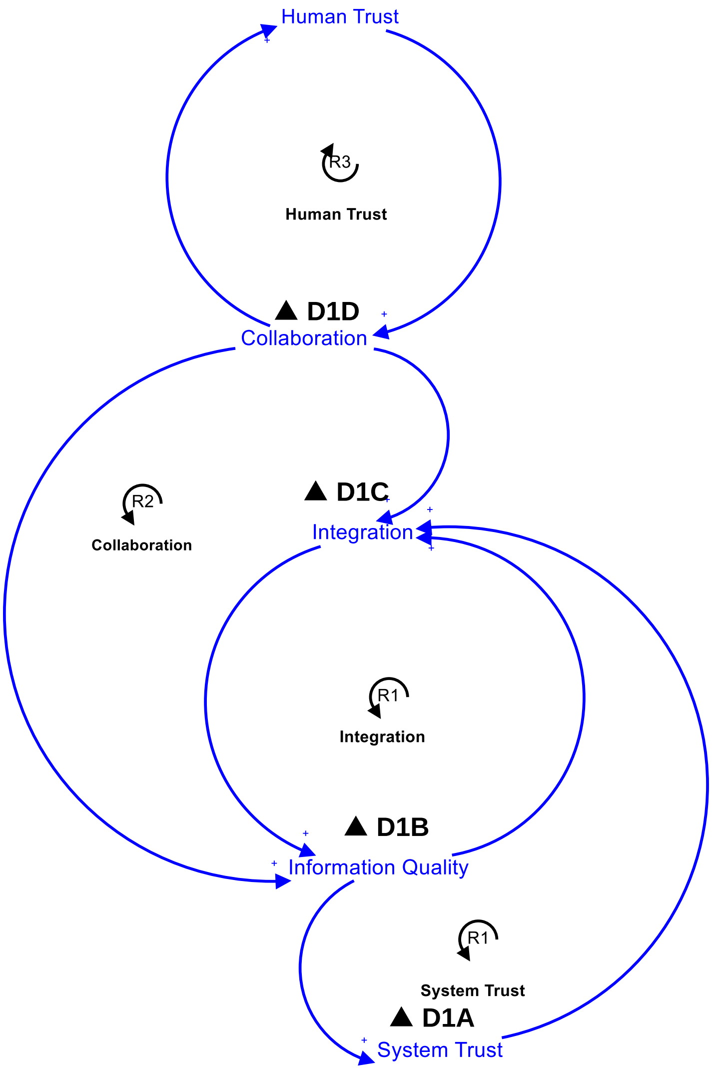

Figure 9.37: Model Certainty - Causal Loop View

(Adapted from (Cox, 2019a))

CLDs are a powerful tool for articulating ‘stories’ as feedback loops but suffer from a fundamental limitation; they make no distinction between information links and rate-to level links, which without care can lead to misinterpretations, such as incorrect directional flows (Richardson, 1986, p.159). This limitation is addressed by transforming the CLD into a System Dynamics (SD) model, which comprises levels (stocks) and transitions (flows) as shown in Figure 9.38. Another important distinction with the SD model is that the deliverable capabilities are mapped not to the levels but flows which change those levels, or more generally, factors influencing the flows. The key point is that deliverables can only enable outcomes through appropriate targeting, aligning and prioritisation of the capabilities on factors which actually cause essential change in the causal system, i.e. points of power.

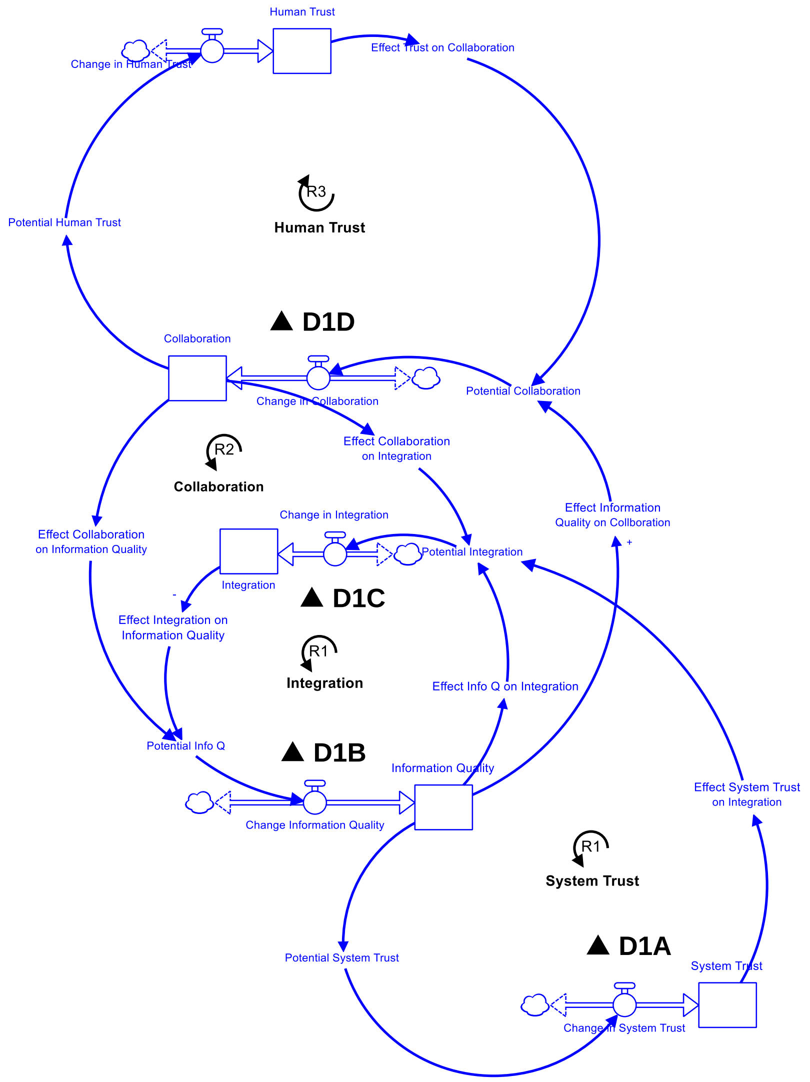

Figure 9.38: Model Certainty - System Dynamics View

Model Track

Model Track is concerned with assessing performance in terms of changes in value drivers and directing appropriate action to correct adverse and exploit favourable variances. Figure 9.39 shows graphical plots for each of the five key drivers which are outputs from the SD model. By displaying the behaviour of measures which are causally connected in a simulation model, it is possible to assess the effect of changes in one parameter on the others, together with the consequential impact on intended outcomes. This is particularly useful when dealing with CAS emergent behaviour which although cannot be predicted exactly, it is possible to predict emergent patterns of behaviour to a level of precision which enables better targeting, alignment and prioritisation of interventions.

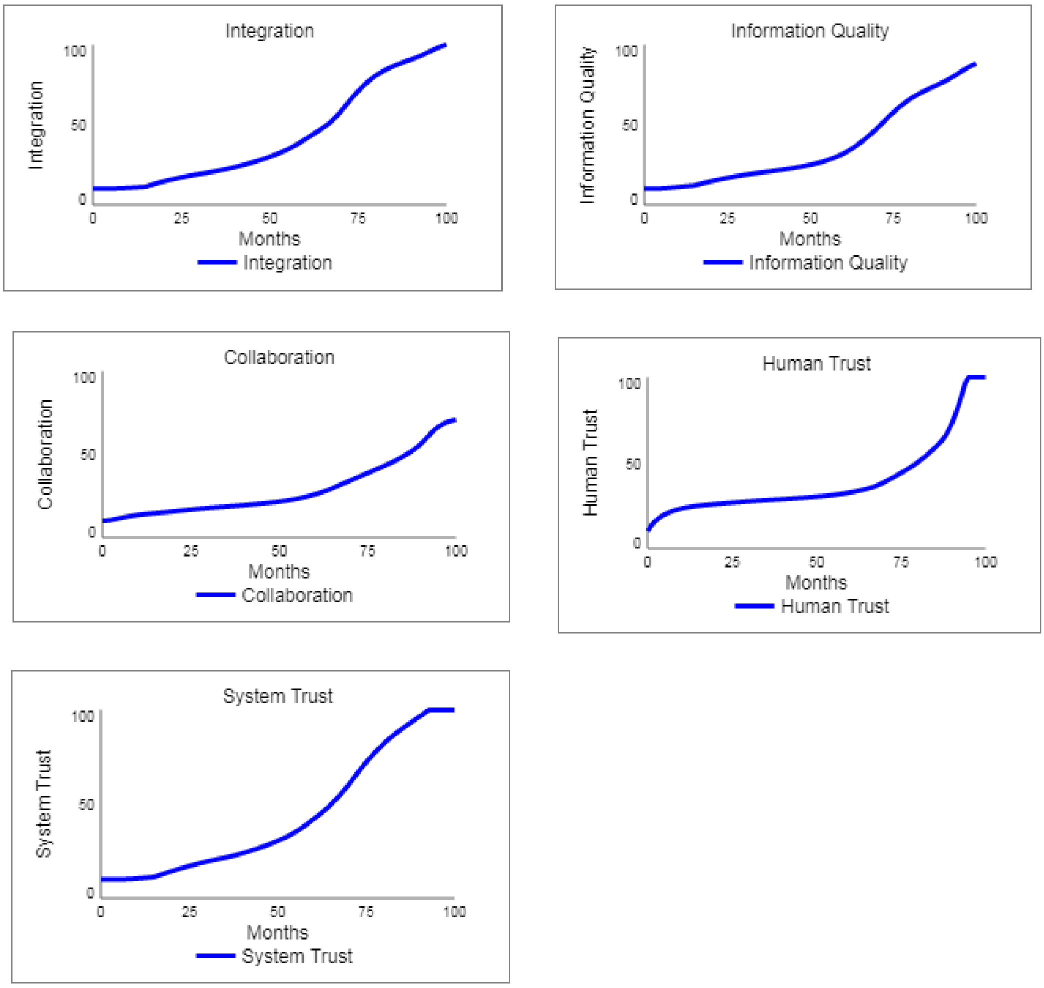

Figure 9.39: Model Track – Key Drivers

Programme

So far, the Intention-Certainty-Track thread specifies purpose, ***why*** the strategic change is important, together with outcomes which represent achievement of the purpose. The Model-Certainty-Track thread defines process, ***how*** intended outcomes are realised in terms of changes in measurable causal factors. For each of these threads, the product, ***what*** is required to effect changes in drivers and consequential outcomes in terms of new or enhanced capabilities, is mapped to specific elements impacted. It is now necessary to add specificity to the deliverables, the criteria for success and assurance of achieving success through the Programme-Certainty-Track thread.

The Programme phase specifies the deliverables to a level of detail which ensures that essential functionality needed to effect prerequisite changes in value drivers are incorporated within the design and build. Figure 9.40 shows the linkage between deliverables and effects on key drivers.

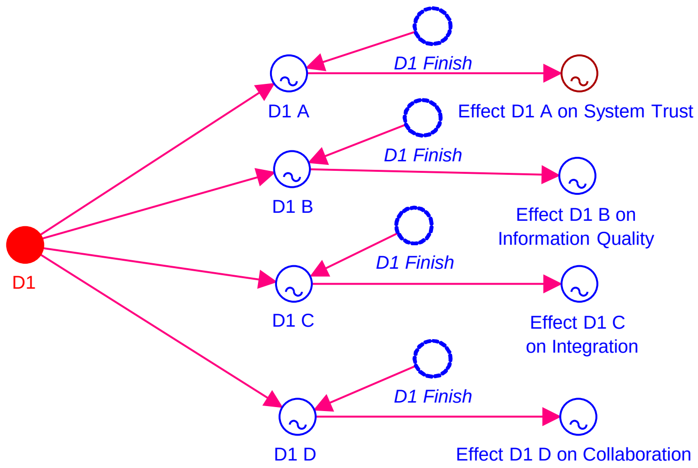

Figure 9.40: Programme - Deliverables

Programme Certainty

Certainty for deliverables, i.e. what, relates to ensuring that capabilities are output in compliance with specification, on time and within budget, using strong project and programme management disciplines. Cost is a common measure for programme status and comprises two components: CAPEX which is non-recurring expenditure on the development and production of deliverables, while OPEX refers to the recurring cost, monthly, annual etc., of supporting the deliverables over the entire programme life. Figure 9.41 shows how CAPEX and OPEX components of cost are structured in the model.

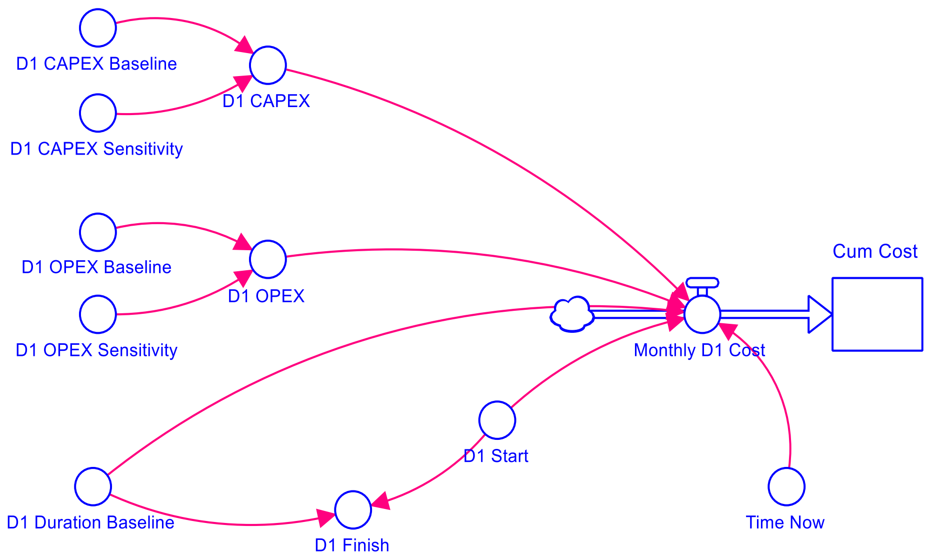

Figure 9.41: Programme Certainty – CAPEX, OPEX and Duration

Programme Track

Programme track concerns management of compliance, time and budget. Cumulative cost is the most common means of tracking programme cost, and can also provide an indicator of schedule and compliance. More formally, Earned Value Management (EVM), not used in this case but discussed in Chapter 3, is a powerful technique for defining programme status by relating cumulative cost to both cost and schedule variance in relation to the degree of functional compliance delivered (Webb, 2003). Cumulative cost typically assumes an S-curve profile, reflecting a slow call on resource early in the life cycle, peaking in the middle and plateauing towards the end. Using simplified linear behaviour for this case study, the cumulative cost profile comprises a zero period, leading up to the programme start, steep accumulation during development, i.e. CAPEX, slowing post completion to reflect support, i.e. OPEX, as shown in Figure 9.42.

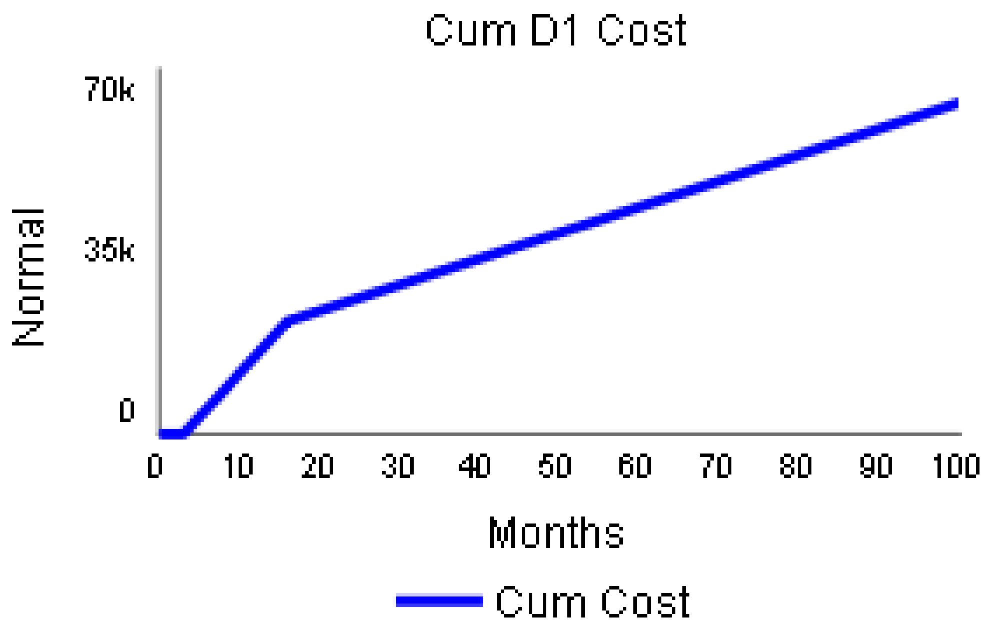

Figure 9.42: Programme Track – Cumulative Cost

Alignment

Alignment represents the programme keystone where purpose, process and product threads are converged and optimised for stakeholder value and made resilient to risk. To this end, there are two parts to Alignment, Value Optimisation and Resilience, together providing targeting, alignment, prioritising (TAP) in respect of value. The SD model accommodates alignment by providing a dashboard comprising key outputs needed for tracking, together with input devices, such as slider bars, for simulating 'what-if?' scenarios which facilitate sensitivity and risk analyses.

Value Optimisation

For value optimisation the aim is to configure the targeting, alignment and prioritisation of programme deliverables to optimise stakeholder value. This is facilitated through input devices in the dashboard as shown in Figure 9.43. The SD model allows a 'Go Live' function which allows real time impact on graphical outputs of changes input sliders.

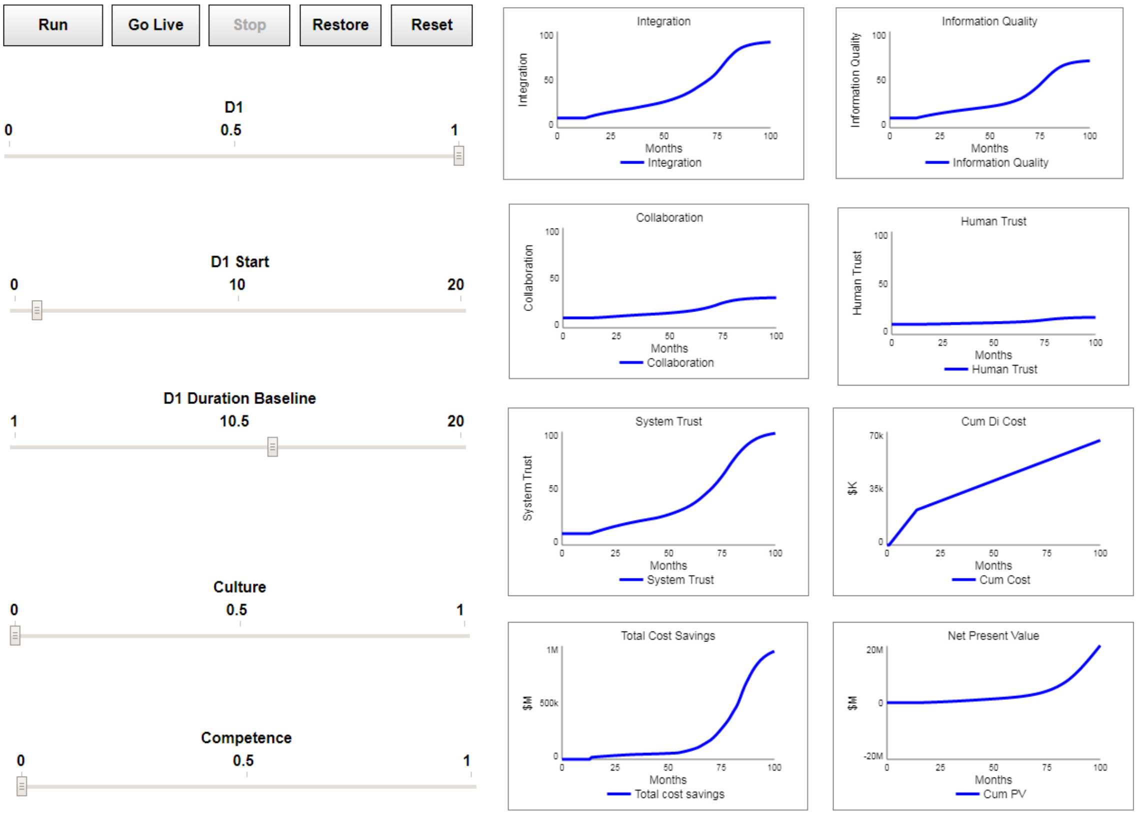

Figure 9.43: Alignment Optimisation - Dashboard

Value Resilience

Value resilience concerns protection of stakeholder value facilitated through two complementary techniques, sensitivity and risk analysis, which combine to inject certainty that intended value is realised. For sensitivity analysis, key parameters are varied either individually or in combination to explore the impact on value, in order to determine two things: factors to which value is most sensitive and how sensitive value is to changes in specific factors. For example, Figure 9.44 shows the impact on NPV of a 1 year slip in the deliverables. In the new value theory, risk analysis is used for destruction testing to simulate what combination of circumstances break the value viability of the programme. Taken together, sensitivity and risk analysis constitute Certainty Analysis, resulting in the integration of strategy and implementation which provides greatest certainty that stakeholder value is realised.

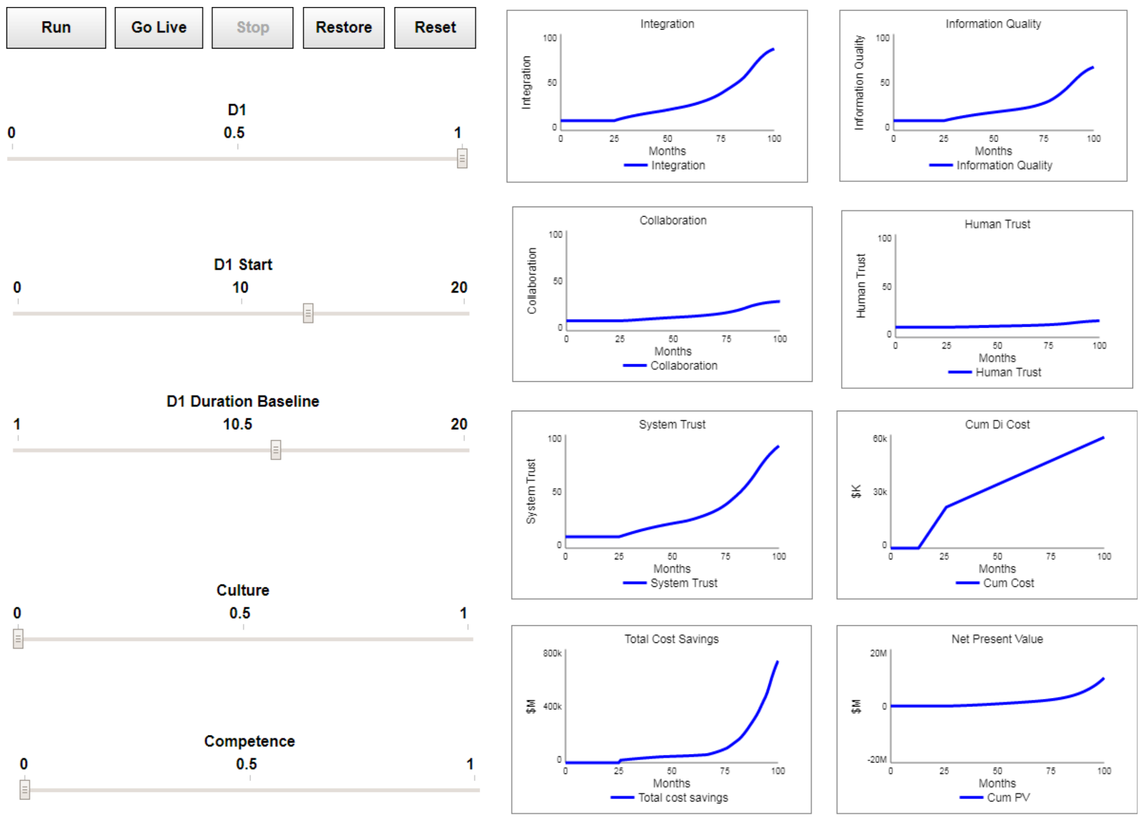

Figure 9.44: Alignment Resilience - 1 year Delay in Implementation

9.4.3 Outcomes

The most successful outcome from this assignment was the ability to apply Action Learning to both train the client in the approach generally, and SD modelling specifically, completely remotely, using 1 hour slots with a 9 hour time difference. The client, Seb Cox stated, “[The work] provided me with very useful insights that I have been able to take forward when diving deeper, maintaining the original story and avoiding potential modelling pitfalls.” In relation to modelling complexity, he also stated, “It became apparent to me during my previous MSc research project in 2015 that the problem in question needed to be treated as a Complex Adaptive System with a value management framework”. However, Cox was not convinced with the level of abstraction used, “As an Engineer, I have struggled somewhat with Roger’s notion of “precise simplicity” and references to neuro-linguistic programming such as “chunking.”

9.5 Essence

The validation case studies provide evidence of successful framework operation across different contexts, with no prior knowledge, by integrating resources to create stakeholder value, and transferring the knowledge to replicate success. This does not prove universal applicability but offers evidence which supports it. Whilst specific content and techniques vary, the thinking processes invoked overall and at each phase are conceptually identical. Deployment of Value Principles is demonstrated through declaration of output from each framework phase. Evidence of efficacy is provided in three ways: actual content produced at each framework phase, outcomes with client statements, summaries of which are provided in this chapter, and before and after feedback. Full statements and detailed before and after questionnaires completed by each client are including in Chapter 10.

PART V EVALUATION AND DISCUSSION

Having constructed the new value theory and framework in Part III, then developed prerequisite capabilities for, and validated, effective deployment in Part IV, this final part includes a critical assessment of implementation and discusses how the Value Management approach is embedded functionally and in time through Dynamic Integration. The final chapter provides conclusions and summarises novel contributions from the research.

10 Evaluation of Proposed Theory

10.1 Introduction

This chapter provides an evaluation of solutions for the three prerequisite capabilities: Agile Learning, Causal Precision and Causal Certainty, progressed through the developmental case study, Chapter 8, and deployed across contexts using the Value Power Framework in validation case studies, Chapter 9. Table 10.1 restates research objectives, associated success criteria and evidence, as previously defined in Chapter 5 Table 5.1. For each research objective, success criteria and evidence are restated from Table 10.1, and achievement submitted with cross-references to main body text. Noteworthy points and proposals for further work are included in this chapter and revisited in Chapter 12. Additional descriptions are provided in Appendix B1 for the developmental case study and Appendix B2 covering validation case studies.

Table 10.1: Capability Objectives Success Criteria and Evidence

Research Objective	Success Criteria	Evidence
Developmental Case Study: Section 10.2		
C1 Agile Learning: Capability to specify purpose and translate into performance with speed and certainty		
O1.1 Direct Learning: Structure value creation as a Learning Journey	Stakeholder value creation can be modelled as a generic Learning Journey process	Stakeholder Learning Journey simulated dynamically
O1.2 Power Learning: Measure and apply means to increase value creative learning	Learning Power is incorporated within the Learning Journey	Learning Power modelled within stakeholder Learning Journey
C2 Causal Precision: Capability to model the causal translation of purpose into performance		
O2.1 Model CAS: Model all relevant causal relationships within a CAS	CAS can be modelled dynamically	Dynamic value causality within a CAS traced and interpreted
O2.2 Direct Value: Apply model to support value specification and realisation	Sufficient accuracy of calibration and prediction to facilitate intended value creation within a CAS	Dynamics model applied to inform decision making

Research Objective	Success Criteria	Evidence
C3 Causal Certainty: Capability to define, source, transform, validate and apply measures to reduce uncertainty in causal translation of purpose into performance		
O3.1 Define Measures: Define Metadata for all value driver and outcome measures	Hard and soft measures are specified precisely	Hard and soft factors simulated interactively
O3.2 Quantify Measures: Populate model with all input measure values	Data is sourced, transformed, validated and applied in the causal model to create value	Hard and soft measure values and relationships proved valid
Validation Case Studies: Sections 10.3, 10.4 and 10.5		
C4 Generic Application: Capability of Value Power Framework to support intended stakeholder value across different contexts		
O4.1 Span Contexts Validation: Evidence of successful use across sectors, industries and applications	Efficacy of the Value Power Framework is proven across diverse real case studies	Free, full and unchanged general and specific before and after client feedback

10.2 Bacs Developmental Case Study

This longitudinal case study centred on a Market Dynamics Model (MDM) for the UK Current Account market and provided the vehicle through which solutions to prerequisite capabilities needed to support the new theory and framework were developed and tested.

Success Criteria: Stakeholder value creation can be modelled as a generic Learning Journey process

Framing value creation as a Learning Journey was implemented from three angles: stakeholder groups, internal journeys of individuals and change programme, together with their integration.

In respect of stakeholder groups, the MDM incorporated the Learning Journey as a Customer Journey, drawing on an approach widely used in industry, covered in Sections 8.3.1 and 8.5.1. The journey was structured as a balancing feedback loop in which customer needs are matched with provider value propositions, consistent with learning as correction of error, defined in Section 3.6.2.

Customers follow individual Customer Journeys within the essential dynamics of the market, shown in Section 8.3.2, which are influenced through experience, interaction with other customers and promotion from providers, Central Services and price comparison websites.

Application of the Learning Journey frame to change programmes is modelled through the Value Journey, discussed in Section 11.2, comprising Master Stages which are implemented over time but structured as a cycle to reflect the continuous nature of change.

Integration of external journeys, such as a change programme, with internal journeys of stakeholders engaged in the change process, is achieved through Action Learning, covered in Section 3.6.5, and adopted in the validation case studies. An important qualification by Tracy (2018) is that external and internal Learning Journeys are part of the same system and should be explicitly coupled.

Evidence: Stakeholder Learning Journey simulated dynamically

Evidence of simulating a Learning Journey dynamically is provided through results from the MDM which include switching rate prediction, shown using both SD and ABM in Section 8.5.2. Results apply equally to customers as individuals and stakeholder group.

Change programmes are not modelled explicitly as part of this research. However, the Value Journey is simulated dynamically using the Value Management Toolset™, described in Section 11.7.

Although intended, a controlled implementation of external and internal Learning Journey integration was not conducted, due to time and resource constraints, and is proposed for further research in Chapter 12.

10.2.1 O1.2 Power Learning

Success Criteria: Learning Power is incorporated within the Learning Journey

Learning Power is openness to learning measured through seven dispositional attributes, for example, creativity and resilience. Self-assessments can identify current weaknesses and inform effective interventions to address them. Some dimensions are incorporated within the Value Principles, for example, Principle 6 Value Certainty, Section 6 6.7, integrates intuitive creativity and analytical rigour for resilience.

The focus for this research is rate of learning and translation into value, and in this vein empowerment was broadened to include other factors which accelerate effective learning, such as neurological preferences and range of perspective, covered in a strategy context under Section 3.2.6.

Evidence: Learning Power modelled within stakeholder Learning Journey

Learning Power was implemented in the MDM as a second level of customer segmentation to fine tune predictive behaviour, using archetypes, as covered in Section 8.4.1.

Whilst successful deployed functionally, there was insufficient data to validate the approach and it was concluded that more appropriate dispositional foundations may be better suited for any further development, such as self-determination and motivational theory (Ryan *et al.*, 2000; Deci *et al.*, 2008) on the grounds that these are more closely linked to behaviour (Tracy, 2018). Further research on behavioural dispositions is proposed in Chapter 12.

10.2.2 O2.1 Model CAS

Success Criteria: CAS can be modelled dynamically

The MDM models customer engagement in the market manifested in switching. The market as a CAS was modelled conceptually using CLDs, described in Section 8.5.1.

Transition from the highly abstracted SD model to an ABM, which captures genuinely emergent behaviour, represented a significant shift and this was facilitated through rigour invested in the conceptual model, as described in Section 8.5.2.

Further research is proposed in Chapter 12 concerning the integration of dynamics modelling paradigms (Nguyen *et al.*, 2020), increasingly facilitated by functional advances in software support tools.

Evidence: Dynamic value causality within a CAS traced and interpreted

The entire CAS was mapped using CLDs which provided causal tracing of results and the master vehicle for Verification and Validation (V&V), undertaken independently in order to provide objective evidence of model efficacy , as covered in Section 8.5.3 and Appendix B1 (Huang, 2018b).

Output graphs from the MDM proved effective for interpreting results as causal stories and key measures were included in the Market Performance Framework, covered in Section 8.6.2.

Use of CLDs, translation into SD and spreadsheet models and deployment of output graphics to support decision making are also evidenced through the validation case studies in Chapter 9.

10.2.3 O2.2 Direct Value

Success Criteria: Sufficient accuracy of calibration and prediction to facilitate intended value creation within a CAS

From earliest Proof of Concept (PoC) stages the modelling informed decision making within Bacs, transcending from budgeting support to effective market analysis, over the five year period with improvements in data quantity, quality and validity, as outlined in Section 8.2.1.

The solution to balancing imperatives for rigour and clarity proved to be the use of storytelling, in which results were presented as a chain of graphical outputs linked through causal tracing. These were rendered viable through verification consistency between conceptual and physical models. This approach was further formalised through the Market Performance Framework, covered in Section 8.6.2.

Evidence: Dynamics model applied to inform decision making

Successes included a decision not to proceed with Account Number Portability ((ANP), potentially saving the industry £10 billion, using a prediction from the MDM of only marginal, transitory benefit corroborated by subsequent experience, covered in Appendix B1.

The final MDM version continues to function as an operational tool by Pay.UK. The process of perpetual calibration was implemented, involving formal procedures for data updates, recalibration and output of latest results. This is a major step towards real time performance management, an area proposed for future research in Chapter 12.

10.2.4 O3.1 Define Measures

Success Criteria: Hard and Soft measures are specified precisely

A continual challenge was reconciling the absence of available data, in either quantity or format, with the convergent imperatives of academic rigour and real world business validity. From earliest PoC modelling, the solution involved separating measure definitions from data quantities using Metadata principles drawn from Business Intelligence (BI), in which the Author elicited expert advice from Fletcher (2018), combined with best practice in SD modelling, as shown in Section 8.7.2.

Implementation also drew on the Author's experience in Activity Based Costing and Management (ABCM), specifically causal drivers of performance (Kaplan, 1998; Cokins, 2001; Turney, 2005), covered in Section 3.5.1.

Evidence: Hard and soft factors simulated interactively

The MDM incorporated both hard and soft measures which are causally linked. For example, events experienced by customers, such as engagement with providers, word of mouth, exposure to promotion and life events are hard measures, because they can be counted. Conversely, the impact of events on customer cognition in relation to their propensity to consider switching is a soft behavioural measure, which cannot be quantified directly.

Evidence of the successful simulation of hard and soft measures operating interactively is provided through the causal mapping in 8.5.1 and results from the models covered in Section 8.5.2.

10.2.5 O3.2 Quantify Measures

Success Criteria: Data is sourced, transformed, validated and applied in the causal model to create value

The challenge of quantifying measures invoked the concept of data value Hubbard (2014) in prioritising acquisition, outlined in Section 8.7.1. In this respect, the MDM exposed those outstanding data items to which results were most sensitive, thus informing data priority.

MDM data was initially defined the Author, together with development of a spreadsheet transformation tool, after which data sourcing, transformation and validation was undertaken by the UoB (Huang, 2018b). The history and process is covered in Appendix B1.

Proposed future developments covered in Chapter 12 include integration of systemic and econometric modelling, incorporating econometric principles of causal inference (Pearl *et al.*, 2018; Stouli, 2018) and use of Big Data, which leads to near real-time dynamic performance management (Davies *et al.*, 2011, p. 241).

Evidence: Hard and soft measure values and relationships proved valid

Validity of both hard and soft measures is evidenced through the independent validation, which concluded that, applied appropriately, the MDM provided one year predictions with an acceptable error of +/- 15%, as covered in Section 8.5.3.

10.3 io oil and gas Validation Case Study

This cross-sectional case study concerned development of a single System Dynamics (SD) model to evaluate the commercial viability of extending brownfield gas resources during the concept selection stage of upstream exploration, replacing costly, time consuming analyses involving multiple models.

10.3.1 O4.1 Span Contexts

Success Criteria: Efficacy of the Value Power Framework is proven across diverse real case studies

The cross-sectional case studies focused on efficacy of the framework in achieving successful outcomes across diverse complex domains, team mix and learning environmental circumstances with speed and certainty. This case stress tested the approach in the profit-centred Oil and Gas sector the under conditions of uncertainty, to determine whether the proposed unproven modelling would be possible and successful in replacing a highly established and embedded process within the industry.

Evidence: Free, full and unchanged general and specific before and after client feedback

Feedback is provided through two forms. First general statements relating to assignment efficacy and personal experience by clients. Secondly, the client populated before and after templates, as defined in Chapter 5 Table 4.1. All client statements and questionnaire responses are declared verbatim and provided for all validation case studies.

Client Statements

Richard Dyson CEO

“Roger’s work with io greatly assisted the development of io’s bespoke integrated asset approach, which is founded in using systems thinking to deliver value to the concept select phase. The approach was deployed on a study for one of io’s major oil company clients with their VP Global Project Solutions stating, ‘we are seeing real value in their [io’s] expertise’.”

Himadri Singh

“Roger’s has been great asset for success of this project which has helped the client, who is a leading oil and gas operator, to accelerate the project development schedule by six months and the project was commissioned 3Q 2017 which has boosted their gas production to meet their global LNG demand. Roger has no prior upstream oil and gas extraction knowledge or experience but he excelled with his coordination and systems thinking skills. He led the workshops and pulled out vital logical and mathematical information from engineers who never thought that this system thinking’s approach will ever work. The Client was very happy with the tool and commented after testing the tool “I have never seen such a robust tool in my entire career, tried the most to break it but looks to be working all time”. Since the success of this project, io have been using systems modelling in other projects both technical and commercial and Roger has been great mentor; he trained me to full competence level in System Dynamics modelling using Action Learning over the four months we worked together. “

Case Study Validation Questionnaire (Himadri Singh)

The before and after assessment by the client is shown in Table 10.2:

Table 10.2: io Oil and Gas Case Study Before and After Validation

Case Study Before and After Validation	
Before	**After**
What was the perceived challenge?	**How did the approach improve framing and definition of the challenge?**
Since the collapse in global prices, oil companies impose greater scrutiny of potential investments, which include options hitherto considered unviable, such as extending the life of brownfield reservoirs; as with this case. Combined with this shift is the need for more agile ways of selecting and discarding options during the earliest stage of oil and gas exploration, extraction and production. This is particularly pertinent for Concept Screening numerous options into a shortlist of viable options, Pre-FEED, selecting a preferred solution prior to FEED (Front End Engineering Development), detailed development of the preferred solution The challenge was to select optimal compressor to extract maximum gas to generate highest value in shortest period of time.	Framing the problem as: why? financial viability, how? producing sufficient flow to render the option viable and what? power needed to extract sufficient production flow, provided a clear and precise structure for the model development.

Case Study Before and After Validation	
Before	**After**
Who were perceived as stakeholders and why was the challenge important to them?	**How did the approach improve specification of intended stakeholder outcomes?**
There are 3 key stakeholders: io oil and gas, io's client, a global petrochemical company and territorial government where gas is located. For io the importance is advancing a differential consulting value proposition and coming up with some innovative ideas For io's client the purpose is twofold: specifically, extending the commercial life of a brownfield gas reservoir and generically, acquiring repeatable capability to increase the speed and cost effectiveness of concept screening and pre-FEED analyses For the territorial government the benefit is revenue in the form of royalties from gas production	For the specific gas project, the dynamics model explicitly included financial viability of extending production, as a Discounted Cash Flow (DCF) analysis, which incorporated royalties payable to the territorial government. The model also delivered io's client with the capability to repeat the approach using the tool for other similar opportunities to extend oil and gas production from brownfield facilities The intention to provide io with a differential value proposition is satisfied on two counts: reusability of the specific model for assessing similar opportunities and capability to develop new models independently through the hands-on training. The model also incorporated royalties due to the territorial authorities.
How was a solution to the challenge perceived as being prevented?	**How did the approach improve causal analysis of the challenge?**
The capability to conduct rapid and cost effective concept screening and pre-FEED studies is prevented through an absence in suitable tools in the market.	Dynamics modelling offers a very rapid and cost effective approach to assessing and filtering options during early stages in the oil and gas production life cycle.

Case Study Before and After Validation	
Before	**After**
What other approaches were tried or were available?	**What solution was proposed?**
Various specialist modelling tools designed for detailed analysis of specific aspects of gas extraction were deployed.	io proposed and was commissioned to develop a System a Dynamics model.
How did other approaches tried or available fail to address the challenge?	**How did the approach and deliverable capabilities address failure of alternatives?**
Conventional specialist tools have 4 key limitations: Narrow focus and poor integration with other applications needed to explore the opportunities holistically High cost with significant risk of write-off Time consuming Poor flexibility to model new options and scenarios	The systemic approach addresses all 4 limitations of conventional tools: The holistic model incorporates all key aspects of gas extraction: reservoir, pipe flow systems, compression power and commercial viability. The approach is cost effective Analyses can be conducted rapidly The approach facilitates real-time exploration of options through what-if scenario modelling
What were the key criteria for success and to what extent were they not met?	**To what extent were success criteria met in relation to alternative approaches?**
There are 2 core criterial for success: Capability of the model to simulate financial viability of extending the brownfield gas reservoir Technical credibility to provide the necessary level certainty	Both criteria are met by the approach: The model provides clear and rigorous financial viability in the form of the DCF analysis covering Net Present Value (NPV). The model uses data from and is corroborated by detailed specialist tools

Case Study Before and After Validation Before	 After
What repeatable desired outcomes were not possible using other approaches?	**To what extent did the approach enable repeatable success across different applications**?
Previously, it proved difficult, time consuming and expensive to assess new opportunities, each requiring a fresh build of conventional detailed models with very limited scope for reuse.	Repeatability of both the learning and generic nature of the approach is evidenced by the subsequent successful development by io, with support from the Author, of a System Dynamics model for underground gas storage facility using the learning from this case study This is made possible through the Action Learning approach to development and reusability of the modelling approach.

10.4 KWMC Case Study: Citizen-led Housing

This cross-sectional case study developed a financial business model for the purpose of gaining capital funding for rollout of mobile units utilising small existing spare plots, which by eliminating the land cost component and simplifying planning permissions, facilitated rapid provision of affordable private and social housing.

10.4.1 O4.1 Span Contexts

Success Criteria: Efficacy of the Value Power Framework is proven across diverse real case studies

This case exercised the framework in a situation where a soft societal benefit, housed citizens, was both enabled and dependent upon hard financial grounds for third commercial party funding, providing an opportunity to develop a business model with mutually supporting stakeholder intentions.

Evidence: Free, full and unchanged general and specific before and after client feedback

Client Statements

Melissa Mean

“Working with Roger created a step change in the reality and bite of our research and development process. We are seeking “a financial animal” who could understand the social heart of the project, and Roger was exactly what we needed. His thoughtful approach, searching questions and ability to digest and synthesise was an important contribution to the project. His work helped us demonstrate to other stakeholders that our approach was plausible and could be viable.”

Craig White

“Working with Roger has been a pleasure. He challenged our thinking on the financial reality of delivering affordable, community-led housing and helped us shape a viable financial model. The credibility this has brought to the project is immeasurable, especially when dealing with funding organisations. Roger was able to synthesise the complexity of modelling a mixed tenure housing model in to an elegant tool that allowed us to run a number of ‘what-if’ scenarios. The model will form a foundation to the wider legal and financial frameworks that will have to be developed to ensure the project proceeds from concept to delivery.”

Case Study Validation Questionnaire (Craig White)

The before and after assessment by the client is shown in Table 10.3:

Table 10.3: KWMC Case Study Before and After Validation

Case Study Before and After Validation	
Before	**After**
What was the perceived challenge?	**How did the approach improve framing and definition of the challenge?**
To deliver a new model of affordable housing that changed the paradigm of conventional development, where speculation on land plays a major role.	The work carried out with Roger allowed us to build a high level economic model which demonstrated that a transformational model for property development is possible. We were able to contextualise a variety of tenures for housing that could be delivered affordably and satisfy how investors would fund the model of interest.

Case Study Before and After Validation Before	After
Who were perceived as stakeholders and why was the challenge important to them?	**How did the approach improve specification of intended stakeholder outcomes?**
The We Can Make project has a number of stakeholders. The community of Knowle West in housing need. Bristol City Council, who were struggling to get developers to meet their obligations to deliver affordable homes. Legal and financial organisations involved in the development of housing.	The model ensured that we could demonstrate to Bristol City Council at a strategic level that affordable housing is possible if the capital cost of land acquisition is turned into a revenue cost through leases being taken on state owned land. At the same time, we were unable to unlock the energy of the community, to imagine that development of homes could be driven by them and not 3rd parties.
How was a solution to the challenge perceived as being prevented?	**How did the approach improve causal analysis of the challenge?**
That there is only one development model, which assumes that land costs must be borne by the development model on sale of the developed housing.	It transformed it into a new model of development, were land acquisition costs are decoupled from the capital cost of building homes, removing up to 40% of the total development costs of delivering homes in Knowle West.
What other approaches were tried or were available?	**What solution was proposed?**
None were considered.	The one adopted.
How did other approaches tried or available fail to address the challenge?	**How did the approach and deliverable capabilities address failure of alternatives?**
The project focussed on just one model.	Alternatives were not considered.
What were the key criteria for success and to what extent were they not met?	**To what extent were success criteria met in relation to alternative approaches?**
People in need of affordable homes having those needs met within the geographical footprint of their community.	Alternative approaches were not considered. Conventional development was not possible.
What repeatable desired outcomes were not possible using other approaches?	**To what extent did the approach enable repeatable success across different applications**?

Case Study Before and After Validation	
Before	**After**
Other approaches could not deliver a development model that commercial developers would entertain.	The model demonstrated the financial and investment viability of a non-land-owning development model, instead transferring the land from Council and private ownership, into a community land trust via a lease, enabling significant savings to be achieved. The local authority, was not disposing of the land asset, with the land held in trust it cannot form part of a speculative land banking system and the community is able to have their housing needs met. The project has gone on to be supported by the Nationwide Foundation and Power to Change. The funding to support the planning applications for the first 20 homes has been approved by Homes England and the first homes will be built in the Autumn of 2019. The support from The Nationwide Foundation and Power to Change targets the scaling of the project across Bristol, the South West Region and across the UK.

10.5 System Eyes Validation Case Study

This cross-sectional case study explores the use of Building Information Modelling (BIM) as an enabler of mutually supportive partnership in construction and infrastructure programmes through development of a SD model which focuses on the impact of BIM on soft relationships between stakeholders.

10.5.1 O4.1 Span Contexts

Success Criteria: Efficacy of the Value Power Framework is proven across diverse real case studies

This case provided another opportunity to explore the viability of a ‘win-win’ business model in which stakeholder intentions are mutually supportive, through alignment and integration of hard measures, e.g. information quality, with soft factors, such as trust and collaboration, within the traditionally conservative construction industry.

Evidence: Free, full and unchanged general and specific before and after client feedback

Client Statements

Seb Cox, Principal

"Roger's work has helped me to validate the feasibility of utilising SD modelling for analysing the potential value of digital transformation initiatives in the AECOO industry. It became apparent to me during my previous MSc research project in 2015, that the problem in question needed to be treated as a Complex Adaptive System with a value management framework equipped to deal with such - and to deal with such flexibly and economically due to the relative lack of integration and repetition that is characteristic of construction programs. My contact with Roger began after I read his Value Management book during this research. We exchanged notes over the following 3 years before deciding to collaborate on this project."

"As an Engineer, I have struggled somewhat with Roger's notion of "precise simplicity" and references to neuro-linguistic programming such as "chunking." I fully support the fact that a coherent story needs to be communicated at different levels of abstraction, and perhaps most critically at the meta-level. However, this does not automatically imply to my mind that shortcuts taken at the conceptual stage of model development will result in model behaviour that nearly resembles the behaviour of a model containing greater granularity (for example containing specific and useful measures as a minimum). Were such a similarity to occur, I would be interested to know to what extent human bias effects the correlation. Any research shedding light on this would probably influence the speed and volume of adoption of the new value theory and help identify the optimal approach of a modelling exercise (considering diminishing returns) to increase value by avoiding non-essential work."

"The other challenge I have had is that the relationships between new or improved/sustained capabilities (the inputs) and other existing capabilities is not explicitly captured. In some cases, the simplicity achieved by such an omission is desirable but in other cases the credibility of the story is actually enhanced (at the risk of being lost in the details) by a more architectural approach with additional and more explicit tangible associations."

"Overall, Roger's approach to conceptual modelling and his extensive experience has provided me with very useful insights that I have been able to take forward when diving deeper, maintaining the original story and avoiding potential modelling pitfalls. I wish to thank Roger for his patience and generosity in sharing his knowledge with considerable dedication of time. I eagerly anticipate the outcome of his research into the new value theory."

Case Study Validation Questionnaire (Seb Cox)

The before and after assessment by the client is shown in Table 10.4:

Table 10.4: System Eyes Case Study Before and After Validation

Case Study Before and After Validation Before	 After
What was the perceived challenge?	**How did the approach improve framing and definition of the challenge?**
Apply the Value Management approach to SD modelling with the aim of developing a value proposition and industry strength support tool for integration based initially on indicative data and assumptions with the ability to continually reconfigure as requirements/opportunities for greater granularity increase and data quality / availability increases.	Following on from my work with Roger, I was able to develop my own SD-based scenario and sensitivity analysis tool, as described in (Cox, 2019c) that has helped me to successfully communicate a value proposition to a wide range of people, gaining further useful insights and opportunities for refinement. Prior to this, the conceptual model Roger and I developed together (Cox *et al.*, 2019) has also been sufficient to demonstrate the core value proposition to some stakeholders not intimately connected with the construction industry.
Who were perceived as stakeholders and why the challenge was important to them?	**How did the approach improve specification of intended stakeholder outcomes?**
Building contractors, corporations using or leasing buildings for business and/or residential use, citizens requiring housing, civil government (municipal provincial and federal)	The mapping of objectives and subsequent decomposition to categories of measures / aggregated measures, combining strategy and systemic mapping provided an indicative / non-exhaustive specification of intended outcomes, facilitated through reduced waste.
How was a solution to the challenge perceived as being prevented?	**How did the approach improve causal analysis of the challenge?**
Although the problem of fragmentation and the potential for BIM and integrated project delivery in construction is well recognised, the precise causal process for exploiting the digital transformation is not widely captured in a value framework	Combining my previous qualitative causal mapping (Cox, 2019b) with quantitative SD modelling (Cox *et al.*, 2019) identified the core dynamics of the problem space and enabled targeting and alignment of key aspect of BIM to points of greatest positive leverage.

Case Study Before and After Validation	
Before	**After**
What other approaches were tried or were available?	**What solution was proposed?**
Benefits realization, cost benefit analysis, value analysis, multi-criteria decision analysis, analytical hierarchy/network process, model-based systems engineering, solution architecture, business intelligence, enterprise risk management, multi-variant analysis etc.	Key aspects of BIM and integrated project delivery targeted specific points in the core systemic to reduce fragmentation and consequential waste through integration.
How did other approaches tried or available fail to address the challenge?	**How did the approach and deliverable capabilities address failure of alternatives?**
Given the variance between design and construction strategies/processes and procurement/delivery team structure, the chosen approach needed to be economical and flexible. It also needed to address complexity and uncertainty. Existing frameworks were either (a) excessively complex - and with that relatively unadaptable from a resourcing perspective (b) limited in terms of ability to address either complexity (especially causal feedback) or dynamic effects over time. (c) addressing only certain components of value instead of all of them.	Although it is hard to answer the question without a field-tested benefits realization value/performance framework and without testing the conceptual model on a real project, I am able to provide only limited perspective from having further adapted/refined the modelling approach to facilitate conceptual scenario and sensitivity analysis and also an initial framework for benefits realization, from which I have gained feedback from multiple peers. The value management approach based on System Dynamics provides necessary flexibility and has the ability to assist comprehension of complexity. The complexity of the modelling process itself is a challenge for stakeholder engagement but the ease of configuration and power of the interfaces available mitigates this to some extent. I have successfully configured the interface to function like a project/conceptual "wiki" to assist stakeholder learning and participation.

Case Study Before and After Validation	
Before	**After**
	The buy-in for innovation and systems thinking in the construction industry is limited and therefore utilizing what is perceived as an innovative approach to unlock innovation is a hard sell for gaining consensus between stakeholders. If a mindset shift were to take place whereby more of the construction industry can accept other approaches to problem solving (e.g. from IT or strategic asset management), it would help promote more systems thinking.
What were the key criteria for success and to what extent were they not met?	**To what extent were success criteria met in relation to alternative approaches?**
1. Ability to communicate the logic and structure of the model to different stakeholders interested in different levels of disaggregation 2. Ability to integrate all components of value (benefits, dis-benefits costs, risk) as well as uncertainty. 3. Ability to adapt for different levels of detail (1) Was limited as a result of general lack of systems thinking ability or orientation amongst most stakeholder (but less so as a result of the visual programming itself and even less so as a result of the interfaces available) (2) Was limited in terms of integrating risk management. There is already debate surrounding how to integrate value and risk management but the SD approach changes not only the approach to value management but also risk management (e.g. a greater focus	(1) For stakeholders who are already oriented towards systems thinking, the ease of configuring user interfaces makes SD an excellent communication platform. However, the lack of architectural rules will limit the extent to which stakeholders can communicate or validate the underlying logic and structure. (2) From an economical perspective, SD can very powerfully capture the majority of the essence of a value proposition and accommodate uncertainty or voids of data/logic through placeholders and documentation. (3) SD is highly adaptable from an economical perspective. But the lack of architectural rules may limit adaptability where modelling authorship changes hands.

Case Study Before and After Validation	
Before	**After**
on certainty management but does not provide any easier a platform for integration. (3) I am no expert in all of the alternatives, but I expect that SD is comparatively limited in terms of the level of detail that can be obtained due to lack of architectural rules or available structure.	
What repeatable desired outcomes were not possible using other approaches?	**To what extent did the approach enable repeatable success across different applications**?
From my limited understanding, other approaches do not inject learning insights to the causal dynamics so easily, thereby missing some opportunity to correct future programmes or being limited in number of candidate programs with sufficient budget for such analysis.	Insights from this case are generic to any change programme, specifically the integration of human and system resources to achieve intended stakeholder outcomes.

10.6 Essence

This chapter provides evidence that proposed solutions to the three perquisite capabilities: Agile Learning, Causal Precision and Causal Certainty, developed using the longitudinal case study, are both feasible and practical. Evidence includes independent verification and validation of the MDM model, as the vehicle for developing the solutions. Generic Application of the Value Power Framework is evidenced through three diverse validation case studies, which exercised the entire framework, successful deployment supported by client feedback.

11 Discussion: Dynamic Integration

11.1 Introduction

Chapter 2 evidenced the imperative for, and failure of, strategic change programmes to deliver stakeholder value. In researching potential reasons Chapter 3 explored key disciplines, finding them effective; ***individually***. However, Chapter 4 proposed failure patterns accounting for value under-performance through causal decoupling ***between*** the disciplines, concluding the need for three prerequisite capabilities: Agile Learning, Causal Precision and Causal Certainty, which shaped the research objectives and methodology in Chapter 5. A new theory comprising principles to correct the failure patterns was formulated in Chapter 6 and a framework to integrate the principles constructed in Chapter 7. The prerequisite capabilities, defined in Part I, were developed using case study research methods in Chapter 8. The new approach was validated across contexts to evidence generic application in Chapter 9 and evaluated in Chapter 10.

So far, the principles and framework provide causal integration across change programme disciplines at a given point in time, rather than sequentially. To be truly effective, it is essential that the entire approach is embedded within and across all change initiatives both functionally and over time. The Author calls this embedding in function and time Dynamic Integration:

> **Dynamic Integration is the dynamic causal coupling of all change programme disciplines and deliverables in function and time to maximise value creation.**

In discussing Dynamic Integration, six further challenges are addressed in this chapter. **Value Journey** provides the process for embedding the approach throughout an entire programme comprising Master Stages, certainty increasing through Value Maturity. Integration over time is assured through a **Causal Architecture**, created and maintained through the framework. **Value Transformation** extends embedding beyond a single programme into portfolios comprising the entirety of change initiatives within an organisation. **Value Breakthrough Workshops** facilitate intensive stakeholder interaction essential for populating and maintaining the framework. The workshops are focused around a fractal process, **Precise Simplicity**, which combines advances in neuroscience with causal thinking. Finally, the **Value Management Toolset™** provides the means to capture and coordinate the scope, complexity and pace of CAS landscapes in near real-time.

11.2 Value Journey

Whereas all phases of the Value Power Framework are populated simultaneously, causal reality dictates that the physical manifestation of value is realised over time. In this context, a programme is framed as a Value Journey and this section discusses two key aspects: Master Stages and Value Maturity.

11.2.1 Master Stages

Typically, programmes transcend a number of stages, which although named differently tend to be similar in nature. For example, major UK Defence programmes following the Smart Acquisition Process are decomposed into five stages, [excluding disposal]: Concept, Assessment, Demonstration, Manufacture and In-Service, during which key decision points, called Gates, are defined with precise criteria for progression to the next stage (MoD, 2002, p. 4). Defence programmes provide a useful model due of their emphasis on complexity and risk.

A more generic designation of stages is proposed as: Concept, Approval, Build and Operation. Concept explores the feasibility of an idea, for example the commercial exploitation of new technological innovations. If viable, Approval progresses the concept to a sufficient level of certainty with which to authorise the full cost and commitment of resources. Build incorporates design, concerned with detailed planning and development of programme deliverables, and production focusing on provision of deliverables. Conventionally treated as separate stages supported by different disciplines, agile approaches require that design and production are integrated and concurrent. Operation shifts the emphasis onto utilisation of deliverable capabilities to create stakeholder value.

These generic programme tranches are named Master Stages. The entire Value Power Framework is maintained and enhanced through all stages. Although logistically temporal, the programme is framed as a cyclic Learning Journey to reflect the perpetual nature of change, as shown in Figure 11.1 in which line thickness denotes Value Maturity, covered next. The Author calls this frame a Value Journey, which is guided by a Causal Architecture described in Section 11.3.

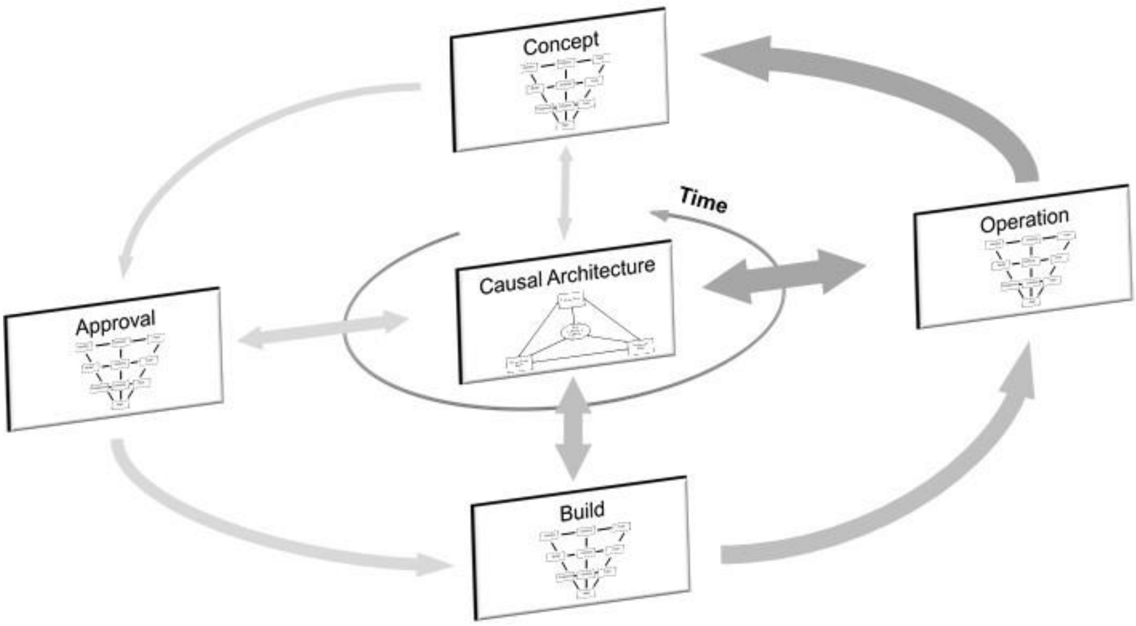

Figure 11.1: Value Journey

11.2.2 Value Maturity

To reiterate previous assertions, the Value Power Framework does not follow traditional 'waterfall' approaches, which comprise a number of sequential, self-contained phases separated in time, each of which is completed, approved and 'frozen' before the next is commenced. On the contrary, it is critically important that all framework phases are completed and maintained holistically, as a temporal recursive spiral, throughout the Value Journey, shown in Figure 11.2. This synchronicity is achieved using Value Breakthrough Workshops, described in Section 11.5.

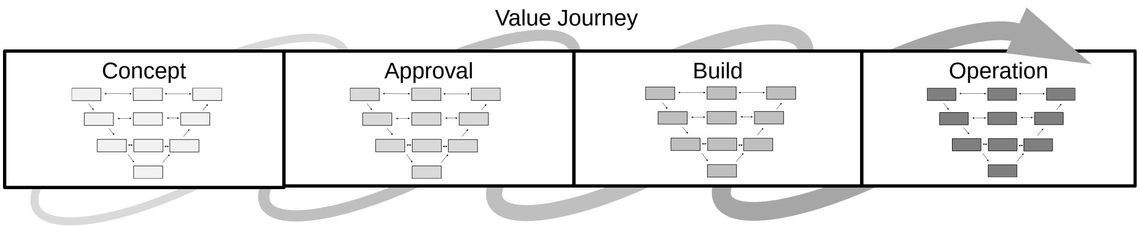

Figure 11.2: Temporal Value Journey View

Elements which cannot be physically undertaken until much later, such as tracking, are simulated from the outset, applying an appropriate balance between simplicity and precision; Precise Simplicity, explained in Section 11.6. Iterations of the entire framework are completed to an optimal level from a perspective of value certainty at Master Stages in the programme. The Value Maturity process builds certainty as early and quickly as possible through the removal of risk, as shown in Figure 11.3, for simplicity not time scaled.

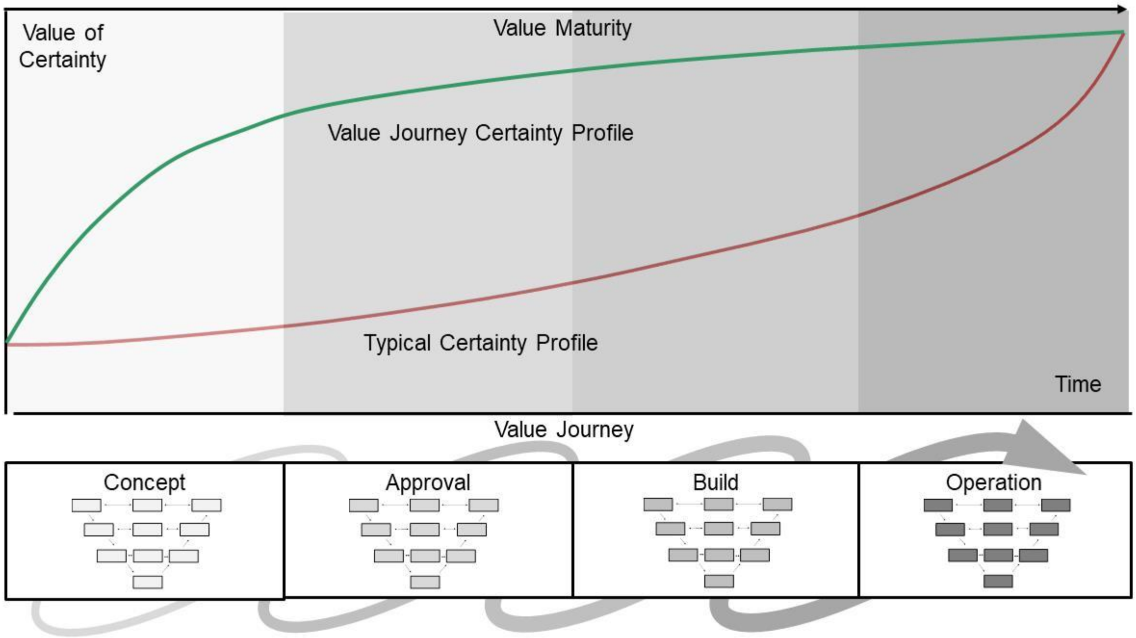

Figure 11.3: Value Maturity Value Certainty Profile

It follows that an important aspect of value maturity concerns the value certainty profile, reflecting the rate at which risk is eliminated. Often with complex programmes, significant risk persists until late in the cycle, resulting in the Typical Certainty Profile. Conversely, exposing and eliminating risk as early as possible, through agile learning, results in the Value Journey Certainty Profile.

This shift in risk profile has important implications on the programme cost profile. The emphasis on early risk containment requires additional investment in certainty management, an example of essential redundancy, with subsequent disproportionate reduction during later stages as a result of eliminating waste (Impact Dynamics, 2018). This was discussed in Section 6.8.2. The improved certainty and cost profiles are achieved through pragmatic deployment of Value Principle 7 Combine Right First Time and Correction, as reshown in Figure 11.4

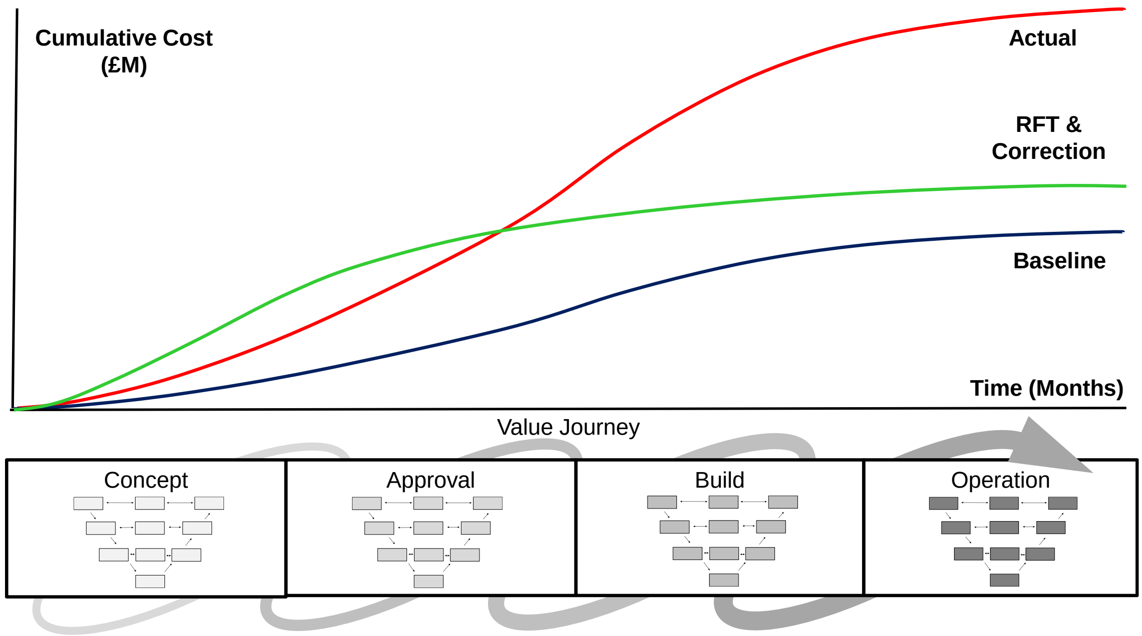

Figure 11.4: Value Journey Resource Profile

11.3 Causal Architecture

Causal Architecture forms the linchpin to this Value Journey approach by providing a perpetual compass with which to assure prerequisite capabilities developed in Chapter 8, causal precision and certainty under agile learning. Founded on causal modelling and measurement, the architecture is constructed around the V&V model for simulation (Sargent, 2013) introduced in Chapter 5, applied in Chapter 8 and reshown in Figure 11.5. In practice, prerequisite capabilities are achieved through highly interactive workshops which the Author calls 'Value Breakthroughs' deploying a fractal process, Precise Simplicity' (Davies *et al.*, 2011, p. 51) both covered later in this chapter.

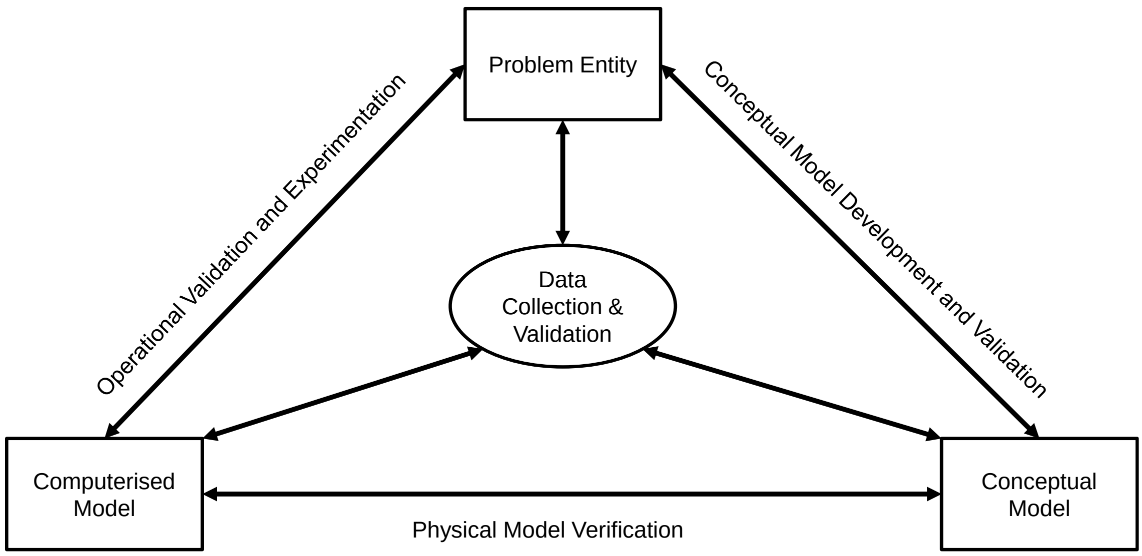

Figure 11.5: Verification and Validation Model for Simulation

To be effective, agile learning involves both rapid exploration and iteration to drive creativity, along with precise scrutiny, measurement and computation to provide causally traceable quantification. The former draws upon fast intuitive capabilities, the latter deploying slower analytical neural mechanisms; an entire process that Kahneman (2011) calls ‘thinking fast and slow’, used as the basis for Value Principle 6 Integrate Intuition and Analysis. Causal precision is achieved by creating ‘storylines’ linking cause and effect, as shown pictorially in Section 6.4.

Causal certainty is then injected using explicitly named measures incorporated within a mathematical calculation, which explicitly mirrors the storyline. These computational storylines are immediately challenged analytically and populated with data, using necessary estimation to ensure full coverage. The causal storylines can be combined to build, or be derived from, a systemic map and dynamics model, specific examples of which are provided in Chapter 8. Although modelling is specifically addressed in the Model Phase, the Causal Architecture is formulated and consulted during all Value Power Framework phases and throughout the entire Value Journey.

11.4 Value Transformation

As with any life journey, the change programme framed as a Value Journey should not be viewed in isolation but as an integral part of a broader canvas of continuous Value Transformation, as shown in Figure 11.6. This may be a number of sequential journeys, but more realistically interlinked concurrent initiatives configured into a programme portfolio, as depicted in Figure 11.6, line thickness denoting increasing stakeholder value over time.

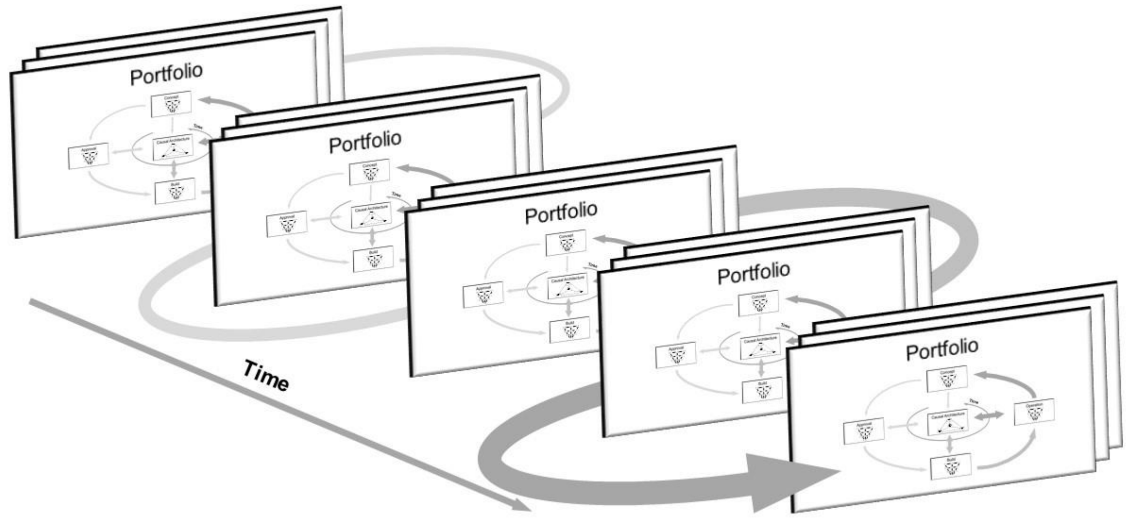

Figure 11.6: Value Transformation

In practice, value from a portfolio is managed through the three levels of performance, Programme, Business and Value, described in Section 6.8, both within and across programmes. Programme performance concerns compliance, timing and cost of deliverable capabilities. Business performance assures that capabilities cause necessary changes in value drivers and that these changes result in intended stakeholder benefits. Value performance links the programme and business perspectives to reflect stakeholder value, the relationship between actual benefits experienced and cost of their realisation. The dynamic causal linkage between programme and value, covered in Section 6.8.4, is extended to encompass the entire portfolio, as shown temporally in Figure 11.7. For all performance levels, traceability is facilitated by the Causal Architecture, a form of Digital Twin developed from the earliest programme stage (Jones *et al.*, 2019).

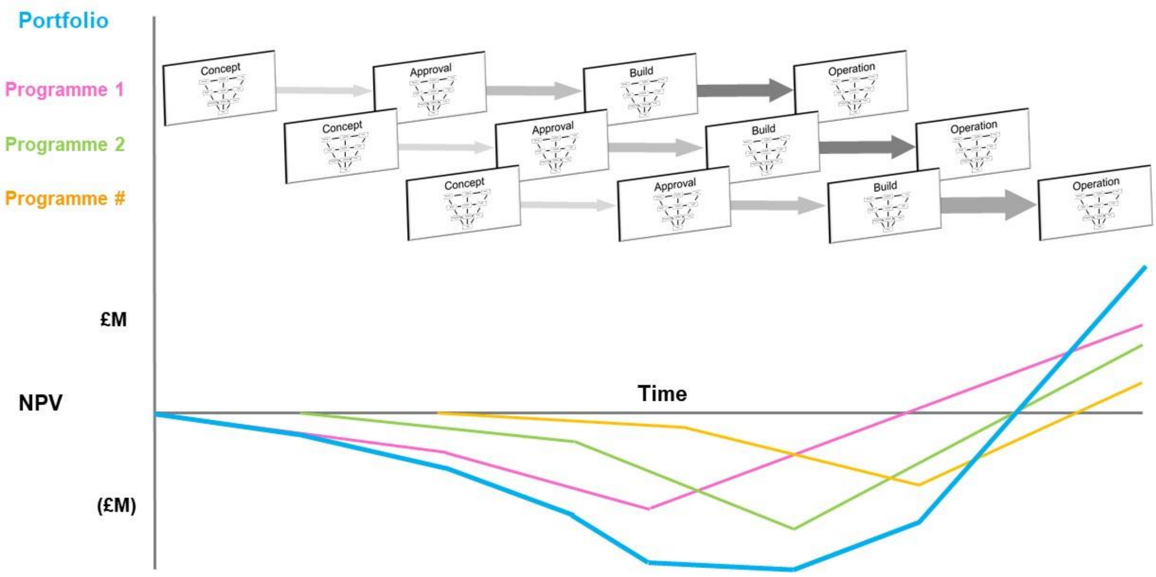

Figure 11.7: Value Performance Dynamics

11.5 Value Breakthrough Workshops

The entire Value Transformation process is directed through the Value Power Framework, which builds and evolves the Causal Architecture, facilitating performance dynamics. Crucially, direction through the framework for each programme is extended across the portfolio, the emerging calibrated architecture, providing a perpetual causal compass for value creation. As previously stressed, all phases of the framework are populated coincidently, on an ongoing basis at Master Phases, to ensure value integration of all change programme disciplines.

This approach demands an extreme form of agile working, whereby the strategy, business case, implementation plan, performance management framework and management of change are completed to a given level of precision appropriate to the Master Stage; ***at the same time***. The practical means of achieving this feat is through intensive workshops, Value Breakthroughs. Ideally, breakthroughs are completed over one or two days. However, logistical reality usually dictates that they are conducted over a longer but still compact timescale, as was the case with the case studies, all of which deployed the breakthrough approach.

Breakthroughs are structured around the Meta Model III directed questions covered in Section 7.9, which can be pivoted for any phase in the framework using the principle of equifinality (Morgan, 1997, p. 41). Three conditions must be met. First, participants possess sufficient coverage of all disciplines and the real world entity under scrutiny, critically including where to source information. Secondly, they embrace ambiguity by suspending judgement about what is possible through the workshops. Thirdly, they actively leverage ambiguity to achieve rigour through application of Precise Simplicity, discussed next.

11.6 Precise Simplicity

All models are wrong (Sterman, 2000, p. 846) and the value approach adopts an overarching principle, 'be sufficiently right rather than exactly wrong', which involves reducing errors to a prerequisite level. In practical terms, this means that we achieve the appropriate balance between simplicity, to render inherent complexity manageable, whilst ensuring adequate precision to provide the level of certainty necessary for realising intended purpose.

One of Albert Einstein's most cited quotes is, "Everything should be made as simple as possible, but no simpler". Whilst caution is needed to ensure that the meaning is not taken out of context (Physics Forums, 2012), the concept is usefully adopted in many domains, including neuroscience (Maccaferri *et al.*, 2003). The principle is also particularly relevant for causal modelling, where the challenge is managing complexity without losing key aspects of reality through undue reductionism. This dichotomy lies at the heart of conflict between natural and social sciences and must be reconciled in order to render the new value theory effective. Sargent (2013) argues that the key to this balance concerns focusing on model purpose. In this vein, Precise Simplicity (Davies *et al.*, 2011, p. 53) provides a framework for combining hard and soft factors by combining systems thinking and engineering disciplines with advances in neuroscience.

> **Precise simplicity is the mindset and process of using the simplest models possible which provide sufficient precision to enable cause of intended outcomes**

The process operates holistically and provides a fractal framework enabling development of causally rigorous models applicable at any stage in a change initiative, and at every phase in the Value Power Framework. Precise Simplicity comprises four sub-processes: Frame, Level, Inquisite and Precision (FLIP), as shown in Figure 11.8 and subsequently explained:

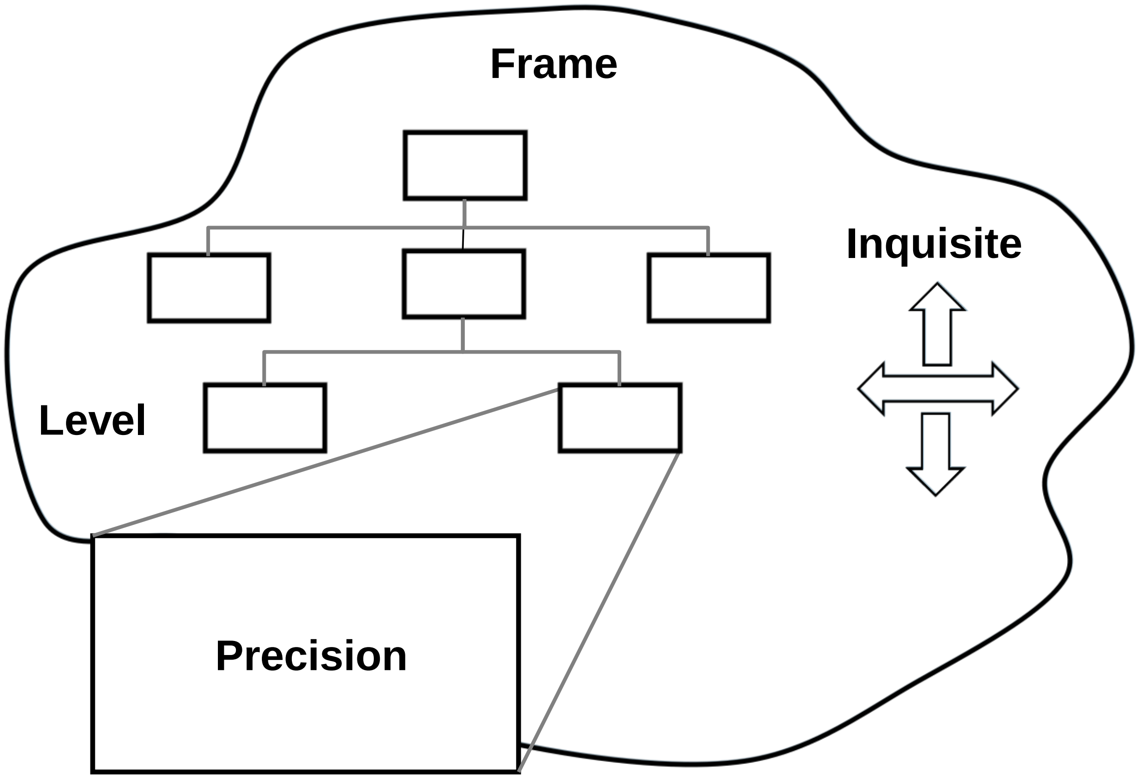

Figure 11.8: Precise Simplicity

11.6.1 Frame: Right Problem

Systems Thinking informs us that cause and effect are separated in space and time. We experience life as a series of presenting circumstances and problems; surface level events, which rarely constitute the deep structural cause. The perpetual challenge in life concerns reconnecting cause and effect so that performance reflects purpose, manifested as intended outcomes achieved through action, i.e. intervention. Reframing bounds and defines the contextual structure of a presenting problem with the aim of finding true meaning, and consequently causation. Bandler *et al.* (1982) make a distinction between two kinds of reframing: meaning and context.

Meaning Reframe

In a meaning reframe, the meaning of the presenting problem is challenged in relation to the same context. For example, a problem is often presented in the form of a cause and effect violation, using the word 'means', on the premise that one thing automatically infers another. This linguistic structure is called a 'complex equivalence'. For example, a manager may conclude that, "Recent poor performance of this person ***means*** that they have low motivation", and as a result assigns more challenging work when the cause may be burnout due to overload.

A meaning reframe challenges the underlying causal assumption using a 'how' question, such as, "How does poor performance mean low motivation" and then explore other causes, as shown in Figure 11.9. It is important to use ‘how ‘and not ‘why’ because whilst the latter is more intuitive and common, it tends to inject a mental model of blame and excuse, whereas ‘how’ necessitates examination of internal representation to find true cause. For example, the question, “Why does poor performance mean low motivation?” is likely to elicit a response in relation to the assumed cause, “Because they do not have enough work to keep them motivated”. If the assumption is wrong the problem is simply reinforced. ‘Why’ is used to specify purpose and importance, whilst ‘how’ elicits the precise causal process by which purpose is manifested; a distinction reflected in the why-how-what structure of the Value Power Framework.

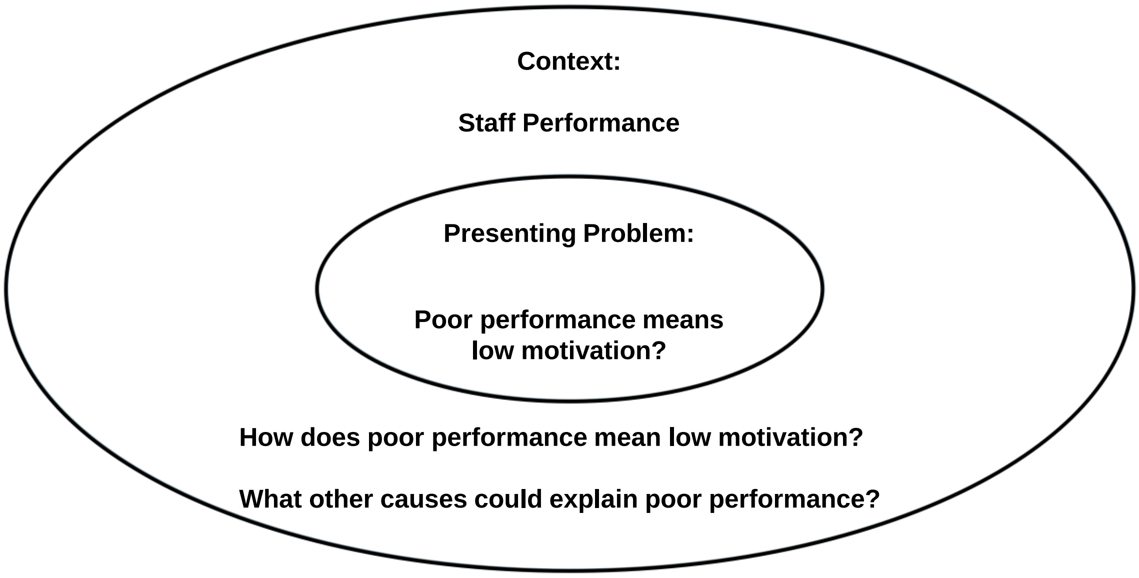

Figure 11.9: Meaning Reframe

Context Reframe

In context reframing, the context within which the problem is presented is shifted and the original meaning challenged in relation to this new perspective. For example, a problem is often presented in the form, “it is too big” or “it is too small”. This linguistic structure is called a ‘comparative deletion’ because the context in which the problem is expressed is missing. For example, a CEO may say, “We are losing business because we are too slow in responding to customers”. In this case, true meaning is elicited by challenging the context by asking such questions as, “Too slow for which customers?” and “What is the value of these customers?” The context is shifted from meeting customer demands to customer value and this causal inquisition reinstalls the deletion, in this case the customer, as shown in Figure 11.10. When combined with robust analysis, this simple shift can result in profound practical insights. For example, early applications of Activity Based Costing (ABC) (Kaplan, 1998; Cokins, 2001; Turney, 2005) exposed that the least profitable customers often accounted for the greatest support and consequential cost.

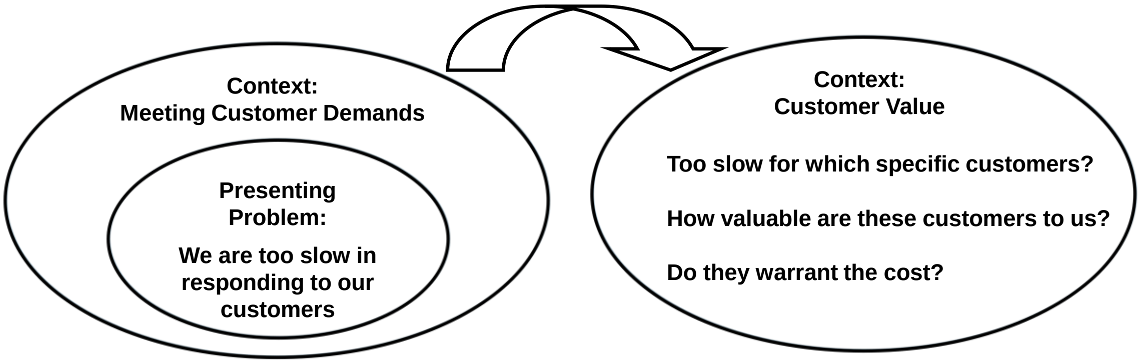

Figure 11.10: Context Reframe

11.6.2 Level: Causal Point of Power

From a value modelling perspective, level concerns causal structure which involves abstraction. Levels of abstraction are important within many domains and also for working across disciplines. Epstein (2019, p. 50) cites Wing (2006), who advocates a 'Swiss army knife' approach to building skills, in stressing the critical importance of 'computational thinking', in particular abstraction, for dealing with complex problems. In the context of neuroscience, NLP applies the process of abstraction, referred to as 'chunking', to determine the level at which true problem causes reside, a core tent in NLP (O'Connor *et al.*, 1996, p.104).

Shephard (2017) attributes chunking to the work of Alfred Korzybski who developed the Structural Differential, which he deemed essential for teaching the principles of non-Aristotelian thinking (Nous) to derive true causation (Korzybski, 1994, p. 13 & p. 397). The principles in Korzybski's opus, Science and Sanity first published in 1933, translate in to what we now know as Systems Thinking, Complexity Theory and elements of neuroscience. Ted Falconer consolidated Korzybski's work in two books (Falconar, 1997; Falconar, 2000) and attributes application to his significant success in profit improvement whilst running major companies.

The practical application and power of causal levels is most effectively demonstrated by example, for which we return to the relationship between business and staff, explored under Section 6.3.3 in the context of engagement represented as a high level causal loop diagram (CLD), reshown in Figure 11.11.

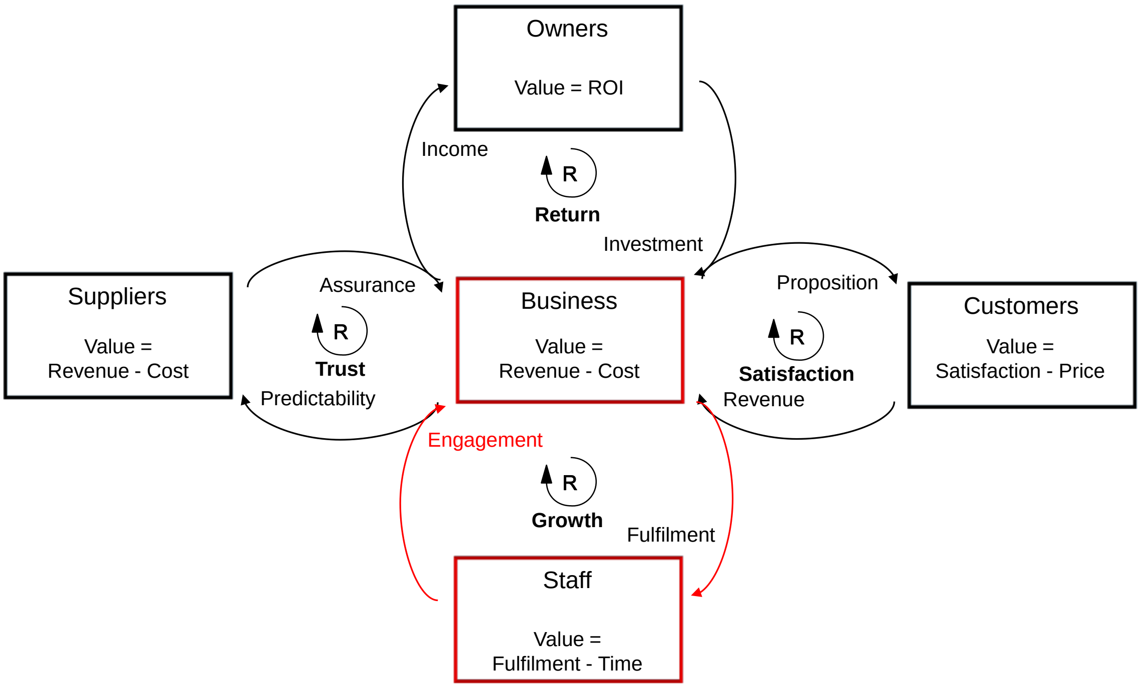

Figure 11.11: Relationship between Business and Staff in the Context of Engagement

The case draws on NLP Master Practitioner training material (Shephard, 2005a) and is shown in Figure 11.12. From any starting point, there are three directions in which we can build, i.e. chunk, the hierarchy of ideas: up, across and down.

Chunking Up

Chunking up is the process of shifting from detail to a higher level view, towards purpose. For example, starting with engagement, we ask, "What is engagement an example of?" This question returns an answer, strategy, articulated as the vision, and chunking up again leads to mission which expresses purpose of the business. To this end, other chunking up questions are, "For what purpose is engagement?" and "Why is engagement important?"

Chunking Across

Chunking across adds elements at the same level of abstraction. For example, these are identified through the question "What are other examples of strategy? This elicits the need for assured supply from suppliers and value from customers as other objectives within the strategy.

Chunking Down

Chunking down, in business often called drilling down, injects greater detail into the hierarchy by asking, "What are examples, or components, of engagement?" This question leads to two prerequisites for engagement: availability of fulfilling opportunities and staff motivated to engage in them. Further decomposition of fulfilling opportunities elicits planning and resource allocation, and for motivated staff, selection and development.

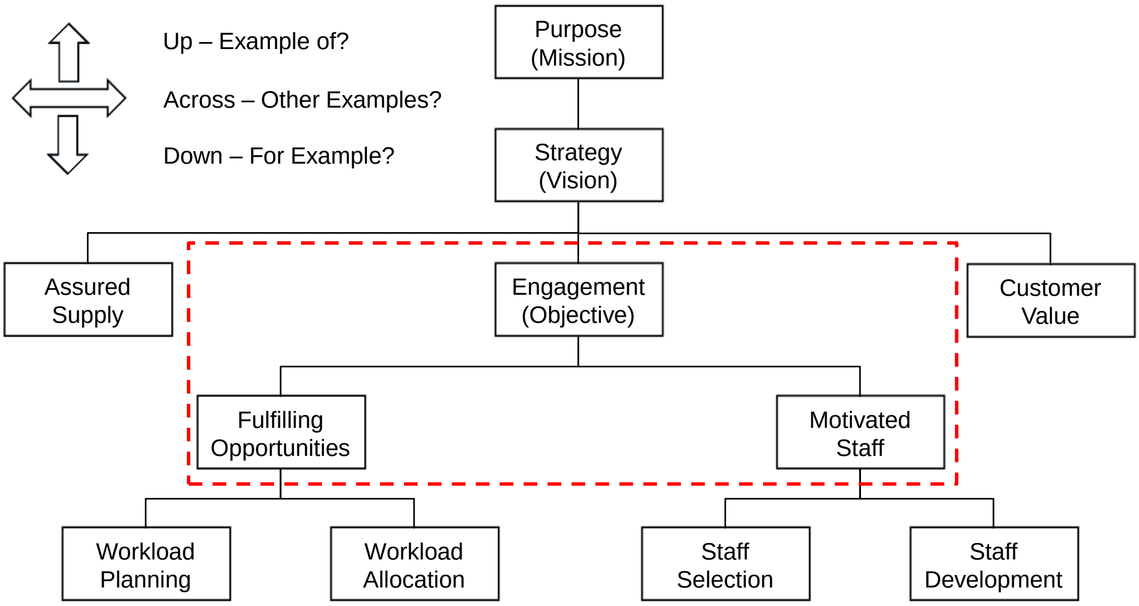

Figure 11.12: Levels of Abstraction

Critically, levels of abstraction deliver results which are consistent with the causal loop view as depicted in Figure 11.12 by elements within the dashed areas. This is because they are different perspectives of the same issue. However, there are important, and if used properly complementary, differences. The abstraction levels model does not explicitly capture feedback loops. Conversely, the CLD does not show hierarchy; although this can be incorporated through modular construction of simulation models, it is usually at the expense of transparency. Also, both the systemic and level views provide a robust foundation from which to develop a Strategy Map (Kaplan *et al.*, 2004) as shown in Figure 11.13, and performance management framework, such as a Balanced Scorecard (BSC) (Kaplan *et al.*, 1996; Niven, 2002). It is important to recognise that both the Strategy Map and BSC are specific tools, whilst the systemic mapping and levels of abstraction are entirely generic.

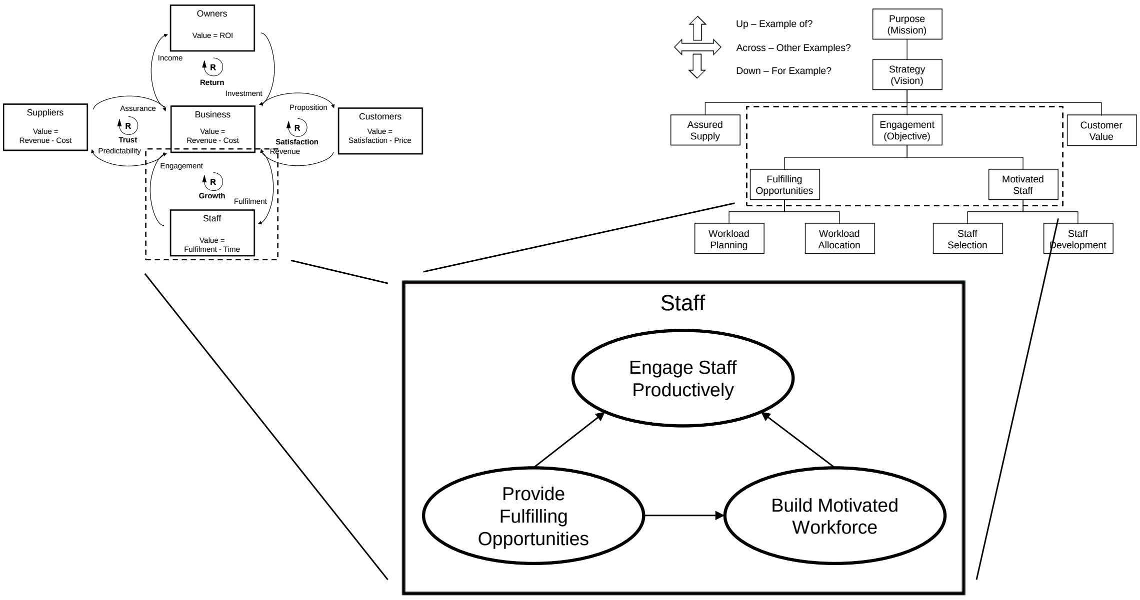

Figure 11.13: Systemic-Levels Relationship and Strategy Mapping

11.6.3 Inquisite: Causal Curiosity

The process of chunking requires significant energy, which is provided by curiosity. In the context of a new value theory, Inquisite refers to the critical role of curiosity in eliciting the deep causal structure of presenting problems, in which regard there are two primary aspects: power of questions and inquisitive mindset.

Power of Questions

We are educated to believe that power lies in answers. Our modern economies operate on this premise, together with the focus on data as a means to provide answers. However, as Shephard (2005a) states in the NLP Master Practitioner course material, where change is concerned real power resides in questions; more specifically linguistically structured questions designed to elicit true causal reality. These are covered under the next sub-process, Precision.

There are strong neurological reasons behind this assertion. First, focus on answers opens vulnerability to biases which conspire with our evolutionary tendency to link cause and effect based on surface events, with over-confidence in the heuristic processes we employ to explain causality (Kahneman, 2011). This can lead us to miss critical shifts, such as economic meltdowns, which Taleb (2007) refers to as Black Swans. Secondly, models of human cognitive function, developed through recent advances in neuroscience, converge on the importance of internal representation in our experience of reality, which is influenced through filtering and storage of temporal references. This convergence is evidenced by consistency between the NPL Communications Model (Parungao, 2011) and Cognitive Functional Framework (Baars *et al.*, 2013, p.26).

The relationship between our cognitive internal representation and how we experience reality is also corroborated through quantum physics, which links reality with consciousness (Capra, 1982; Talbot, 1991; Goswami, 1993). A key point is that the process of shifting internal representation, i.e. mental models, is driven by questions and inhibited by assumed answers. Under this frame, confusion and ambiguity cease to be constraints but essential raw materials and energy for change; causal curiosity.

Inquisitive Mindset

The questioning mindset comprises three driving forces needed to provide necessary directed energy: curiosity, truth and ownership (Shephard, 2005a). First, it is insufficient to follow rote with only a vague notion of interest. The essential mindset is aching, childlike curiosity; an uncompromising determination to get to the bottom of the real cause and create an effective intervention. 'Inquisite', rather than 'inquiry', is used to emphasise the importance of this causal curiosity. Even the most skilfully articulated questions are ineffective in the absence of energy driven by curiosity and commitment to truth.

Secondly, there must be commitment to non-judgemental, unbiased elicitation of reality without any manipulation of the truth, however painful. Thirdly, the process is conducted with acceptance of absolute responsibility for defining both problem cause and solution. This last perquisite is counterintuitive. It is likely that the practitioner is neither organisationally responsible for the problem nor the solution. However, it is essential that all participants 'act as-if' (Assagioli, 1994, p. 79) they own determination of cause and any proposed interventions in their capacities of both individuals and partners with mutually supportive intentions. Precise Simplicity is embodied through directed questions in relation to frame and levels in order to inject the degree of precision and elimination of bias necessary to realise purpose.

11.6.4 Precision: Eliminating Bias

Linguistic precision is extremely important for Precise Simplicity due to the link between defining true causality and associated measurement. The Meta Model, one of the first NLP techniques developed by modelling Satir (1988) in her family therapy, provides linguistic patterns which invoke specific internal representations of presenting problems, thereby eliciting reliable responses (Bandler *et al.*, 1976; Linder-Pelz *et al.*, 2007).

The Meta Model also draws on Korzybski's core principle of General Semantics; "The map is not the territory" (Korzybski, 1994, p. 750), which encapsulates the concept that perception of the world as being generated by our brain as a map of reality written in neural patterns. Most importantly, the Meta Model corrects three common flaws in language used in presenting problems: distortions, generalisations and deletions (Lewis, 1990; O'Connor *et al.*, 1996).

Distortions

Distortions refer to incorrect perceptions of reality, often articulated as some form of cause and effect violation. For example, “Our supplier delivers late because we are not important to them”, when the real reason for delay may be the supplier’s endeavour to ensure delivery of what is needed despite poor procurement specifications from us. Distortions are corrected by challenging the causal violation as with the meaning reframe, “How does late delivery mean that we are not important to them?” or exploring other causal explanations, “How else can their late delivery be explained?”

Generalisations

Generalisations are instances where a characteristic of one item in a set is incorrectly assigned to the entire set or time frame, expressed as a universal quantifier, such as all, every or always. For example, “Every time we use this supplier they deliver late?” Generalisations often form the mental model behind prejudices, such as, “all small suppliers are unreliable”, which drive self-fulfilling behaviour that appears to confirm the belief, for example, engaging only major suppliers; another instance of confirmation bias (Kahneman, 2011). Interestingly, this cycle is an instance of the Buddhist explanation of karma, law of cause and effect, discussed in Chapter 5. Generalisations are addressed by challenging the universal quantifier and exploring distinctions, for example, “Always?” or “Have there been any specific occasions when they have delivered on time?” and “What specifically was different about that situation?”

Deletions

Deletions are statements of perceived reality in which key elements are omitted. For example, the assertion “They have no communication” includes two key omissions, what ‘they’ is referring to and what is not being communicated. Also, deletions can involve nominalisations; verbs converted to nouns as in this case ‘communication’. Deletions are corrected by challenging the omissions and turning nouns back into verbs, “Who do you mean and how specifically are they not communicating?” In other words, converting an object, what, into a process, how.

Most real world presenting problems contain combinations of deletions, generalisations and deletions, for example, “This supplier always delivers late and there is no communication, so it is clear that our relationship is not important to them” As a general rule, the Meta Model is used in the order: distortions, generalisations then deletions, and effectiveness can be greatly enhanced by combining softening words with specificity. For distortion, “I’m curious, how does late delivery mean that our relationship is not important to this supplier?” For generalisation, “That’s interesting, has this supplier ever delivered on time? Finally, deletion, “Tell me more, how specifically, is this supplier not communicating?”

11.7 Value Management Toolset™

The volume and complexity of information generated in populating Value Power Framework and maintaining it through the Value Journey normally exceeds the capacity of common workshop techniques, such as white boards and flip charts, and associated fragmented data analysis and planning tools, notably spreadsheets. Although not submitted as part of the thesis, a software tool, Value Management Toolset™ (Toolset), developed by the Author over 15 years, was enhanced significantly in parallel with this research to support non-financial benefits and value-based measures proposed in Chapters 4 and 6.

The Toolset facilitates real-time capture in Value Breakthrough workshops by integrating the five change programme disciplines covered in Chapters 2 to 4. For example, concepts and ideas captured on a whiteboard are incorporated immediately into the Toolset as a Value Model, populated using a combination of knowledge-based estimates and Internet searches often conducted in real time by a data sourcing team. No pretence is harboured that the emergent model is robust initially, the aim being speed and coverage. Consequently, outside the workshop it is subjected to intense academic rigour and challenge by combining factfulness (Rosling, 2018) with destruction testing (Blokdyk, 2018).

The model encompasses the entire Value Power Framework and constructed around the Implementation Strategy view, previously depicted pictorially under Section 6.6.2 in Figure 6.21, and displayed in the Toolset as shown in Figure 11.14. The left window contains a builder, Value Explorer, which organises the Value Model in a hierarchical tree format. The upper window contains the change programme phases. The lower window contains analyses over time driven by the programme in the top window; comparative DCF Analyses, as shown, or non-financial benefits, covering multiple scenarios. All aspects of the emerging model are dynamically linked, a change in any parameter being reflected in all dependent variables and outputs. The Toolset supports the whole Value Journey, together with Value Transformation through portfolio management.

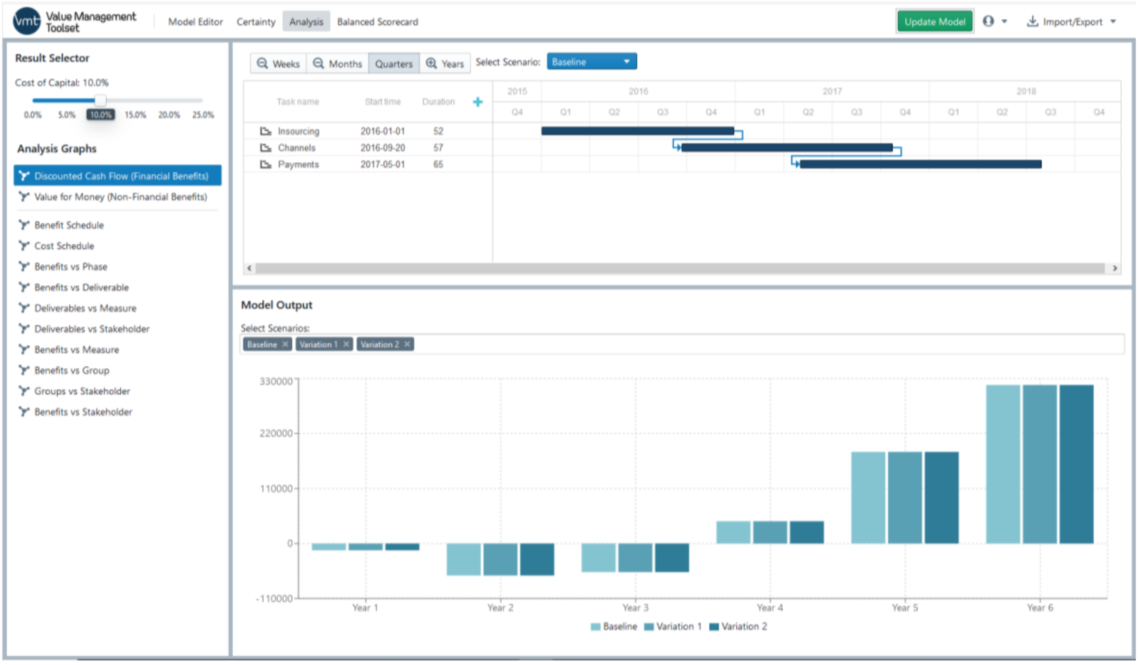

Figure 11.14: Implementation Strategy View in the Value Management Toolset™

A critical role is providing a platform for Causal Architecture, through Cause and Effect Linkage, covered in Section 7.8, captured as causal storylines in the Toolset. Figure 11.15 shows how each storyline, referenced T# for Thread, includes a calculation containing performance measures and other parameters needed to complete the computation, suffixed m_ and p_ respectively, using a strict naming convention facilitating compatibility with dynamic simulation models. BSC measure suffixes are further refined as mb_, ms_ (shown) and mc_ to denote baseline, standard and change respectively. Storylines and associated calculations represent causal chains within a greater systemic story and the Cause and Effect table can be, and sometimes is, replaced by a dynamics model.

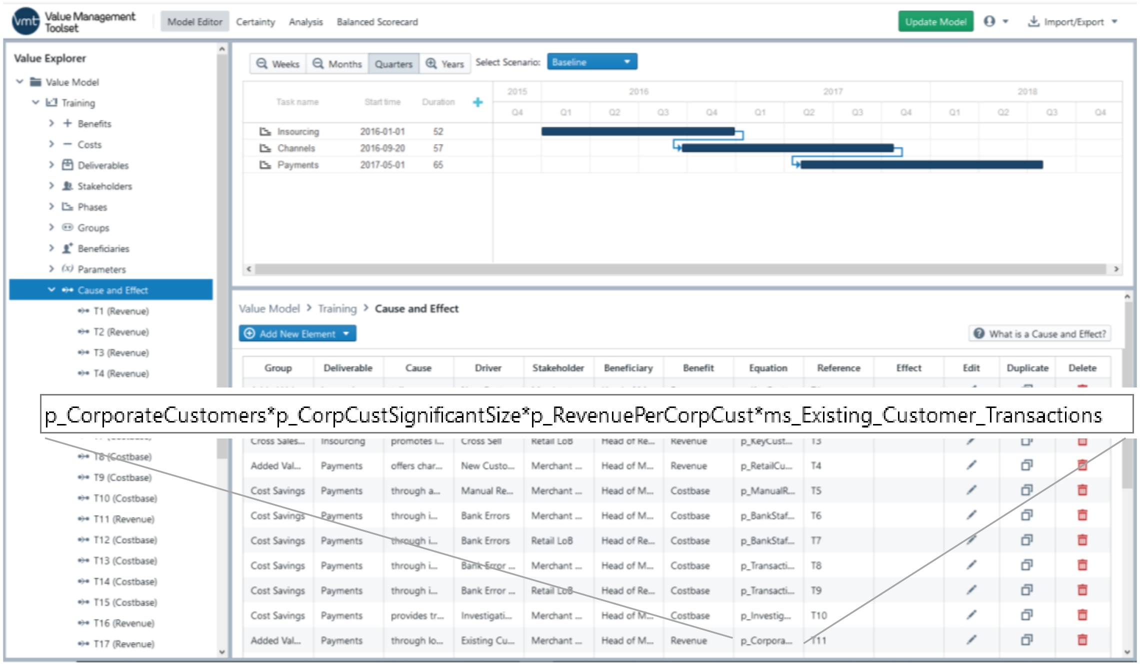

Figure 11.15: Cause and Effect Linkage in the Value Management Toolset™

11.8 Critical Reflection on Research

This section provides a critical reflection on the research from four viewpoints: overall approach, framework, toolset and case studies. For each perspective, critique is divided into what the Author considers to be key successes, together with perceived limitations of the process and results. Limitations are cross-referenced to proposed future research in Table 12.1.under Section 12.4.

11.8.1 Overall Approach

The overall approach centred on exploring corroborative evidence and explanations of fundamental flaws in current frameworks in strategic change programmes to deliver stakeholder value and how these can be corrected through advances in systemic thinking and learning incorporated within value management frameworks

Successes

Action Research and Case Studies as research methods combined particularly well in providing evidence of successful real world application, and also with Critical Realism philosophy as a sound academic foundation for the causal focus.

The combination of dynamics modelling and rapid prototyping using an agile, fail-fast approach delivered contractual commitments whilst providing the opportunity to inject academic rigour through cross-disciplinary teams spanning industry and academia.

More specifically, System Dynamics (SD) and Agent-based Modelling (ABM) were deployed effectively by harnessing their characteristic strengths, rapid conceptualisation and emergent CAS behaviour respectively.

Limitations

Although complementary, SD and ABM models were not explicitly coupled. However, both literature research and practical application through case studies revealed potential added value in integrating modelling paradigms; facilitated by the AnyLogic Software used. This would provide levels of abstraction and multiple perspectives in a single model, together with greater validation and verification. Proposed future research Table 12.1, Item 1.

Despite gaining greater acceptance, Systems Thinking (ST) and dynamics modelling do not enjoy the same widespread use as spreadsheets and Econometrics in key decision making organisations, such as HM Treasury. Intended integration of causal inference principles used in Econometric modelling with causal mapping capabilities of SD was not completed. Proposed future research Table 12.1, Item 2.

11.8.2 Framework

The framework combined key aspects of learning with systemic thinking, most notably learning levels and cycles were mapped to, and extended, the Systems Engineering V-Model to include performance drivers and value outcomes; to enable integration of hard and soft measures.

Successes

A linchpin development concerned coherence between patterns, principles and framework phases. These relationships progressed naturally without shoehorning or manipulation and provided coherent coupling between strategy and execution.

Three measures were developed which explicitly linked hard and soft measures, all applying energy principles and constructed from the elemental building blocks of value as defined in this research: inputs, outputs and outcomes. Value Equation, Value Productivity and Value for Money (VfM) provided a means of integrating hard and soft factors. Injecting the time dimension led to the concept of Value Power.

Limitations

Only the System Eyes BIM case exercised the proposed value measures involving non-financial benefits were presented in any of the case studies and the study client expressed reservation concerning the level of abstraction. Therefore, despite shown to be theoretically and mathematically rigorous, the non-financial stakeholder outcome measures were not proven under real world conditions. Proposed future research Table 12.1, Item 3.

Whilst energy principles, particularly the concept of Transformity because of its close relationship with productivity, were used to develop new value measures, full mapping of energy laws with problem patterns, value principles and framework phases was not completed. Proposed future research Table 12.1, Item 4.

11.8.3 Toolset

The Value Management Toolset™ (Toolset) is designed to capture essential causal dynamics then mange value throughout the programme life with speed and certainty demanded by today's landscape of complexity, scope and pace, by supporting the Value Breakthrough process.

Successes

Constraints of the otherwise proven application, concerning platform, scaling, usability, confinement to financial benefits and linear causal computation were resolved by porting the Toolset to a machine independent browser platform, offering complete scalability, intuitive value model construction and enhanced to support value measures integrating hard and soft factors. Critically, the Toolset can now be linked to dynamics models, essential for fulfilling a full Causal Architecture role.

Limitations

There was no opportunity to track and manage the value measures using the Toolset, supported by dynamics modelling, during implementation; deemed important in proving viability and efficacy of real time management of programme value. Proposed future research Table 12.1, Item 5.

Similarly, the case studies did not provide opportunity to exercise the Toolset and dynamics modelling under Value Breakthrough conditions. Therefore, the capability of the Toolset in enabling population of the entire framework within a single two-day workshop remains unproven. Proposed future research Table 12.1, Item 6.

11.8.4 Case Studies

Two type of case study were deployed. A longitudinal case study facilitated development and testing of the three prerequisite capabilities, whilst generic applicability of the framework was evidenced through cross-sectional case studies.

Successes

For the longitudinal case, successes included supporting a decision not to proceed with Account Number Portability ((ANP), potentially saving the industry £10 billion, using a prediction from the MDM of only marginal, transitory benefit, corroborated by subsequent experience; referenced as evidence under Section 10.2.3 and amplified in Appendix B1.

The io Oil and Gas and KWMC Citizen-led Housing cross-sectional cases both resulted in successful stakeholder outcomes in the form of deliverable models. In the former case, the model not only satisfied io's global client but enabled io to win other strategic assignments as a direct result of capabilities transferred to io. For KWMC, acquired commercial funding was directly attributed to financial viability demonstrated by the model.

Limitations

Conflict of intention was exposed during the longitudinal case study between contractual delivery commitments and critical academic support, discussed in Appendix A1. In effect, this represented energy of difference manifested as conflict, and a prime candidate for resolution by integrating internal and external Learning Journeys. An intended 'before and after' measurement of Learning Power in participants of Value Breakthrough workshops was not undertaken due to time and resource constraints. This is deemed important to evidence efficacy of the process in harnessing energy of difference for value creation. Proposed future research Table 12.1, Item 7.

Although shown as technically possible to incorporate Learning Power as a second, behavioural level of customer segmentation in the MDM, this was conducted as Proof of Concept only. It was concluded that further work is needed, together with exploration of other dispositional characteristic which may predict behaviour more effectively. Proposed future research Table 12.1, Item 8.

11.9 Reflection on Researcher Position

Chapter 5 included a statement of the researcher's position, reflecting upon how it changed through experience and how experience impacted the research process. It is now appropriate to reflect on how the research shifted the Author's position, encapsulated through key insights from the research:

- The market is not a natural phenomenon which self-regulates equitably but a man-made organisation driven by profit and controlled through price
- However, financial price neither assures stakeholder value nor accounts for limited natural resources and these disconnects lead to unsustainability in two ways: inequality and exceeded ecological capacity
- Productivity through technology predominantly accounted for increased economic wealth and reduced poverty but currently limited to outputs which do not necessarily translate into prosperity outcomes, such as wellbeing, or assure equality

- Productivity is limited to the relationship between inputs and outputs, efficiency, whereas value includes effectiveness, relationship between outputs and outcomes; Value Productivity is the product of effectiveness and efficiency
- Change programmes are the principal vehicle for delivering intentional value but around 70% are failing to realise this role equating to a combined direct and opportunity cost of 8% GDP for IT programmes alone
- More specifically, change programmes are failing to harness technology to improve productivity, for the UK offering over 30% headroom in GDP when compared with similar economies

Another manor change in position concerns a shift to academic research and self-learning as the natural first preference when faced with a new challenge, where previously the default would have been to rely upon expert support and formal training.

11.10 Essence

Dynamic Integration concerns causally coupling all change programme disciplines discussed in Chapters 3 and 4, together with deliverable capabilities, in function and time to maximise value creation. A programme is framed as a Value Journey, a process for maturing the Value Power Framework over time, and portfolio as a broader canvas of Value Transformation. The value maturation process both develops and is informed by the Causal Architecture, a form of Digital Twin which is perpetually honed and calibrated to provide an increasingly reliable causal compass for decision making and action.

The Value Power Framework is constructed and populated holistically through Value Breakthrough workshops designed to achieve the unreasonable but plausible by eliciting knowledge using Precise Simplicity, which combines Systems Thinking and Systems Engineering disciplines with advances in neuroscience. Dynamic Integration is supported by the Value Management Toolset™, which covers all aspects of this approach to Value Management, and ensures that any change is reflected causally across the entire programme and portfolio both functionally and in time.

12 Conclusions

This final chapter summarises the research findings and novel contributions.

12.1 Research Summary

An overview of the thesis outlined in Chapter 1 is reshown in Figure 12.1, with numbers denoting chapters. Conclusions are summarised in subsequent paragraphs.

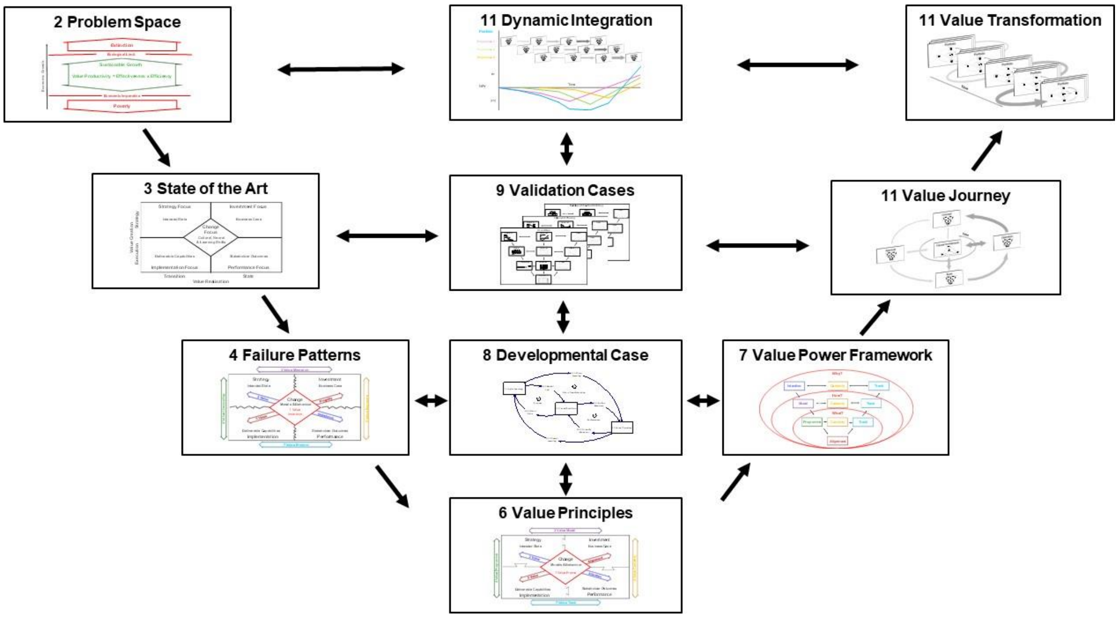

Figure 12.1: Research Overview

The **Problem Space** centres on a persistent failure of programmes, the primary vehicle for effecting significant intentional change, to deliver stakeholder value, together with the opportunity to increase GDP by around 8% by redressing associated wasted resources and lost benefits. A potential source is headroom offered by improving productivity, for the UK 30% below best performing comparable economies, through change programmes harnessing advances in technology. This economic imperative is rendered even more pressing by the COVID-19 pandemic.

However, economic growth must meet two criteria, equitable distribution between stakeholders and sustainability within ecological limits, which invokes the distinction between wealth and prosperity. Whereas wealth primarily concerns monetary value, prosperity includes non-financial wellbeing outcomes, such as health and happiness, essential for a flourishing society. The role of change programmes must be viewed in this context with sustainable and equitable stakeholder value, the relationship between outcomes and inputs, as the highest purpose.

GDP, the principle measure of growth, is a scalar quantity confined to financial transactions related to outputs, which assure neither desired outcomes for, nor equitable distribution across, stakeholders automatically. It follows that complementary vector measures are needed to include both outcome magnitude and direction towards specific stakeholders. The focus on GDP also reflects a broader perpetual conflict between economic positivist and social science interpretivist standpoints, which obscures the need for their integration. To this end, value framed as the transformation of energy provides a foundation for required shifts in mindset, measurement and behaviour.

In their role as strong attractors for behaviour, it is crucial that measures are defined precisely to direct action which causes the transition of purpose into performance. In this vein, three key value-related measures are defined, Value Equation, Value Productivity and Value for Money (VfM), which are constructed from inputs, outputs and outcomes, the components of value.

Critically, the measures encompass financial and non-financial benefits, together with hard tangible measures and soft factors such as stakeholder values. The concept of value power is introduced as the rate stakeholder value is realised, drawn from physics where power is energy per unit of time. Three power-related measures are derived from the previous value relationships: Value Power, Value Productivity Power and VfM Power, providing the means to reflect the time value of not only money but also non-financial outcomes, such as well patients, safe citizens and flourishing communities. Stakeholder specificity injects direction, in addition to magnitude, in all value related measures.

Under current **State of the Art**, change programmes are typically approached from five focus perspectives: Strategy, Investment, Implementation, Performance and Change. Despite some overlap, the views correspond to fraternities which champion each discipline. For example, strategy is the domain of business schools and management consultancy, investment is largely accountancy led, implementation centres on project, programme and portfolio management, performance is grounded in measurement and change emphasises human factors, drawing on culture, neuroscience and learning. The disciplines also reflect generic key temporal stages of a programme, for example the sequence: Concept, Approval, Build and Operation under Management of Change.

Although robust in their own right, the disciplines tend to be deployed as silos, resulting in casual decoupling between strategy and execution in two dimensions, functional and temporal. Functional fragmentation concerns poor integration manifested as weak causal linkage between deliverable capabilities output from the programme with stakeholder outcomes. Temporal fracture relates to erosion of potential value during transition, reflecting inadequate response to shifting circumstances spanning the programme and external environment. Both dimensions are echoed in seven Meta level **Failure Patterns** emanating from flaws in causal thinking and behaviour. Six map to permutations between the first four disciplines, operating under an overall value inversion frame which shapes all other perspectives.

The flaws are redressed through a new value theory comprising **Value Principles**, each corresponding to a failure pattern, synchronised functionally though phases which map to both failure patterns and phases in the **Value Power Framework**.

Experiential and literature research converge around three imperative capabilities for rendering the new theory and framework viable: Agile Learning translates learning into stakeholder value, Causal Precision models Complex Adaptive Systems (CAS) to direct value creation and Causal Certainty is injected through practical measurement.

The first imperative, Agile Learning, is achieved by framing both target domain and programme for effecting change as an integrated Learning Journey, facilitating rapid feedback and correction against purpose. For Causal Precision, dynamic simulation provides the means for modelling CAS by capturing essential hard and soft causal relationships relating to value creation. Causal Certainty is achieved by integrating hard and soft factors quantitatively in the models. All imperative capabilities are evolved, honed and validated using a five year longitudinal **Developmental Case Study** through a systems lens and strong causal emphasis under Critical Realism philosophy.

To be of practical use, the approach must be viable across different domains and contexts. In this vein, the Value Power Framework is validated across three diverse cross-sectional real-world **Validation Case Studies** which evidence generic application.

The first case developed a System Dynamics model to assess commercial viability of extending brownfield gas reservoirs under low price extremes, offering significant cost and time saving against conventional modelling techniques. The second deployment delivered a financial model resulting in successful commercial funding of citizen-led housing. The third study, conducted entirely online, produced a System Dynamics model for multiple stakeholder benefits attributable to Building Information Modelling (BIM). In each case, clients provided evidence of not only general viability but also specific unique value delivered as a direct result of deploying the approach.

In addition to cross-contextual applicability, the Value Management approach must permeate the entire programme and portfolio of change initiatives within an organisation, and beyond, over time. This embedding is called **Dynamic Integration**, defined as the causal coupling of all change programme disciplines and deliverables in function and time to maximise value creation.

The Value Power Framework is populated and updated throughtout the programme life, in particular the four Master Stages: Concept, Approval, Build and Operation, of a Value Journey**,** managed temporally but structured as a cycle to capture the perpetual nature of change. Master Stages also map to the perspectives. For example, Concept invokes strategy, evaluated in Approval as an investment, authorising Build to deliver performance in Operation under a Causal Architecture covering all aspects of change. In addition, rather than a single expedition, the journeys are configured into programme portfolios providing continuous Value Transformation over time.

Crucially, whilst the Value Journey is necessarily navigated over time, the entire framework is completed concurrently and remains populated throughout the journey; including phases concerning future aspects. For example, during the Concept phase where strategy dominates focus, the performance framework is defined and associated measures modelled ‘as-if’ the programme is in full Operation.

This approach demands willingness to accept, and ability to harness, ambiguity. To this end, the framework is developed and populated through Value Breakthrough workshops, for which three conditions must be met: sufficient coverage of entity and disciplines, open mindedness and application of Precise Simplicity.

Precise Simplicity is a fractal process honed through the research comprising four strongly interrelated elements: Frame, Level, Inquisite and Precision (FLIP). Frame concerns specifying the problem correctly. Level ensures that the correct point of power is identified in the causal structure where intervention is most effectively targeted. Inquisite provides robustness to the causal structure by interrogating levels in three directions, up, across and down. Precision uses directed questioning to eliminate erroneous assumptions, inappropriate heuristics and biases, thereby respecting distinctions and linkage between surface level events and deep causal structure.

12.2 Novel Contributions

This thesis delivers seven novel contributions:

Value Measures: Provide the means to define and integrate both hard financial and soft but critical values-based outcomes across multiple stakeholders and manage their rate of delivery; supporting the translation of sustainable economic growth into equitable prosperity.

Value Principles: Integrate change programme disciplines, addressing functional and temporal fractures between perspectives by synergising their strengths and enhancing any specific methods and tools.

Value Power Framework: Synchronises principles, facilitating speed and certainty by aligning all disciplines and stages into a single coherent causal canvas throughout the entire change programme.

Value Journey: Frames the change programme as a Learning Journey undertaken by all stakeholders in a partnership of commitment to mutually reinforcing intentions, as part of a greater story of sustainable and equitable Value Transformation.

Dynamic Integration: Consolidates the Value Management approach by providing causal coupling between all change programme disciplines and deliverables in function and time to maximise value creation.

Precise Simplicity: Provides a practical, learnable process for integrating the speed and creativity of intuition with robust analytical challenge and corroboration across all stages and phases of the Value Management approach.

Value Management Toolset™: Although not submitted as part of this thesis, supports all insights from the research, in particular, Value Breakthroughs in which the entire Value Power Framework is populated during Master Stages of the Value Journey.

12.3 Challenge and Proposition

COVID-19 has brought into sharp focus the opening tenet of this research; a fundamental imbalance between economic growth, equitable distribution of rewards from that growth and capacity of the ecosystem to support it. They are also inextricably linked, those most impacted being the most vulnerable who are also economically critical, such as low paid retail and health workers. In this vein, there is a strong case for a shift from focus on profit to purpose, together with resilience in the face of increasingly frequent and severe shocks. It is increasingly clear that return to a pre-COVID world is both unachievable and undesirable, but the precise nature of the reset remains uncertain. More certain is that conditions allowed to manifest from unchecked circumstances will impose greater distress.

Conversely, there exists an opportunity to affect a shift towards sustainable, equitable growth which creates a flourishing society, by harnessing technological breakthroughs deployed effectively using advances across neuroscience and learning. However, this realisation demands a step change in the capability of change programmes to transform potential into stakeholder value. The headroom is there. Current failure rates equate to around 8% GDP for IT programmes alone. If directed to productivity, potential improvement for the UK raises to 30% GDP, based on the gap with comparative economies. It is proposed that Value Productivity, which combines efficiency and effectiveness to integrate economy with prosperous wellbeing, provides a basis to realise this potential and can be implemented through the Value Management approach developed in this research.

12.4 Proposed Future Research

This final section proposes potential future research aligned with the title and purpose of this work in focusing upon strengthening actual delivery of stakeholder value from change programmes. Although all work can be conducted in parallel, the threads are mapped in Table 12.1 to limitations referenced in Section 11.8: items 1 and 2 the overall approach, items 3 and 4 the framework, items 5 and 6 the toolset and items 7 and 8 case studies. Real world case studies are proposed for all work with the aim of combining a proven approach with rapid, practical real world application.

Table 12.1: Proposed Future Research

Proposed Research	Case Description	Purpose
1. Integration of dynamics modelling paradigms for Complex Adaptive Systems (CAS)	Programme involving a CAS, such as market, city or society involving requirement for predictive capability	Evidence two things: viability of integrating modelling paradigms and increased predictive certainty of stakeholder value delivery
2. Integration of systemic and econometric modelling through causal inference	Programme directed through a Causal Architecture in which core relationships within the underlying dynamics model are corroborated using causal inference	Evidence efficacy of combining the strengths of Systems Thinking and dynamics modelling with Causal Inference and Econometric Modelling
3. Case study research to stress test new Value Measures, e.g. Value Productivity, Value for Money and Value Power	Programme incorporating dependent hard financial and soft non-financial intended outcomes, e.g. health trust refresh combining high success rates delivered through cost efficient services	Evidence realising mutually supportive sustainable and resilient stakeholder intentions by integrating hard and soft performance and outcome measures

Proposed Research	Case Description	Purpose
4. Case studies exploring explicit linkage between energy laws, system archetypes and Value Principles	Programmes providing opportunities to develop the new theory and framework to include explicit quantitative integration of energy, causality and value	Evidence practical application to increase agility and resilience through resourcefulness by optimising energy transformation into value
5. Longitudinal case study research for Value Integration incorporating Value Measures	Programme directed through a Causal Architecture comprising a dynamics model perpetually updated with, and calibrated against, real data	Evidence practical feasibility of real-time Programme, Business and Value Performance Management, integrating RtB and CtB
6. Case study research for Value Breakthroughs incorporating causal modelling	Programme at Concept Stage involving a new business model or similar strategic transformation	Evidence feasibility and effectiveness of populating the entire Value Power Framework, coupling strategy and execution in a 2-day Value Breakthrough workshop
7. Before and after application of Learning Power for integrating internal and external Learning Journeys	Programme initiated and managed as a Value Journey using Value Breakthrough workshops in which Learning Power of programme stakeholder partners is actively measured, tracked and improved	Evidence two things: impact on Learning Power of partners and impact of increased Learning Power on efficacy of the programme to deliver stakeholder value
8. Explore behavioural influence of Learning Power and other dispositional criteria	Programme offering opportunity to measure the impact on value realisation through increased Learning Power and other dispositional criteria	Evidence the impact on stakeholder ability to realise value from programme deliverables as a result of behavioural shifts

References

ACKOFF, R. L. (1978). *The art of problem solving: Accompanied by Ackoff's fables*, Wiley New York.

ACKOFF, R. L., ACKOFF, R. L. & EMERY, F. E. (2005). *On purposeful systems: An interdisciplinary analysis of individual and social behavior as a system of purposeful events*, Transaction Publishers.

ACKOFF, R. L., ADDISON, H. J. & BIBB, S. (2007). *Management F-laws: How organizations really work*, Triarchy Press Limited.

ADAM COBB, J. (2016). How firms shape income inequality: Stakeholder power, executive decision making, and the structuring of employment relationships. *Academy of Management Review,* 41**,** 324-348.

ADELMAN, C. (1993). Kurt Lewin and the origins of action research. *Educational action research,* 1**,** 7-24.

AGRAWAL, A., GANS, J. & GOLDFARB, A. (2018). *Prediction Machines: The simple economics of artificial intelligence*, Harvard Business Press.

AL NEIMAT, T. (2005). Why IT projects fail. *The project perfect white paper collection,* 1**,** 1-8.

ALAMI, A. (2016). Why do Projects Fail? *PM World Journal,* 5**,** 1-9.

AMERICAN ECONOMIC ASSOCIATION. (2017a). *Journal of Economic Literature* [Online]. Available: https://www.aeaweb.org/journals/jel [Accessed 15/11/2017].

AMERICAN ECONOMIC ASSOCIATION. (2017b). *Journal of Economic Perspectives* [Online]. Available: https://www.aeaweb.org/journals/jep [Accessed 15/11/2017].

AMIN, S. M., AHMAD, U. N. U. & HUI, L. S. (2012). Factors contributing to customer loyalty towards telecommunication service provider. *Procedia-Social and Behavioral Sciences,* 40**,** 282-286.

ANBARI, F. T. (2003). Earned value project management method and extensions. *Project management journal,* 34**,** 12-23.

ANDERSEN, A. & FAULBECKER, N. (2012). Our Understanding of Next Generation's Target Operating Models. *Cass-Capco Institute Paper Series on Risk***,** 149.

ANDERSON, C. (2008). The end of theory: The data deluge makes the scientific method obsolete. *Wired magazine,* 16**,** 16-07.

ANYLOGIC (2018). An introduction to digital twin development.

APM (2012). *APM Body of Knowledge. 6th edn.,* UK, Association for Project Management,.

APM. (2019). *Introduction to Governance* [Online]. Available: https://www.apm.org.uk/body-of-knowledge/context/governance/ [Accessed 11/07/2019].

APPELBAUM, S. H., LAVIGNE-SCHMIDT, S., PEYTCHEV, M. & SHAPIRO, B. (1999). Downsizing: measuring the costs of failure. *Journal of Management Development,* 18**,** 436-463.

ARCHER, M., BHASKAR, R., COLLIER, A., LAWSON, T. & NORRIE, A. (1998). *Critical realism: Essential readings,* London, Routledge.

ARGYRIS, C. (1976). Single-loop and double-loop models in research on decision making. *Administrative science quarterly*, 363-375.

ARGYRIS, C. & SCHÖN, D. (1978). *Organizational learning: A theory of action perspective,* Reading, MA, Addison-Wesley.

ARGYRIS, C. & SCHON, D. A. (1974). *Theory in practice: Increasing professional effectiveness*, Jossey-Bass.

ARIELY, D. (2010). You are what you measure. *Harvard Business Review,* 88**,** 38.

ARRKGROUP. (2015). *Fail Fast Fail Often Explained* [Online]. Available: https://www.arrkgroup.com/thought-leadership/fail-fast-fail-often-explained/ [Accessed 06/03/2018].

ARTHUR, W. B. (1990). Positive feedbacks in the economy. *Scientific American,* 262**,** 92-99.

ARTHUR, W. B. (1999). Complexity and the economy. *science,* 284**,** 107-109.

ASHBY, R. (1952). *Design for a Brain,* London, Chapman and Hall.

ASHBY, R. (1956). *An introduction to cybernetics,* New York, Wiley.

ASHBY, W. R. (1991). Requisite variety and its implications for the control of complex systems. *Facets of Systems Science.* Springer.

ASHBY, W. R. & GOLDSTEIN, J. (2011). Variety, constraint, and the law of requisite variety. *Emergence: Complexity and Organization,* 13**,** 190.

ASSAGIOLI, R. (1994). *The act of will*, Aquarian Press.

ATKINSON, P. E. (1990). *Creating culture change*, IFS.

ATKINSON, S. R. & MOFFAT, J. (2005). The agile organization: From informal networks to complex effects and agility. ASSISTANT SECRETARY OF DEFENSE (C3I/COMMAND CONTROL RESEARCH PROGRAM ….

AXELOS (2013). *PRINCE2 Pocketbook,* Norwich, TSO.

AXELROD, R. (1990). *The Evolution of Co-operation,* Lodon, Penguin.

AXELROD, R. & HAMILTON, W. D. (1981). The evolution of cooperation. *science,* 211**,** 1390-1396.

AXELROD, R. M. (1997). *The complexity of cooperation: Agent-based models of competition and collaboration*, Princeton University Press.

BAARS, B. J. & GAGE, N. M. (2013). *Fundamentals of cognitive neuroscience: a beginner's guide*, Academic Press.

BACS (2016a). Annual report and financial statements 2016.

BACS (2016b). ANP market impact assessment V1.0.

BACS (2016c). Current Account Switch Service Making Account Switching Easier. London: Bacs.

BACS (2016d). Customer Engagement in the Current Account Market: A Better Functioning Market.

BACS (2016e). Customer Engagement in the Current Account Market: Trust Loop.

BACS (2016f). Customer Engagement in the Current Account Market: Why people don't switch current accounts. London: Bacs.

BACS (2017a). Interventions to foster an effective and competitive ca market.

BACS (2017b). What Constitutes an Effective and Competitive Current Account Market.

BACS (2018). Consumer Switching

BALAJI, S. & MURUGAIYAN, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management,* 2**,** 26-30.

BALDWIN, R. (2006). Globalisation: the great unbundling (s). *Economic Council of Finland,* 20**,** 5-47.

BALDWIN, R. (2016). *The Great Convergence*, Harvard University Press.

BALLARD, T., YEO, G., LOFT, S., VANCOUVER, J. B. & NEAL, A. (2016). An integrative formal model of motivation and decision making: The MGPM*. *Journal of Applied Psychology,* 101**,** 1240.

BANDLER, R. & GRINDER, J. (1976). *The structure of magic*, Science and Behavior Books Palo Alto, CA.

BANDLER, R. & GRINDER, J. (1982). *Reframing: Neuro-linguistic programming and the transformation of meaning*, Real People Press.

BARCLAY, W. (1975). *The Gospel of Matthew. In 2 Vols*, Saint Andrew Press.

BARRY, B. (2018). *Extra money for UK military innovation, but hard choices put off* [Online]. Available: https://www.iiss.org/blogs/analysis/2018/12/uk-military [Accessed 18/11/2019].

BARTUŠEVIČIENĖ, I. & ŠAKALYTĖ, E. (2013). Organizational assessment: effectiveness vs. efficiency. *Social Transformations in Contemporary Society,* 1**,** 45-53.

BATESON, G. (1972). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*, University of Chicago Press.

BEAUTEMENT, P. & BROENNER, C. (2011). *Complexity demystified: a guide for practitioners,* UK, Triarchy Press Limited.

BECK, D. E. & COWAN, C. (2014). *Spiral dynamics: Mastering values, leadership and change*, John Wiley & Sons.

BECK, K. (2003). *Test-driven development: by example*, Addison-Wesley Professional.

BEER, M. & NOHRIA, N. (2000). Cracking the code of change. *HBR's 10 Must Reads on Change***,** 88.

BEER, S. (1979). *The heart of enterprise*, John Wiley & Sons.

BEER, S. (1984). The Viable System Model: Its Provenance, Development, Methodology and Pathology. *Journal of the Operational Research Society,* 35**,** 7-25.

BEER, S. (1985). *Diagnosing the system for organizations*, John Wiley & Sons Inc.

BEER, S. (1994). *Brain of the Firm. 2nd edn.,* England, Wiley.

BEIGI, S. & TAYLOR, C. (2017). Resilient agent. *Draft research paper*.

BELBIN, R. M. (2004). *Management teams: Why they succeed or fail. 2nd edn.,* Oxford, Routledge.

BELLET, C., DE NEVE, J. E. & WARD, G. (2019). Does employee happiness have an impact on productivity? *Saïd Business School WP,* 13.

BENTLEY, C. (2010). *PRINCE2™ Revealed. 2nd ed.,* Oxford, Elsevier.

BHASKAR, R. (1998). Philosophy and Scientific Realism. *Critical realism: Essential readings.* London: Routledge.

BHASKAR, R. (2008). *A realist theory of science,* UK, Routledge.

BHASKAR, R. (2013). *Reflections on MetaReality: Transcendence, Emancipation and Everyday Life*, Routledge.

BINDER, M. & EDWARDS, J. S. (2010). Using grounded theory method for theory building in operations management research: A study on inter-firm relationship governance. *International Journal of Operations & Production Management,* 30**,** 232-259.

BITITCI, U. S., TURNER, U. & BEGEMANN, C. (2000). Dynamics of performance measurement systems. *International Journal of Operations & Production Management,* 20**,** 692-704.

BIZIBLE. (2018). *Core competencies of the marketing operations leaderk* [Online]. Available: https://www.bizible.com/blog/what-is-adaptive-analytics [Accessed 01/`10/2018].

BLASTLAND, M. & DILNOT, A. W. (2007). *The tiger that isn't: seeing through a world of numbers,* London, Profile books.

BLENKO, M., GARTON, E., MOTTURA, L. & WRIGHT, O. (2014). Winning operating models that convert strategy to results. *Bain Company***,** 1-8.

BLOCKLEY, D. I. & GODFREY, P. (2000). *Doing it differently: systems for rethinking construction*, Thomas Telford.

BLOKDYK, G. (2018). *Destructive testing: The Ultimate Step-By-Step Guide*, The Art of Science.

BOE. (2016). *New bank startup unit launched by the financial regulators* [Online]. Available: https://www.bankofengland.co.uk/news/2016/january/new-bank-startup-unit-launched-by-the-financial-regulators [Accessed 06/10/2018].

BORSHCHEV, A. (2013). *The big book of simulation modeling: multimethod modeling with AnyLogic 6*, AnyLogic North America Chicago.

BOULTON, J. G., ALLEN, P. M. & BOWMAN, C. (2015). *Embracing complexity: Strategic perspectives for an age of turbulence*, OUP Oxford.

BOURNE, M., KENNERLEY, M. & FRANCO-SANTOS, M. (2005). Managing through measures: a study of impact on performance. *Journal of manufacturing technology management,* 16**,** 373-395.

BOWLES, S. (2017). *Samuel Bowles* [Online]. Available: https://scholar.google.co.uk/citations?user=GAxYUdgAAAAJ&hl=en [Accessed 15/11/2017].

BOWMAN, C. (1990). *The essence of strategic management,* UK, Prentice Hall.

BRADBURY-HUANG, H. (2010). What is good action research? Why the resurgent interest? *Action Research,* 8**,** 93-109.

BRADLEY, G. (2010). *Benefit Realisation Management: A practical guide to achieving benefits through change. 2nd edn*, Gower.

BRADSHAW, A. (2018). Interview with Anita Bradshaw : State of the Art Value Frame. *In:* DAVIES, R. (ed.).

BRAILSFORD, S., CHURILOV, L. & DANGERFIELD, B. (2014). *Discrete-event simulation and system dynamics for management decision making*, John Wiley & Sons.

BRIDGES, W. (1996). Jobshift: How to prosper in a workplace without jobs. Oxford University Press.

BRINGSJORD, S., BELLO, P. & FERRUCCI, D. (2003). Creativity, the Turing test, and the (better) Lovelace test. *The Turing Test.* Springer.

BROWN, B. J., HANSON, M. E., LIVERMAN, D. M. & MERIDETH, R. W. (1987). Global sustainability: toward definition. *Environmental management,* 11**,** 713-719.

BRYDON-MILLER, M., GREENWOOD, D. & MAGUIRE, P. (2003). Why action research? : Sage Publications.

BRYNJOLFSSON, E. (1993). The productivity paradox of information technology. *Communications of the ACM,* 36**,** 66-77.

BRYSON, J. M., ACKERMANN, F., EDEN, C. & FINN, C. B. (2004). *Visible thinking: Unlocking causal mapping for practical business results*, John Wiley & Sons.

BUGLIONE, L. & ABRAN, A. (Year) Published. Measurement process: improving the ISO 15939 standard. Software Measurement and the International Conference on Software Process and Product Measurement (IWSM-MENSURA), 2014 Joint Conference of the International Workshop on, 2014. IEEE, 136-140.

BULL, R. J. (1974). *Accounting in business. 2nd Edn.,* London, Butterworth.

BUSINESS DICTIONARY. (2015a). *Definition of Objective* [Online]. Available: http://www.businessdictionary.com/definition/objective.html [Accessed 14/03/2015].

BUSINESS DICTIONARY. (2015b). *Definition of Values* [Online]. Available: http://www.businessdictionary.com/definition/values.html [Accessed 02/03/2019].

BUSINESS DICTIONARY. (2016a). *Definition of Policy* [Online]. Available: http://www.businessdictionary.com/definition/policy.html [Accessed 04/04/2019].

BUSINESS DICTIONARY. (2016b). *Definition of Productivity* [Online]. Available: http://www.businessdictionary.com/definition/productivity.html [Accessed 24/08/2018].

BUSINESS DICTIONARY. (2017a). *Definition of Economics* [Online]. Available: http://www.businessdictionary.com/definition/economics.html [Accessed 14/11/2017].

BUSINESS DICTIONARY. (2017b). *Definition of Prosperity* [Online]. Available: http://www.businessdictionary.com/definition/prosperity.html [Accessed 20/09/2017].

BUSINESS DICTIONARY. (2019a). *Definition of Effectiveness* [Online]. Available: http://www.businessdictionary.com/definition/effectiveness.html [Accessed 29/10/2019].

BUSINESS DICTIONARY. (2019b). *Definition of Efficiency* [Online]. Available: http://www.businessdictionary.com/definition/efficiency.html [Accessed 29/10/2019].

BUSINESS DICTIONARY. (2019c). *Definition of Input* [Online]. Available: http://www.businessdictionary.com/definition/inputs.html [Accessed 24/04/2019].

BUSINESS DICTIONARY. (2019d). *Definition of Mental Model* [Online]. Available: http://www.businessdictionary.com/definition/mental-models.html [Accessed 01/08/2019].

BUSINESS DICTIONARY. (2019e). *Definition of Output* [Online]. Available: http://www.businessdictionary.com/definition/output.html [Accessed 24/04/2019].

BUSINESS DICTIONARY. (2019f). *Definition of Spillovers* [Online]. Available: http://www.businessdictionary.com/definition/spillover-effect.html [Accessed 23/10/2019].

BUSINESS DICTIONARY. (2019g). *Definition of Strategy* [Online]. Available: http://www.businessdictionary.com/definition/strategy.html [Accessed 04/04/2019].

BUSINESS DICTIONARY. (2019h). *Definition of Supply Chain* [Online]. Available: http://www.businessdictionary.com/definition/supply-chain.html [Accessed 08/05/2019].

BYRNE, R. (2008). *The secret*, Simon and Schuster.

CALVO-MORA, A., LEAL, A. & ROLDÁN, J. L. (2005). Relationships between the EFQM model criteria: a study in Spanish universities. *Total quality management & business excellence,* 16**,** 741-770.

CAMBRIDGE DICTIONARY. (2018a). *Definition of Loyalty* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/loyalty [Accessed 18/09/2018].

CAMBRIDGE DICTIONARY. (2018b). *Definition of Risk* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/risk [Accessed 18/09/2018].

CAMBRIDGE DICTIONARY. (2019a). *Definition of Convergence* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/convergence [Accessed 24/10/2019].

CAMBRIDGE DICTIONARY. (2019b). *Definition of Efficacy* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/efficacy [Accessed 29/10/2019].

CAMBRIDGE DICTIONARY. (2019c). *Definition of Important* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/important [Accessed 27/09/2019].

CAMBRIDGE DICTIONARY. (2019d). *Definition of Integrity* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/integrity [Accessed 31/07/2019].

CAMBRIDGE DICTIONARY. (2019e). *Definition of Redundancy* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/redundancy [Accessed 05/06/2019].

CAMBRIDGE DICTIONARY. (2019f). *Definition of Usefulness* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/usefulness [Accessed 27/09/2019].

CAMBRIDGE DICTIONARY. (2019g). *Definition of Value* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/value [Accessed 26/09/2019].

CAMBRIDGE DICTIONARY. (2019h). *Definition of Waste* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/waste [Accessed 05/06/2019].

CAMBRIDGE DICTIONARY. (2019i). *Meaning of Affordance* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/affordance [Accessed 07/02/2019].

CAMBRIDGE DICTIONARY. (2019j). *Meaning of Purpose* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/purpose [Accessed 17/02/2019].

CAMBRIDGE DICTIONARY. (2020a). *Definition of Income* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/income [Accessed 31/07/2020].

CAMBRIDGE DICTIONARY. (2020b). *Definition of Wealth* [Online]. Available: https://dictionary.cambridge.org/dictionary/english/wealth [Accessed 31/07/2020].

CAMPBELL, D. (2019). *The Many Errors that Brought Down the Boeing 737 Max* [Online]. The Verge. Available: https://www.theverge.com/2019/5/2/18518176/boeing-737-max-crash-problems-human-error-mcas-faa [Accessed 22/05/2019].

CAMPBELL, J. (1993). *The hero with a thousand faces,* London, Fontana Press.

CAPRA, F. (1982). *The Tao of physics: An exploration of the parallels between modern physics and eastern mysticism, 3rd edn.,* London, Flamingo.

CAPRA, F. (1996). *The web of life: A new synthesis of mind and matter*, HarperCollins.

CARROLL, J. (2012). *Agile project management in easy steps*, In Easy Steps.

CAUSTON, R. (1995). *The Buddha in daily life: an introduction to the Buddhism of Nichiren Daishonin*, Random House.

CEIC. (2019). *United Kingdom Private Consumption: % of GDP* [Online]. Available: https://www.ceicdata.com/en/indicator/united-kingdom/private-consumption--of-nominal-gdp [Accessed 19/10/2019].

CENTRE FOR SOCIAL INVESTIGATION (2018). CSI Brexit 4: People's Stated Reasons for Voting Leave or Remain.

CHANDLER, D. (2014). *Resilience: The governance of complexity*, Routledge.

CHANG, H.-J. (2011). *23 things they don't tell you about capitalism*, Penguin.

CHARMAZ, K. & BELGRAVE, L. L. (2007). Grounded theory. *The Blackwell encyclopedia of sociology*.

CHARVET, S. R. (1997). *Words that change minds: Mastering the language of influence*, Author's Choice Publishing.

CHECKLAND, P. (2000). Soft systems methodology: a thirty year retrospective. *Systems research and behavioral science,* 17**,** S11.

CHERNOZHUKOV, V., FERNÁNDEZ-VAL, I., NEWEY, W., STOULI, S. & VELLA, F. (2017). Semiparametric Estimation of Structural Functions in Nonseparable Triangular Models. *arXiv preprint arXiv:1711.02184*.

CHOMSKY, N. (2014). *Aspects of the Theory of Syntax*, MIT press.

CHOO, J. (2017). *How to design a Target Operating Model (TOM) that delivers* [Online]. The Strategy Journey. Available: https://strategyjourney.com/2017/03/02/target-operating-model-that-delivers/ [Accessed 24/07/2019].

CHRISTENSEN, C. (2013a). *Clay Christensen Talks About The Innovator's Dilemma at IMD* [Online]. Available: https://www.youtube.com/watch?v=JKH-Nak9nK4 [Accessed].

CHRISTENSEN, C. (2013b). *Clayton Christensen: Disruptive innovation* [Online]. Available: https://www.youtube.com/watch?v=rpkoCZ4vBSI [Accessed].

CHRISTENSEN, C. M. (2003). *The innovator's dilemma: The revolutionary book that will change the way you do business*, HarperBusiness Essentials New York, NY.

CLAXTON, G. (2002). *Building learning power*, TLO Limited Bristol.

CMA (2016a). Retail banking market investigation Final Report.

CMA (2016b). Retail banking market investigation: Summary of final report.

CMA. (2018). *About Us* [Online]. Available: https://www.gov.uk/government/organisations/competition-and-markets-authority/about#responsibilities [Accessed 06/09/2018].

COCCA, P. & ALBERTI, M. (2010). A framework to assess performance measurement systems in SMEs. *International Journal of Productivity and Performance Management,* 59**,** 186-200.

COKINS, G. (2001). *Activity-based cost management: an executive's guide*, John Wiley & Sons.

COLLIER, A. (1994). *Critical Realism: An Introduction to Roy Bhaskar's Philosophy*, Verso.

COLLINS DICTIONARY. (2015). *Definition of Outcome* [Online]. Available: https://www.collinsdictionary.com/dictionary/english/outcome [Accessed 21/04/2015].

COLLINS DICTIONARY. (2020). *Definition of Causality* [Online]. Available: https://www.collinsdictionary.com/dictionary/english/causality [Accessed 02/06/2020].

COLLINS, J. (2001). *Good to Great: Why Some Companies Make the Leap and others Don't,* London, Random House.

COLLINS, J. (2009). *How the mighty fall: And why some companies never give in,* London, Random House.

COLLINS, J. (2018). Interview with Jon Collins: Problem Space Value Potential. *In:* DAVIES, R. (ed.).

COLLIS, J. & HUSSEY, R. (2009). *Business research: A practical guide for undergraduate and postgraduate students, 3rd edn.,* Hampshire, UK, Palgrave macmillan.

COOPER, R. & KAPLAN, R. S. (1988). Measure costs right: make the right decisions. *Harvard business review,* 66**,** 96-103.

CORE, D. & PIECKIELON, A. (2018). Interview with David Core and Anne Pieckielon: Bacs Case Study. *In:* DAVIES, R. (ed.).

COVENEY, M., GANSTER, D., HARTLEN, B. & KING, D. (2003). *The strategy gap: Leveraging technology to execute winning strategies*, John Wiley & Sons.

COVEY, S. R. (1992). *The 7 habits of highly effective people: Powerful lessons in personal change*, Simon and Schuster.

COWAN, C. C. & TODOROVIC, N. (2000). Spiral dynamics: the layers of human values in strategy. *Strategy & Leadership,* 28**,** 4-12.

COWAN, C. C. & TODOROVIC, N. (2005). *The Never Ending Quest: A Treatise on an Emergent Cyclical Conception of Adult Behavioral Systems and Their Development: Clare W. Graves Explores Human Nature*, ECLET.

COX, S. (2018). Extending the Enterprise to Close the Performance Gap in the Built Environemnt. *MainTrain 2018.* Ottawa.

COX, S. (2019a). *Better Integration Management for the Built Environment, pt.1* [Online]. Available: https://exchange.iseesystems.com/public/sebcox/better-integration-management-for-the-built-environment-part-one/index.html#page1 [Accessed 27/05/2019].

COX, S. (2019b). *Better Integration Management for the Built Environment, pt.3* [Online]. Available: https://exchange.iseesystems.com/public/sebcox/better-integration-management-for-the-built-environment-part-three/index.html#page1 [Accessed 27/05/2019].

COX, S. (2019c). Causal Insight in Technology and Innovation Benefits Forecasting and Realization. *Canadian Network of Asset Managers, May 6-9, 2019.* Kelowna, Canada.

COX, S. & DAVIES, R. (2019). *Better Integration Management for the Built Environment, pt.2* [Online]. Available: https://exchange.iseesystems.com/public/sebcox/better-integration-management-for-the-built-environment-part-two/index.html#page1 [Accessed 27/05/2019].

COYLE, D. (2015). *GDP: A brief but affectionate history*, Princeton University Press.

COYLE, D. (2018). *The culture code: The secrets of highly successful groups*, Bantam.

CRAIG, D. (2005). *Rip off*, Original Book Company.

CRAIG, D. (2008). *Squandered,* London, Constable.

CRAIG, D. & BROOKS, R. (2006). *Plundering the public sector,* London, Constable.

CRICK, D. (2016). *Learning Analytics and Educational Leadership* [Online]. Available: https://ruthdeakincrick.net/ [Accessed 29/06/2017].

CRICK, R. D. (2009). Inquiry-based learning: reconciling the personal with the public in a democratic and archaeological pedagogy. *The Curriculum Journal,* 20**,** 73-92.

CRICK, R. D. (2017). Learning Analytics: Layers, Loops and Processes in a Virtual Learning Infrastructure. *Handbook of Learning Analytics.* Solar.

CRICK, R. D., STRINGHER, C. & REN, K. (2014). *Learning to Learn: International perspectives from theory and practice*, Routledge.

CROSS, J. (2011). *Informal learning: Rediscovering the natural pathways that inspire innovation and performance*, John Wiley & Sons.

CROWE, S., CRESSWELL, K., ROBERTSON, A., HUBY, G., AVERY, A. & SHEIKH, A. (2011). The case study approach. *BMC medical research methodology,* 11**,** 100.

CRUICKSHANK, D. (2000). Competition in uk banking. London: HMSO.

CSIKSZENTMIHALYI, M. (1990). *Flow: The Psychology of Optimal Experience*.

DAILY TELEGRAPH. (2008). *Home Secretary Jacqui Smith apologises over knife crime figures* [Online]. Available: https://www.telegraph.co.uk/news/uknews/3777808/Home-Secretary-Jacqui-Smith-apologises-over-knife-crime-figures.html [Accessed 23/04/2019].

DAILY TELEGRAPH. (2013). *Stafford Hospital scandal: the victims who died needlessly* [Online]. Available: https://www.telegraph.co.uk/news/health/heal-our-hospitals/9782478/Stafford-Hospital-scandal-the-victims-who-died-needlessly.html [Accessed 23/04/2019].

DALLAS, M. (2010). *Management of Value*, TSO (The Stationary Office).

DAVIES, R. (1989). *The Development and Implementation of a Five Year Plan for Computer Integrated Manufacturing.* MBA, IMCB.

DAVIES, R. (2018). Bacs Model Causal Tracing Document V6.2. Impact Dynamics Limited and University of Bristol.

DAVIES, R. H. & DAVIES, A. J. (2011). *Value management: Translating aspirations into performance,* Farnham, UK, Gower Publishing, Ltd.

DAWKINS, R. (1989). *The Selfish Gene. New Edn.,* UK, Oxford University Press.

DE REUVER, M., NIKOU, S. & BOUWMAN, H. (2015). The interplay of costs, trust and loyalty in a service industry in transition: The moderating effect of smartphone adoption. *Telematics and Informatics,* 32**,** 694-700.

DEAKIN CRICK, R., CHRISTENSON, S., RESCHLY, A. & WYLIE, C. (2012). *Student Engagement: Identity, Learning Power and Enquiry-A Complex Systems Approach,* New York, Springer.

DEAKIN CRICK, R., CRICK, T. & SEABROOK, R. (2017a). The Learning Journey Platform. Learning Emergence.

DEAKIN CRICK, R. & GOLDSPINK, C. (2014). Learner Dispositions, Self-Theories and Student Engagement. *British Journal of Educational Studies,* 62**,** 19-35.

DEAKIN CRICK, R., HUANG, S., AHMED SHAFI, A. & GOLDSPINK, C. (2015). Developing Resilient Agency in Learning: The Internal Structure of Learning Power. *British Journal of Educational Studies,* 63**,** 121-160.

DEAKIN CRICK, R., HUANG, S., GODFREY, P., TAYLOR, C. & CARHART, N. (2017b). Learning Journeys and Infrastructure Services: A Game Changer for Effectiveness (advanced copy). InT. Dolan, & B. Collins (Eds.). London.

DEBELAK, D. (2006). *Business models made easy*, Entrepreneur Press.

DECI, E. L. & RYAN, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie canadienne,* 49**,** 14.

DEFAQTO (2016). A review of personal current accounts.

DEMING, W. E. (1982). *Out of the Crisis*, MIT press.

DEMING, W. E. (1994). *The new economics: for industry, government, education*, MIT press.

DENNING, S. (2006). Effective storytelling: strategic business narrative techniques. *Strategy & Leadership,* 34**,** 42-48.

DENT, H. (2018). *The Dent Method* [Online]. Available: https://dentresearch.com/the-dent-method/ [Accessed 19/10/2019].

DEVADIGA, N. M. (Year) Published. Tailoring architecture centric design method with rapid prototyping. 2017 2nd International Conference on Communication and Electronics Systems (ICCES), 2017. IEEE, 924-930.

DEVAUX, S. A. (1999). *Total project control: A manager's guide to integrated project planning, measuring, and tracking*, Wiley New York.

DEVAUX, S. A. (2015). *Managing projects as investments: earned value to business value,* FL, CRC press.

DEVI, T. R. & REDDY, V. S. (2012). Work breakdown structure of the project. *Int J Eng Res Appl,* 2**,** 683-686.

DIFFEN. (2014). *Mission Statement vs Vision Statement* [Online]. Available: http://www.tellcarole.com/uploads/7/6/8/2/7682161/mission_statement_vs_vision_statement_-_difference_and_comparison__diffen_copy.pdf [Accessed 14/03/2019].

DILTS, R. (1990). *Changing belief systems with NLP*, Meta Publications.

DILTS, R. & DELOZIER, J. (2000). *Encyclopedia of Systemic Neuro-Linguistic Programming and NLP New Coding*, NLP University Press.

DIXON, R. (1983). *Financial Management,* Bath, Pitman.

DOERR, J. (2018). *Measure What Matters: OKRs: The Simple Idea that Drives 10x Growth*, Penguin UK.

DOLAN, K. (2018). *Implementing Project and Program Benefit Management*, Auerbach Publications.

DOMINGOS, P. (2015). *The master algorithm: How the quest for the ultimate learning machine will remake our world*, Penguin.

DOOLEY, K. J. (1997). A complex adaptive systems model of organization change. *Nonlinear dynamics, psychology, and life sciences,* 1**,** 69-97.

DRISCOLL, M. P. & DRISCOLL, M. P. (2005). Psychology of learning for instruction.

DRUCKER, P. F. (2001). The Essential Drucker: the pre-eminent management thinker of our time. *Great Britain: Butterworth-Heinemann*.

DRUCKER, P. F. (2006). The Effective Executive: The Definitive Guide to Getting the Right Things Done (Harperbusiness Essentials). *New York: Collins*.

DU SAUTOY, M. (2019). *The Creativity Code: Art and Innovation in the Age of AI*, Belknap Press.

DUDMAN, J. (2016). Why the UK is failing on infrastructure, the cornerstone of Tory policy. *Guardian*, 06/01/2016.

DUNBAR, G. (2016). *Project Management Failures - Standish (Chaos) reports (1994-2015)* [Online]. Available: https://www.linkedin.com/pulse/project-management-failures-standish-chaos-report-2015-dunbar [Accessed 26/06/2017].

DUSCHINSKY, P. (2009). *The Change Equation: Ho to identify and overcome the real barriers to organisational change,* UK, Management Books.

DUTCHVOLVOFAN. (2009). *Trent 900 Destruction Test* [Online]. Available: https://www.youtube.com/watch?v=9m7zRLJEIvw [Accessed 31/07/2019].

DYSON, J. R. (1994). *Accounting for non-accounting students. 3rd Edn.,* London, Pitman.

ECONOMIST. (2016). *How to measure prosperity* [Online]. Available: https://www.economist.com/news/leaders/21697834-gdp-bad-gauge-material-well-being-time-fresh-approach-how-measure-prosperity [Accessed 22/11/2017].

ECONOMIST (2018). Show me the Money. *The Economist, September 1st 2018***,** 12.

EDMONDSON, A. C. (2012). *Teaming: How organizations learn, innovate, and compete in the knowledge economy*, John Wiley & Sons.

EL-MANSTRLY, D., PATON, R., VELOUTSOU, C. & MOUTINHO, L. (2011). An empirical investigation of the relative effect of trust and switching costs on service loyalty in the UK retail banking industry. *Journal of Financial Services Marketing,* 16**,** 101-110.

EL-SAPPAGH, S. H. A., HENDAWI, A. M. A. & EL BASTAWISSY, A. H. (2011). A proposed model for data warehouse ETL processes. *Journal of King Saud University-Computer and Information Sciences,* 23**,** 91-104.

ELLIOTT, M. & ROTHERHAM, L. (2007). The Bumper Book of Government Waste 2008. Harriman House: London.

EMERY, F. (2012). *Futures we are in*, Springer Science & Business Media.

EMERY, F. E. (1978). *Systems thinking*, Penguin Books.

EMPOWERMENT PARTNERSHIP. (2019). *Meta Model III Detailed Questioning for a Specific Result* [Online]. Available: http://www.nlpinfo.com/meta-model-iii-detailed-questioning-for-a-specific-result/ [Accessed 08/09/2019].

EMPOWERMENT PARTNERSHIP. (2020). *T.O.T.E. Model of Strategies* [Online]. Available: http://www.nlpinfo.com/tote-model-of-strategies/ [Accessed 01/03/2020].

ENGELBART, D. C. (Year) Published. Improving our ability to improve: A call for investment in a new future. IBM Co-Evolution Symposium, 2003.

ENGELBART, D. C. (2012). Triple-loop Learning. *Federal Health Futures Summit Learnign for Transformational Change. September 10-11, 2012* Washington DC Metro Region.

EPSTEIN, D. (2019). *Range: How Generalists Triumph in a Specialized World,* London, Macmillan.

ERAUT, M. (2004). Informal learning in the workplace. *Studies in continuing education,* 26**,** 247-273.

EVANS, J. R. & JACK, E. P. (2003). Validating key results linkages in the Baldrige performance excellence model. *Quality Management Journal,* 10**,** 7-24.

FAGAN, M. (2002). Design and code inspections to reduce errors in program development. *Software pioneers.* Springer.

FALCONAR, T. (1997). *How to Use Your Nous,* Isle of man, Non-Aristotelian Publishing.

FALCONAR, T. (2000). *Creative Intelligence, and Self-liberation: Korzybski, Non-Aristotelian Thinking and Eastern Realization*, Crown House.

FARQUHAR, J. & MICHELS, N. (2016). Triangulation without tears. *Marketing challenges in a turbulent business environment.* Springer.

FCA (2015). Making Current Account Switching Easier : The effectiveness of the Current Account Switch Service (CASS) and evidence on account number portability.

FCA. (2017a). *Our Mission 2017* [Online]. Available: https://www.fca.org.uk/publications/corporate-documents/our-mission [Accessed 06/09/2018].

FCA (2017b). Understanding the financial lives of UK adults.

FERRUCCI, D. & BRINGSJORD, S. (2017). *Artificial intelligence and literary creativity: inside the mind of BRUTUS, a storytelling machine*.

FERRUCCI, D., LEVAS, A., BAGCHI, S., GONDEK, D. & MUELLER, E. T. (2012). Watson: beyond jeopardy! *Artificial Intelligence,* 199**,** 93-105.

FIFIELD, P. (2018). *The Value Equation how to calculate value* [Online]. Available: https://www.catalogues4business.co.uk/blog/2018/5/10/the-value-equation-how-to-calculate-value [Accessed 24/08/2018].

FISHER, I. & BARBER, W. J. (1907). *The rate of interest*, Garland Pub.

FISHER, R., URY, W. L. & PATTON, B. (2012). *Getting to yes: Negotiating agreement without giving in,* London, Random House.

FLEETWOOD, S. (Year) Published. What is (and what isn't) critical realism. The first in this year's CESR seminar series will be held on Friday 20th September, 2013. 30-16.

FLEMING, Q. W. & KOPPELMAN, J. M. (2000). *Earned value project management. 2nd edn.*, Project Management Institute.

FLETCHER, E. (2018). Interview with Eleaine Fletcher: State of the Art Modelling. *In:* DAVIES, R. (ed.).

FLYVBJERG, B. (2006). From Nobel prize to project management: getting risks right.

FLYVBJERG, B., BRUZELIUS, N. & ROTHENGATTER, W. (2003). *Megaprojects and risk: An anatomy of ambition*, Cambridge University Press.

FORUM FOR THE FUTURE. (2017). *The Five Capital Model a framework for sustainability* [Online]. Available: https://www.forumforthefuture.org/Handlers/Download.ashx?IDMF=8cdb0889-fa4a-4038-9e04-b6aefefe65a9 [Accessed 01/08/2018].

FOSTER, M. (2013a). *Critical Realism, Capitalism and Socialism* [Online]. Available: https://www.youtube.com/watch?v=zT7RY-W3gbg [Accessed 19/01/2020].

FOSTER, M. A. (2013b). *Critical Realism* [Online]. Available: https://www.youtube.com/watch?v=6bHeCBKITPo [Accessed 01/12/2019].

FOWLER, M. & KENDALL, S. (2000). *UML distilled: a brief guide to the standard object modeling language. 2nd edn.,* US, Addison-Wesley.

FRANCIS, R. (2013). *Report of the Mid Staffordshire NHS Foundation Trust public inquiry: executive summary*, The Stationery Office.

FRANKL, V. E. (1985). *Man's search for meaning*, Simon and Schuster.

FRANKLIN, D. (2017). *Megatech: Technology in 2050,* London, Profile Books.

FREEMAN, R. E. (2010). *Strategic management: A stakeholder approach. 2010 Reussue*, Cambridge university press.

FREEMAN, R. E., HARRISON, J. S., WICKS, A. C., PARMAR, B. L. & DE COLLE, S. (2010). *Stakeholder theory: The state of the art*, Cambridge University Press.

FROW, P. & PAYNE, A. (2011). A stakeholder perspective of the value proposition concept. *European journal of marketing,* 45**,** 223-240.

FSCP. (2015). *Response to CMA retail banking market investigation interim report* [Online]. Available: https://fs-cp.org.uk/sites/default/files/fscp_response_cma_market_study.pdf [Accessed 07/10/2018].

GAGNÉ, R. M. (1965). *Conditions of learning,* New York, Rinehart and Winston

GALLUP (2015). Companies Are Maximizing Only 5% of Their Workforces.

GALLUP (2016a). The Relationship Between Engagement at Work and Organizational Outcomes.

GALLUP (2016b). The Worldwide Employee Engagement Crisis.

GAMBLES, I. (2009). *Making the business case: Proposals that succeed for projects that work*, Gower Publishing, Ltd.

GARDNER, H. (2004). *Changing minds: The art and science of changing our own and other peoples minds,* US, Harvard Business Review Press.

GARTNER (2017). Top 10 Strategic Technology Trends for 2018.

GFK. (2015). *Personal Current Account Investigation: A Report for the CMA* [Online]. Available: https://assets.publishing.service.gov.uk/media/555cabd0ed915d7ae2000007/PCA_Banking_Report.pdf [Accessed 06/10/2018].

GIESE, J. L. & COTE, J. A. (2000). Defining consumer satisfaction. *Academy of marketing science review,* 1**,** 1-22.

GILB, T. (1988). *Principles of software engineering management*, Addison-Wesley Reading, MA.

GILB, T. (2005). *Competitive engineering: a handbook for systems engineering, requirements engineering, and software engineering using Planguage*, Butterworth-Heinemann.

GILB, T. (2017a). Interview with Tom Gilb: State of the Art Measurement. *In:* DAVIES, R. (ed.).

GILB, T. (2017b). *Value Planning: Practical tools for clearer management communication*.

GILL, J. & JOHNSON, P. (2002). *Research methods for managers*, Sage.

GIRIDHARADAS, A. (2019). *Winners take all: The Elite Charade of changing the world*, Penguin UK.

GLADWELL, M. (2000). *The tipping point: How little things can make a big difference*, Abacus.

GLADWELL, M. (2002). The talent myth. *The New Yorker,* 22**,** 28-33.

GLADWELL, M. (2005). *Blink: The power of thinking without thinking,* UK, Penguin.

GLADWELL, M. (2008). *Outliers: The story of success,* UK, Penguin.

GLASER, B. G. & STRAUSS, A. L. (2017). *Discovery of grounded theory: Strategies for qualitative research*, Routledge.

GLEICK, J. (1997). *Chaos: Making a new science,* London, Minerva.

GLOBERSON, S. (1994). Impact of various work-breakdown structures on project conceptualization. *International Journal of Project Management,* 12**,** 165-171.

GOLDRATT, E. M. (1990). *What is this thing called theory of constraints and how should it be implemented?*, North river press.

GOLDRATT, E. M. & COX, J. (1989). *The goal: a process of ongoing improvement,* Aldershot, England, Gower.

GOODMAN, M. (1997). Systems thinking: What, why, when, where, and how. *The systems thinker,* 8**,** 5-7.

GOSWAMI, A. (1993). *The self-aware universe: How consciousness creates the material world,* London, Simon & Schuster.

GÖTZE, U., NORTHCOTT, D. & SCHUSTER, P. (2008). Investment appraisal. *Methods and models,* 2.

GOV.UK. (2018). *Loyalty Penalty super complaint* [Online]. Available: https://www.gov.uk/cma-cases/loyalty-penalty-super-complaint?utm_source=04ec0ae5-caa4-468a-8429-526bb9c8226a&utm_medium=email&utm_campaign=govuk-notifications&utm_content=immediate [Accessed 28/09/2018].

GRAVES, C. W. (1970). Levels of existence: An open system theory of values. *Journal of humanistic psychology,* 10**,** 131-155.

GREEN, A. N. & JACK, A. (2004). Creating stakeholder value by consistently aligning the support environment with stakeholder needs. *Facilities,* 22**,** 359-363.

GRIBBIN, J. (2005). *Deep simplicity: Chaos, complexity and the emergence of life*, Penguin UK.

GRIEVES, M. & VICKERS, J. (2017). Digital twin: Mitigating unpredictable, undesirable emergent behavior in complex systems. *Transdisciplinary Perspectives on Complex Systems.* Springer.

GRINDER, J. & BANDLER, R. (1976). The structure of magic: II.

GRINDER, J. & PUCELIK, F. (2012). *The Origins of Neuro Linguistic Programming*, Crown House Publishing.

GRUNDY, T. (2012). *Demystifying Strategy: how to become a strategic thinker*, Kogan Page Publishers.

HACKMAN, J. R. & WAGEMAN, R. (1995). Total quality management: Empirical, conceptual, and practical issues. *Administrative science quarterly***,** 309-342.

HAGEL, J. & BROWN, J. S. (2005). *The only sustainable edge: Why business strategy depends on productive friction and dynamic specialization*, Harvard Business Press.

HALPER, F. (2014). Eight considerations for utilizing big data analytics with hadoop. TDWI Research.

HAMILL, L. & GILBERT, G. N. (2016). *Agent-based modelling in economics*, Wiley Online Library.

HAMMER, M. (1990). Reengineering work: don't automate, obliterate. *Harvard business review,* 68**,** 104-112.

HAMMER, M. & CHAMPY, J. (1993). *Reengineering the Corporation: A Manifesto for Business Revolution*, Nicholas Brealey.

HARDING, R. (2018). Interview with Rich Harding: State of the Art Modelling. *In:* DAVIES, R. (ed.).

HARRIN, E. (2016). *7 Factors of Good Project Governance* [Online]. Strategy Execution. Available: https://www.strategyex.co.uk/blog/pmoperspectives/7-factors-good-project-governance/ [Accessed 11/07/2019].

HARRINGTON, H. J. (1991). *Business process improvement: The breakthrough strategy for total quality, productivity, and competitiveness*, McGraw Hill Professional.

HARTFREE, Y., EVANS, J., KEMPSON, E. & FINNEY, A. (2016). Personal current account switching: Why don't more people switch and what could encourage them to do so? .

HASHIMOTO, T. (2008). Japanese Clocks and the History of Punctuality in Modern Japan. *East Asian Science, Technology and Society,* 2**,** 123-133.

HASKEL, J. & WESTLAKE, S. (2018). *Capitalism Without Capital: The Rise of the Intangible Economy*, Princeton University Press.

HASSAN, C. (2017). Interview with Carolyn Hassan: State of the Art Learning. *In:* DAVIES, R. (ed.).

HAWAWINI, G. & VIALLET, C. (2010). *Finance for executives: Managing for value creation. 4th Edn.*, Cengage Learning.

HENRICH, J. (2017). *The secret of our success: how culture is driving human evolution, domesticating our species, and making us smarter*, Princeton University Press.

HENRIQUES, A. & RICHARDSON, J. (2004). *The triple bottom line: Does it all add up,* London, Earthscan.

HERON, J. (1996). *Co-operative inquiry: Research into the human condition*, Sage.

HEYES, A. & KAPUR, S. (2012). Angry customers, e-word-of-mouth and incentives for quality provision. *Journal of Economic Behavior & Organization,* 84**,** 813-828.

HIPPO ENGINEERING. (2012). *What is Value Improvement?* [Online]. Available: http://www.hippoengineering.com/blog/2012/1/3/what-is-value-improvement.html [Accessed 11/03/2019].

HIXON, L. (2003). *The heart of the Qur'an: An introduction to Islamic spirituality. 2nd edn.,* Wheaton, IL., Quest Books.

HMG (2015). Digital Built Britain: Level 3 Building Information Modelling–Strategic Plan.

HMT (2011). Green Book: Appraisal and Evaluation in Central Government.

HMT (2013). Green book guidance using the five case model.

HMT (2014). National Infrastructure Plan 2014.

HMT (2016). National Infrastructure Delivery Plan 2016–2021.

HOLLINS, P. (2019). *Mental Models*, petehollins.com.

HOQUE, Z. (2014). 20 years of studies on the balanced scorecard: Trends, accomplishments, gaps and opportunities for future research. *The British accounting review,* 46**,** 33-59.

HOVERSTADT, P. (2008). *The fractal organization: Creating sustainable organizations with the viable system model*, John Wiley & Sons.

HOVERSTADT, P. (2017). Interview with Patrick Hoverstadt: State of the Art Causality. *In:* DAVIES, R. (ed.).

HOVERSTADT, P. & LOH, L. (2017). *Patterns of Strategy*, Taylor & Francis.

HOWICK, S. & EDEN, C. (2001). The impact of disruption and delay when compressing large projects: going for incentives? *Journal of the Operational Research Society,* 52**,** 26-34.

HOWSON, P. (2003). *Due diligence: The critical stage in mergers and acquisitions*, Gower Publishing, Ltd.

HUANG, S. (2017). Bacs MDM GfK Data Transformation Technical Report.

HUANG, S. (2018a). Interview with Shaofu Huang: State of the Art Learning. *In:* DAVIES, R. (ed.).

HUANG, S. (2018b). Interview with Shaofu Huang: State of the Art Modelling. *In:* DAVIES, R. (ed.).

HUANG, S. (2018c). Validity of Bacs Market Dynamics Model. University of Bristol.

HUBBARD, D. W. (2009). *The failure of risk management: Why it's broken and how to fix it*, John Wiley & Sons.

HUBBARD, D. W. (2014). *How to measure anything: Finding the value of intangibles in business*, John Wiley & Sons.

HUDSON, A. (2018). Interview with Andrew Hudson: State of the Art Measurement. *In:* DAVIES, R. (ed.).

HUGHES, M. (2011). Do 70 Per Cent of All Organizational Change Initiatives Really Fail? *Journal of Change Management,* 11**,** 451-464.

HUMPHREY, C. (2017). *What can we learn from the Americans about productivity* [Online]. LinkedIn. Available: https://www.linkedin.com/pulse/what-can-we-learn-from-americans-productivity-chris-humphrey/ [Accessed 24/03/2017].

HUSMANN, P. R. & O'LOUGHLIN, V. D. (2019). Another nail in the coffin for learning styles? Disparities among undergraduate anatomy students' study strategies, class performance, and reported VARK learning styles. *Anatomical sciences education,* 12**,** 6-19.

HUTTON, W. (1996). *The state we're in*, Random House.

IANSITI, M. & LAKHANI, K. R. (2017). The truth about blockchain. *Harvard Business Review,* 95**,** 118-127.

IBARRA, H. (2015). *Act like a leader, think like a leader*, Harvard Business Review Press.

ICB (2011). Final Report Recommendations.

IDEF. (2021). *IDEF0 Function Modelling Method* [Online]. Available: https://www.idef.com/idefo-function_modeling_method/ [Accessed 05/03/2021].

IMPACT DYNAMICS. (2018). *Programme Dynamics Model* [Online]. Available: https://exchange.iseesystems.com/public/impact-dynamics/programme-dynamics/index.html#page1 [Accessed 11/06/2019].

INCOSE (2010). INCOSE systems engineering handbook v. 3.2. INCOSE-TP-2003-002-03.2.

INSTITUTE FOR WORK AND HEALTH. (2015). *Cross-sectional vs.longitudinal studies* [Online]. Available: https://www.iwh.on.ca/what-researchers-mean-by/cross-sectional-vs-longitudinal-studies [Accessed 01/11/2018].

INSTITUTE OF VALUE MANAGEMENT. (2017). *What is Value and Value Management* [Online]. Available: https://ivm.org.uk/what-is-value-management [Accessed 02/09/2017].

IOWA STATE UNIVERSITY. (2016). *Vision and Mission Statements* [Online]. Available: https://www.extension.iastate.edu/agdm/wholefarm/html/c5-09.html [Accessed 14/03/2019].

ISTQB, I. (2015). Glossary of Testing Terms. *ISTQB Glossary http://www. istqb. org/downloads/finish/20/193. html*.

JACKSON, A. (2018). Market Dynamics Model Cosde Verification Analysis. Impact Dynamics Limited.

JACKSON, M., C. (2019). *Critical Systems Thinking and the Management of Complexity: Responsible Leadership for a Complex World,* Chichester, UK., John Wiley and Sons Ltd.

JACKSON, M. C. (2003). *Systems thinking: Creative holism for managers*, Wiley Chichester.

JACKSON, T. (2017). *Prosperity without growth: foundations for the economy of tomorrow. 2nd edn.*, Routledge.

JAMES, T. (2016). *NLP Communication Model* [Online]. Available: https://www.nlpcoaching.com/nlp-a-model-of-communication-and-personality/ [Accessed 07/08/2019].

JAMES, T. & SHEPHARD, D. (2001). *Presenting Magically: Transform your stage presence with NLP*, Crown House Publishing.

JAMES, T. & WOODSMALL, W. (1988). *Time line therapy and the basis of personality*, Granite Hill Publishers.

JANZEN, D. & SAIEDIAN, H. (2005). Test-driven development concepts, taxonomy, and future direction. *Computer,* 38**,** 43-50.

JEANTY, J. (2017). *What are Buinsess Intervention Strategies?* [Online]. Bizfluent. Available: https://bizfluent.com/info-7751856-business-intervention-strategies.html [Accessed 04/04/2019].

JENNER, S. (2009). *Realising Benefits from Government ICT Investment: A Fool's Errand?,* UK, Academic Publishing Limited.

JENNER, S. (2012). *Managing Benefits*, The Stationery Office.

JENNER, S. (2017). Interview with Stephen Jenner: State of the Art Value Delivery. *In:* DAVIES, R. (ed.).

JENNER, S. & KILFORD, C. (2011). *Management of portfolios*, The Stationery Office.

JOHNSON, G. & SCHOLES, K. (1999). *Exploring corporate strategy*, Prentice Hall.

JOHNSON, N. (2007). *Simply complexity: A clear guide to complexity theory,* Oxford, Oneworld Books.

JONES, D. E., SNIDER, C., KENT, L. & HICKS, B. (Year) Published. Early Stage Digital Twins for Early Stage Engineering Design. Proceedings of the Design Society: International Conference on Engineering Design, 2019. Cambridge University Press, 2557-2566.

JUNG, H. S. & YOON, H. H. (2012). Why do satisfied customers switch? Focus on the restaurant patron variety-seeking orientation and purchase decision involvement. *International Journal of Hospitality Management,* 31**,** 875-884.

KAHNEMAN, D. (2011). *Thinking, Fast and Slow,* London, Penguin Books Ltd.

KAHNEMAN, D. & TVERSKY, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the econometric society***,** 263-291.

KAHNEMAN, D. & TVERSKY, A. (2013). Choices, values, and frames. *Handbook of the Fundamentals of Financial Decision Making: Part I.* World Scientific.

KAISER, K. & YOUNG, S. D. (2013). *The Blue Line Imperative: What Managing For Value Really Means*, Wiley.

KAPLAN, R. S. (1998). *Cost & effect: using integrated cost systems to drive profitability and performance*, Harvard Business Press.

KAPLAN, R. S. (2009). Conceptual foundations of the balanced scorecard. *Handbooks of management accounting research,* 3**,** 1253-1269.

KAPLAN, R. S. & NORTON, D. P. (1996). *The balanced scorecard: translating strategy into action*, Harvard Business Press.

KAPLAN, R. S. & NORTON, D. P. (2001). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment*, Harvard Business Press.

KAPLAN, R. S. & NORTON, D. P. (2004). *Strategy maps: Converting intangible assets into tangible outcomes*, Harvard Business Press.

KAPLAN, R. S. & NORTON, D. P. (2006). *Alignment: Using the balanced scorecard to create corporate synergies*, Harvard Business Press.

KAPLAN, R. S. & NORTON, D. P. (2008). *The execution premium: Linking strategy to operations for competitive advantage*, Harvard Business Press.

KAY, J. (2016). *Other People's Money,* London, Profile Books.

KAY, R. (2012). Patterns of prediction The basis of resilient organizations. *Keeping Good Companies,* 64**,** 588.

KEAVENEY, S. M. (1995). Customer switching behavior in service industries: An exploratory study. *The Journal of Marketing***,** 71-82.

KEIRSEY, D. (1998). *Please understand me 2*, Prometheus Nemesis Book Company.

KELLER, S. & AIKEN, C. (2009). The inconvenient truth about change management. *McKinsey & Company*.

KELLEY SCHOOL OF BUSINESS. (2014). *Three-Tier Client-Server Architecture* [Online]. Available: https://www.youtube.com/watch?v=jJYv-nfkMXk [Accessed 05/11/2018].

KENNY, G. (2014). Your Company's Purpose Is Not Its Vision, Mission, or Values.

KIMBALL, R. & CASERTA, J. (2004). *The data warehouse ETL toolkit*, John Wiley & Sons.

KING, M. (2017). *The end of alchemy: Money, banking, and the future of the global economy,* London, Abacus.

KINSTON, W. (2007). The Scientific Basis and Significance of a Taxonomy of Human Elements in Endeavour. *Global Organisation Design Society 2007.*

KINSTON, W. & ROWBOTTOM, R. (1989). Levels of work: new applications to management in large organisations. *Journal of applied systems analysis,* 16**,** 19-34.

KNIGHT, F. H. (1921). *Risk, uncertainty and profit,* New York, Houghton-Mifflin.

KORZYBSKI, A. (1994). *Science and sanity: An introduction to non-Aristotelian systems and general semantics, 5th edn.*, Institute of General Semantics.

KOTTER, J. P. (1990). *Force for change: How leadership differs from management,* New York, Free Press.

KOTTER, J. P. (1995). Leading change: Why transformation efforts fail. *HBR,* March-April 1995.

KOTTER, J. P. (1996). *Leading change*, Harvard business press.

KOTTER, J. P. (2008). *A sense of urgency*, Harvard Business Press.

KWMC (2017a). The Bistol Approach to Citizen Sensing.

KWMC (2017b). We Can Make Summary.

LAMBERT, B. (2018). *A student's guide to Bayesian statistics*, Sage.

LANE, D. C., MUNRO, E. & HUSEMANN, E. (2016). Blending systems thinking approaches for organisational analysis: reviewing child protection in England. *European Journal of Operational Research,* 251**,** 613-623.

LANTZ, B., HELLER, B. & MCKEOWN, N. (Year) Published. A network in a laptop: rapid prototyping for software-defined networks. Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks, 2010. 1-6.

LAVINSKI, D. (2019). *The Two Most Important Quotes In Business* [Online]. Available: https://www.growthink.com/content/two-most-important-quotes-business [Accessed 06/08/2019].

LEE, R. & NEALE, L. (2012). Interactions and consequences of inertia and switching costs. *Journal of Services Marketing,* 26**,** 365-374.

LEES, G., GARLAND, R. & WRIGHT, M. (2007). Switching banks: Old bank gone but not forgotten. *Journal of Financial Services Marketing,* 12**,** 146-156.

LEPORE, D. & COHEN, O. (1999). *Deming and Goldratt: the theory of constraints and the system of profound knowledge: the decalogue*, North River Pr.

LEV, B. (2001). *Intangibles: Management, measurement, and reporting*, Brookings Institution Press.

LEVINE, J. (1983). Materialism and qualia: The explanatory gap. *Pacific philosophical quarterly,* 64**,** 354-361.

LEWIN, R. (1993). *Complexity: Life at the edge of chaos,* London, Dent.

LEWIS, B. (1990). *Magic of NLP Demystified: A pragmatic guide to communication and change,* Portland, Oragon, Metamorphous Press.

LEWIS, W. W. (2005). *The power of productivity: Wealth, poverty, and the threat to global stability*, University of Chicago Press.

LEXICO OXFORD. (2019a). *Definition of Intention* [Online]. Available: https://www.lexico.com/en/definition/intention [Accessed 23/09/2019].

LEXICO OXFORD. (2019b). *Definition of Value* [Online]. Available: https://www.lexico.com/en/definition/value [Accessed 26/09/2019].

LEXICO OXFORD. (2019c). *Defintion of What* [Online]. Available: https://www.lexico.com/definition/what [Accessed 23/02/2019].

LICATA, J. W. & CHAKRABORTY, G. (2009). The effects of stake, satisfaction, and switching on true loyalty: a financial services study. *International journal of bank marketing,* 27**,** 252-269.

LINCOLN, Y. S. & GUBA, E. G. (1990). Judging the quality of case study reports. *Internation Journal of Qualitative Studies in Education,* 3**,** 53-59.

LINDER-PELZ, S. & HALL, L. M. (2007). The theoretical roots of NLP-based coaching. *The Coaching Psychologist,* 3**,** 12-17.

LINDSTROM, M. (2016). *Small data: the tiny clues that uncover huge trends,* London, St. Martin's Press.

LIVING EXPERIMENT. (2019). *Win-win Relating* [Online]. Available: http://livingexperiment.com/winwin/ [Accessed 26/04/2019].

LOEWENSTEIN, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological bulletin,* 116**,** 75.

LONGMAN. (2020). *Meaning of Spin* [Online]. Available: https://www.ldoceonline.com/dictionary/spin [Accessed 24/10/2020].

LOSIER, M. J. (2007). *The law of Attraction,* NY, Hachette Book Group.

LOWE, J. (2017). Interview with Joseph Lowe: Problem Space Value Delivery. *In:* DAVIES, R. (ed.).

LSCB HARINGEY (2009). Serious case review: baby Peter. Executive summary. *available online atwww. haringeylscb. org/executive_summary_peter_final. pdf*.

LYON, A. (2017). *Epistemology, Ontology, and Axiology in Research* [Online]. Available: https://www.youtube.com/watch?v=AhdZOsBps5o [Accessed 02/12/2019].

MACCAFERRI, G. & LACAILLE, J.-C. (2003). Interneuron Diversity series: Hippocampal interneuron classifications–making things as simple as possible, not simpler. *Trends in neurosciences,* 26**,** 564-571.

MACKENZIE, G. (2019). *If You Can't Measure It, You Can't Improve It* [Online]. GuavaBox. Available: https://guavabox.com/if-you-cant-measure-it-you-cant-improve-it/ [Accessed 30/06/2019].

MAGEE, B. (1973). *Popper,* London, Fontana Modern Masters.

MAIGA, A. S. & JACOBS, F. A. (2003). Balanced scorecard, activity-based costing and company performance: an empirical analysis. *Journal of Managerial Issues***,** 283-301.

MAKRIDAKIS, S., WHEELWRIGHT, S. C. & HYNDMAN, R. J. (2008). *Forecasting methods and applications*, John wiley & sons.

MALAMED, C. (2016). *10 Definitions of Learning* [Online]. Available: http://theelearningcoach.com/learning/10-definitions-learning/ [Accessed 29/07/2017].

MANDELBROT, B. & HUDSON, R. L. (2007). *The Misbehavior of Markets: A fractal view of financial turbulence*, Basic books.

MANDELBROT, B. B. (1977). *Fractals: form, chance, and dimension*, WH Freeman San Francisco.

MANSON, M. (2014). *In The Future, Our Attention Will Be Sold* [Online]. [Accessed 07/08/2019].

MANSON, M. (2015). *The Staggering Bullshit of "The Secret"* [Online]. Available: https://markmanson.net/the-secret [Accessed 05/08/2019].

MARGERISON, C. J. (1987). *How to Improve Your Managerial Performance*, MCB University Press.

MARK, B. M. & PEARSON, C. (2001). *The Hero and the Outlaw: Building Extraordinary Brands Through the Power of Archetypes,* US, McGraw Hill.

MARQUARDT, M. J. & REVANS, R. W. (1999). *Action learning in action: Transforming problems and people for world-class organizational learning*, Davies-Black Pub.

MASLOW, A. H. (1943). A theory of human motivation. *Psychological review,* 50**,** 370.

MASOOD, E. (2016). *The Great Invention: The Story of GDP and the Making and Unmaking of the Modern World*, Pegasus Books.

MATTHEWS, C. & MURRAY, D. (2007). Helping bank customers switch: A case study. *Journal of Financial Services Marketing,* 11**,** 360-369.

MATTHIESEN-JONES, M. (2019). *What is Program Governance? - Definition, Structure & Examples* [Online]. Study.com. Available: https://study.com/academy/lesson/what-is-program-governance-definition-structure-examples.html [Accessed 11/07/2019].

MATURANA, H. R. & VARELA, F. J. (1987). *The tree of knowledge: The biological roots of human understanding*, New Science Library/Shambhala Publications.

MAYER-SCHÖNBERGER, V. & CUKIER, K. (2013). *Big data: A revolution that will transform how we live, work, and think*, Houghton Mifflin Harcourt.

MAYO, A. (2001). *The human value of the enterprise*, Nicholas Brealey Publishing London.

MAZZUCATO, M. (2018a). *The entrepreneurial state: Debunking public vs. private sector myths,* UK, Penguin Books.

MAZZUCATO, M. (2018b). *The Value of Everything: Making and Taking in the Global Economy*, Penguin UK.

MCCARTHY, B. & MCCARTHY, D. (2005). *Teaching around the 4MAT® cycle: Designing instruction for diverse learners with diverse learning styles*, Corwin Press.

MCCORMICK, M. (2012). Waterfall vs. Agile methodology. *MPCS, N/A*.

MCGILL, I. & BROCKBANK, A. (2003). *Action learning handbook*, Kogan Page.

MCGRATH, R. G. (2013). *The end of competitive advantage: How to keep your strategy moving as fast as your business*, Harvard Business Review Press.

MCGREAL, I. P. (1995). *Great Thinkers of the Eastern World the Major Thinkers and the Philosophical and Religious Classics of China, India, Japan, Korea, and the World of Islam,* NY, Harper Collins.

MCKENNA, P. & BREEN, M. (1998). The Power to Influence. Audio Training Course. Nightiningale Conant.

MCKINSEY. (2018a). Blockchain beyond the hype What is the strategic business value? Available: https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/blockchain-beyond-the-hype-what-is-the-strategic-business-value?cid=other-eml-ttn-mip-mck-oth-1806&hlkid=edb94061bf2a4d84bc1752934a70c052&hctky=10067572&hdpid=f3a30356-6857-47f4-a1a5-0d0e5ff12a0a [Accessed 01/10/2018].

MCKINSEY. (2018b). *Executives guide to AI* [Online]. Available: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Analytics/Our%20Insights/An%20executives%20guide%20to%20AI/Executives-guide-to-AI [Accessed 29/03/2018].

MCKINSEY AGILE TRIBE. (2017). *The five trademarks of agile organizations* [Online]. Available: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/Organization/Our%20Insights/The%20five%20trademarks%20of%20agile%20organizations%20new/The-five-trademarks-of-agile-organizations.ashx [Accessed 29/03/2018].

MCKINSEY GLOBAL INSTITUTE. (2002). *Productivity, Competitiveness & Growth* [Online]. Available: https://www.mckinsey.com/mgi/our-research/productivity-competitiveness-and-growth [Accessed 15/11/2017].

MCSMITH, A. (2005). The Puclic Will See You Now Mr Blair. *Independent*, 05/06/2005.

MCWILLIAMS, D. (2015). *The Flat White Economy: How the digital economy is transforming London and other cities of the future*, Gerald Duckworth & Co.

MEADOWS, D. H. (2009). *Thinking in systems: A primer,* UK, Earthscan.

MEADOWS, D. H., MEADOWS, D. L., RANDERS, J. & BEHRENS, W. W. (1972). *The limits to growth,* London, Pan Books.

MEAN, M., WHITE, C. & LASOTA, E. (2017). We Can Make: civic innovation in housing.

MILLER, E. (2011a). Theories of story and storytelling. *Retrieved April,* 15**,** 2016.

MILLER, J. H. & PAGE, S. E. (2007). *Complex adaptive systems: An introduction to computational models of social life,* US, Princeton university press.

MILLER, K. (2010). *We don't make widgets*, Governing Books.

MILLER, K. (2011b). *Extreme Government Makeover*, Governing Books, Washington, DC.

MINTZBERG, H., AHLSTRAND, B. & LAMPEL, J. (1998). *Strategy Safari: a guided tour through the wilds of strategic mangament,* London, Pearson.

MIRRIAM-WEBSTER DICTIONARY. (2019a). *Definition of Economics* [Online]. Available: https://www.merriam-webster.com/dictionary/economics [Accessed 19/10/2019].

MIRRIAM-WEBSTER DICTIONARY. (2019b). *Definition of How* [Online]. Available: https://www.merriam-webster.com/dictionary/how [Accessed 23/02/2019].

MIRRIAM-WEBSTER DICTIONARY. (2019c). *Definition of Intervention* [Online]. Available: https://www.merriam-webster.com/dictionary/intervention [Accessed 04/04/2019].

MIRRIAM-WEBSTER DICTIONARY. (2019d). *Definition of Why* [Online]. Available: https://www.merriam-webster.com/dictionary/why [Accessed 23/02/2019].

MIRRIAM-WEBSTER DICTIONARY. (2020a). *Definition of Cause* [Online]. Available: https://www.merriam-webster.com/dictionary/cause [Accessed 03/06/2020].

MIRRIAM-WEBSTER DICTIONARY. (2020b). *Definition of Prosperity* [Online]. Available: https://www.merriam-webster.com/dictionary/prosperity [Accessed 31/07/2020].

MISHEL, L. (2012). The wedges between productivity and median compensation growth. *Issue Brief,* 330**,** 1-7.

MITCHELL, M. (2009). *Complexity: A guided tour*, Oxford University Press.

MITCHELL, S. (2000). *Tao Te Ching Book of the Way: Lao-Tzu,* London, Kyle Cathie.

MOD (2002). The Acquisition Handbook. 4th edn.

MOFFATT, M. (2018). *What is a Commodity in Economics?* [Online]. ThoughtCo. Available: https://www.thoughtco.com/commodity-economics-definition-1146936 [Accessed 15/01/2019].

MONEY ADVICE SERVICE (2016). Market Segmentation: An Overview.

MOORE, T. (1999). *The Lost Gospel Q: The Original Sayings of Jesus,* Berkeley, CA, Ulysses Press.

MORECROFT, J. D., ASAY, D. & STERMAN, J. D. (1994). *Modeling for learning organizations*, Productivity, Incorporated.

MORGAN, G. (1997). *Images of organization,* USA, Sage.

MORIN, E. (2007). Restricted complexity, general complexity. *Worldviews, science and us: Philosophy and complexity.* World Scientific.

MOSTASHARI, A., MCCOMB, S. A., KENNEDY, D. M., CLOUTIER, R. & KORFIATIS, P. (2012). Developing a stakeholder-assisted agile CONOPS development process. *Systems Engineering,* 15**,** 1-13.

MUNRO, E. (2011). *The Munro review of child protection: final report, a child-centred system*, The Stationery Office.

NANCEKIVELL, S. E., SHAH, P. & GELMAN, S. A. (2019). Maybe they're born with it, or maybe it's experience: Toward a deeper understanding of the learning style myth. *Journal of Educational Psychology*.

NAO. (2017). *Value for Money* [Online]. Available: https://www.nao.org.uk/successful-commissioning/general-principles/value-for-money/assessing-value-for-money/ [Accessed 19/08/2017].

NAO (2018). MOD The Equipment Plan 2018 - 2018.

NATIONAL GEOGRAPHIC. (2020). *Industrial Revolution and Technology* [Online]. Available: https://www.nationalgeographic.org/article/industrial-revolution-and-technology/ [Accessed 24/07/2020].

NAZ, F. & TARIQ, A. (2013). Word of Mouth and Its Impact on Marketing.

NEELY, A., RICHARDS, H., MILLS, J., PLATTS, K. & BOURNE, M. (1997). Designing performance measures: a structured approach. *International journal of operations & Production management,* 17**,** 1131-1152.

NEGASH, S. & GRAY, P. (2004). Business intelligence. *Handbook on decision support systems 2.* Springer.

NEWSTATESMAN. (2018). *Kevin McCloud says the quality of new homes in the UK is "unforgivable"* [Online]. Available: https://www.newstatesman.com/spotlight/housing/2018/03/kevin-mccloud-says-quality-new-homes-uk-unforgivable [Accessed 30/05/2019].

NGUYEN, L., MEGIDDO, I. & HOWICK, S. (Year) Published. Combining system dynamics and agent-based models to study transmission of healthcare-associated infections in long-term care facilities. 22nd UK System Dynamics Chapter Annual Conference, 2020.

NICKERSON, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology,* 2**,** 175-220.

NICOLA, M., ALSAFI, Z., SOHRABI, C., KERWAN, A., AL-JABIR, A., IOSIFIDIS, C., AGHA, M. & AGHA, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International journal of surgery (London, England),* 78**,** 185.

NIETO-RODRIGUEZ, A. (2017). Interview with Antonio Nieto-Rodriguez: State of the Art Value Frame. *In:* DAVIES, R. (ed.).

NIETO-RODRIGUEZ, A. & EVRARD, D. (2004). Boosting business performance through programme and project management. *A first goal survey on the current state of project management maturity in organisations across the world*.

NIETO-RODRIGUEZ, M. A. (2012). *The focused organization: how concentrating on a few key initiatives can dramatically improve strategy execution*, Gower Publishing, Ltd.

NIVEN, P. R. (2002). *Balanced scorecard step-by-step: Maximizing performance and maintaining results*, John Wiley & Sons.

NIVEN, P. R. & LAMORTE, B. (2016). *Objectives and Key Results: Driving Focus, Alignment, and Engagement with OKRs*, John Wiley & Sons.

NOVAK, S. & STERN, S. (2008). How does outsourcing affect performance dynamics? Evidence from the automobile industry. *Management Science,* 54**,** 1963-1979.

NPSO. (2018). *Who we are* [Online]. Available: https://www.newpso.uk/who-we-are/ [Accessed 16/09/2018].

O'BRIEN, R. C. & O'BRIEN, R. C. (2001). *Trust: Releasing the energy to succeed*, Wiley Chichester.

O'CONNOR, J. & MCDERMOTT, I. (1996). *Principles of NLP*, Thorsons.

O'CONNOR, J. & MCDERMOTT, I. (1997). *The art of systems thinking*, Thorsons San Francisco.

OAKLAND, J. S. (2014). *Total quality management and operational excellence: text with cases*, Routledge.

ODUM, H. T. (2007). *Environment, power, and society for the twenty-first century: the hierarchy of energy,* New York, Columbia University Press.

ODUM, H. T. & ODUM, E. C. (2000). *Modeling for all scales: an introduction to system simulation*, Elsevier.

OECD. (2012). *Value for money and international development* [Online]. Available: http://www.oecd.org/development/effectiveness/49652541.pdf [Accessed 19/08/2017].

OFT. (2013). *Review of the personal current account market* [Online]. Available: http://webarchive.nationalarchives.gov.uk/20140402182200/http://www.oft.gov.uk/shared_oft/reports/financial_products/OFT1005rev [Accessed 06/10/2018].

OGC (2007a). *For Success Risk Management: Think M_o_R,* Norwich, TSO.

OGC (2007b). *Managing successful programmes,* Norwich, TSO.

OGC (2008). *Portfilio, Programme and Project Offices,* Norwich, TSO.

OGC (2010). *An Executive Guide to Portfolio Management,* Norwich, TSO.

OHNO, T. (1988). *Toyota production system: beyond large-scale production*, crc Press.

OLIVER, R. L. (1995). Attribute Need Fulfillment in Product Usage Satisfaction. *Psychology & Marketing,* 12**,** 1-17.

ORNSTEIN, R. E. (1997). *The right mind: Making sense of the hemispheres*, Harcourt.

ORRELL, D. (2010). *Economyths: How the science of complex systems is transforming economic thought*, Icon Books Ltd.

ORRELL, D. (2017). *Economyths: 11 Ways Economics Gets it Wrong*, Icon Books.

OSBORNE, M. J. (2010). A resolution to the NPV–IRR debate? *The Quarterly Review of Economics and Finance,* 50**,** 234-239.

OSTERWALDER, A. & PIGNEUR, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*, John Wiley & Sons.

OXFORD DICTIONARY. (2017). *Definition of Efficacy* [Online]. Available: https://en.oxforddictionaries.com/definition/efficacy [Accessed 21/08/2017].

OXFORD DICTIONARY. (2018a). *Definition of Economy* [Online]. Available: https://en.oxforddictionaries.com/definition/economy [Accessed 005/08/2018].

OXFORD DICTIONARY. (2018b). *Definition of Inertia* [Online]. Available: https://en.oxforddictionaries.com/definition/inertia [Accessed 18/09/2018].

OXFORD DICTIONARY. (2018c). *Defintion of Trust* [Online]. Available: https://en.oxforddictionaries.com/definition/trust [Accessed 18/09/2018].

OXFORD DICTIONARY. (2019a). *Definition of Agency* [Online]. Available: https://en.oxforddictionaries.com/definition/agency [Accessed 03/03/2019].

OXFORD DICTIONARY. (2019b). *Definition of Cogntion* [Online]. Available: https://en.oxforddictionaries.com/definition/cognition [Accessed 05/03/2019].

PAN, J. N. & NGUYEN, H. T. N. (2015). Achieving customer satisfaction through product-service systems. *European Journal of Operational Research,* 247**,** 179-190.

PANDE, P. S., NEWMAN, R. P. C. & ROLAND, R. (2000). *The Six Sigma Way: How GE, Motorola and Other Top Companies are Honing Their Performance*, McGraw-Hill, Inc., New York, USA.

PANTHER, T. & FARQUHAR, J. D. (2004). Consumer responses to dissatisfaction with financial service providers: an exploration of why some stay while others switch. *Journal of Financial Services Marketing,* 8**,** 343-353.

PARUNGAO, J. E. V. (2011). Values and the communication of change: The value filters of the nlp communication model applied to Aetas in Loob Bunga Zambales. *Jati-Journal of Southest Asian Studies,* 16**,** 177-193.

PEARL, J. (2010). The foundations of causal inference. *Sociological Methodology,* 40**,** 75-149.

PEARL, J., GLYMOUR, M. & JEWELL, N. P. (2016). *Causal inference in statistics: a primer*, John Wiley & Sons.

PEARL, J. & MACKENZIE, D. (2018). *The Book of Why: The New Science of Cause and Effect*, Allen Lane.

PEARSON, C. (1991). *Awakening the heroes within: Twelve archetypes to help us find ourselves and transform our world,* US, HarperCollins.

PEGA. (2012). *Next Best Action Marketing: A Customer Centric Approach* [Online]. Available: https://www1.pega.com/system/files/resources/2018-04/NBA-Marketing-eBook-Jan2012.pdf [Accessed 01/10/2018].

PETERS, S. (2012). The Chimp Paradox: The Mind management programme to help you achieve success, confidence and happiness. UK: Random House Company.

PETERS, T. J., WATERMAN, R. H. & JONES, I. (1982). *In search of excellence: Lessons from America's best-run companies,* US, Harper & Row.

PETERSON, J. B. (2018). *12 Rules for Life An Antidote to Chaos,* UK, Penguin.

PHYSICS FORUMS. (2012). *Meaning of: Make everything as simple as possible, but not simpler* [Online]. Available: https://www.physicsforums.com/threads/meaning-of-make-everything-as-simple-as-possible-but-not-simpler.595440/ [Accessed 16/05/2019].

PIKETTY, T. (2014). *Capital in the twenty-first century*, Harvard University Press.

PINK, D. H. (2011). *Drive: The surprising truth about what motivates us*, Canongate.

PLUTORA. (2018). *Verification vs Validation: Do You know the Difference?* [Online]. Available: https://www.plutora.com/blog/verification-vs-validation [Accessed 31/03/19].

PONTIN, T. (2017). Interview with Tim Pontin: State of the Art Value Delivery. *In:* DAVIES, R. (ed.).

PORTER, M. (1985). *Competitive Advantage: Creating and sustaining superior performance,* NY, Free Press.

PORTER, M. E. & MILLAR, V. E. (1985). How information gives you competitive advantage. Harvard Business Review Reprint Service.

POUNDSTONE, W. (2014). *How to Predict the Unpredictable: The Art of Outsmarting Almost Everyone,* London, Oneworld.

POWER, M., DOHERTY, B., PYBUS, K. & PICKETT, K. (2020). How COVID-19 has exposed inequalities in the UK food system: The case of UK food and poverty. *Emerald Open Research,* 2.

PRA. (2018). *Terms of Reference for the Prudential Regulation Committee* [Online]. Available: https://www.bankofengland.co.uk/about/people/prudential-regulation-committee [Accessed].

PRIGOGINE, I. & STENGERS, I. (1984). *Order out of chaos: Man's new dialogue with nature,* US, Bantam Books.

PROTO, E. (2016). Are happy workers more productive? *IZA World of Labor*.

PSR. (2018). *The PSR Purpose* [Online]. Available: https://www.psr.org.uk/about-psr/psr-purpose [Accessed 06/09/2018].

PURCELL, D. (2016). *Scrum Magic: Ultimate Training Guide to the Agile Framework,* UK, Purcell Consult.

PURDUE UNIVERSITY. (2019). *Education Professional Dispositions* [Online]. Available: https://online.purdue.edu/sped/masters-special-education/resources/dispositions [Accessed 30/01/2019].

PWC (2013). PwC CEO survey 2012-13.

PWC. (2017). *Who are you calling a 'challenger'? How competition is improving customer choice and driving innovation in the UK banking market* [Online]. Available: http://pwc.blogs.com/files/challenger-bank-2017-.pdf [Accessed 06/10/2018].

QA (2013). Systems Modelling Techniques Using UML Traing Course.

RAWORTH, K. (2017). *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*, Random House Business Books.

RAYNOR, M. E. & AHMED, M. (2013a). Three proven rules: discovering how exceptional companies think. *Strategy & Leadership,* 41**,** 5-10.

RAYNOR, M. E. & AHMED, M. (2013b). Three rules for making a company truly great. *Harvard Business Review,* 91**,** 108-117.

RAYNOR, M. E. & AHMED, M. (2013c). *The three rules: how exceptional companies think*, Penguin.

REASON, P. & BRADBURY, H. (2001). *Handbook of action research: Participative inquiry and practice*, Sage.

REICH, R. B. (2016). *Saving capitalism: For the many, not the few*, Icon Books.

REID, J. (2018). *The 3 Laws of TDD Focus on one thing at a time* [Online]. Quality Coding. Available: https://qualitycoding.org/3-laws-tdd/ [Accessed 05/11/2018].

RESTAK, R. (2009). *The naked brain: How the emerging neurosociety is changing how we live, work, and love*, Crown.

REVANS, R. (2011). *ABC of action learning*, Gower Publishing, Ltd.

REVANS, R. W. (1982). What is action learning? *Journal of Management Development,* 1**,** 64-75.

REYNOLDS, F. (2017). Open Banking A Consumer Perspective.

RICHARDSON, G. P. (1986). Problems with causal-loop diagrams. *System dynamics review,* 2**,** 158-170.

RICHMOND, B. (2001). *An Introduction to Systems Thinking,* USA, High Performance Systems, inc.

RIELEY, J. B. (2001). *Gaming the System: How to Stop Playing the Organizational Game, and Start Playing the Competitive Game*, Pearson Education.

RITTEL, H. W. & WEBBER, M. M. (1973a). 2.3 planning problems are wicked. *Polity,* 4**,** 155-169.

RITTEL, H. W. & WEBBER, M. M. (1973b). Dilemmas in a general theory of planning. *Policy sciences,* 4**,** 155-169.

ROBSON, C. (2002). *Real world research: A resource for social scientists and practitioner-researchers*, Blackwell Oxford.

RODRIK, D. (2015). *Economics rules: the rights and wrongs of the dismal science*, Oxford University Press.

ROMME, G. & VAN WITTELOOSTUIJN, A. (1999). Circular organizing and triple loop learning. *Journal of Organizational Change Management,* 12**,** 439-454.

ROSENBERG, G. & CARHART, N. (2013). A systems-based approach to creating value from infrastructure interdependencies.

ROSLING, H. (2018). *Factfulness,* UK, Sceptre.

ROUSE, M. (2008). *Object-oriented programming (OOP)* [Online]. TechTarget. Available: https://searchmicroservices.techtarget.com/definition/object-oriented-programming-OOP [Accessed 11/12/2018].

RUDY, L. J. (2019). *What Is Theosophy? Definition, Origins, and Beliefs* [Online]. learningreligions.com. Available: https://www.learnreligions.com/theosophy-definition-4690703 [Accessed 28/01/2020].

RUMELT, R. P. (2017). *Good strategy/bad strategy: The difference and why it matters,* UK, Profile Books.

RYAN, R. M. & DECI, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist,* 55**,** 68.

SALOM. (2018). *The problem with Public-Private Partnerships and the roleof the EU* [Online]. Available: https://www.theparliamentmagazine.eu/printpdf/8455 [Accessed 13/11/2019].

SARGENT, R. G. (2013). Verification and validation of simulation models. *Journal of Simulation,* 7**,** 12-24.

SATIR, V. (1988). *The new peoplemaking*, Science and Behavior Books Mountain View, CA.

SAUKKORIIPI, L. (2004). Perspectives on Non-Value Added Activities: The case of piece-rate in the Swedish construction industry. *Proceedings of International Group of lean Construction*.

SAUNDERS, M., LEWIS, P. & THORNHILL, A. (2006). *Research methods for business students, 4th edn.,* Harlow, UK, Financial Times Prentice Hall.

SCHEELE, P. R. (2000). *PhotoReading. 3rd edn*, Learning Strategies Corporation.

SCHNEIDER, K. (2017). *Massive Infrastructure Projects are Failing at Unprecedented Rates* [Online]. National Geographic. Available: https://www.nationalgeographic.co.uk/environment-and-conservation/2019/10/we-pump-too-much-water-out-ground-and-thats-killing-our-rivers [Accessed 18/11/2019].

SCHOLES, K. & JOHNSON, G. (2001). *Exploring public sector strategy*, Pearson Education.

SCHÖN, D. A. (2017). *The reflective practitioner: How professionals think in action*, Routledge.

SCHWAB, K. (2016). *The fourth industrial revolution*, World Economic Forum.

SCHWAB, K. & MALLERET, T. (2020). *COVID-19: The Great Reset,* Switzerland, Forum Publishing.

SCOTT, K. (2002). *The unified process explained,* US, Addison-Wesley Longman Publishing Co., Inc.

SEDDON, J. (2003). *Freedom from command and control*, Vanguard Education Limited.

SEDDON, J. (2008). *Systems thinking in the public sector: The failure of the reform regime... and a manifesto for a better way*, Triarchy Press Limited.

SELDON, A. (2018). *The Fourth Education Revoulution: Will Artificial Intelligence liberate or Infantalise Humanity,* UK, University of Buckingham Press.

SEN, A. (2004). Metadata management: past, present and future. *Decision Support Systems,* 37**,** 151-173.

SENGE, P. M. (1990). *The fifth discipline: The art and practice of the learning organization,* London, Century Business.

SENGE, P. M., KLEINER, A., ROBERTS, C., ROSS, R. B. & SMITH, B. J. (1998). *The fifth discipline fieldbook: Strategies and tools for building a learning organization,* London, NIcholas Brealey.

SENTURIA, T., FLEES, L. & MACEDA, M. (2008). Leading change management requires sticking to the PLOT. *Bain and Company*.

SESSIONS, R. (2009). *Cost of IT Failure* [Online]. Available: http://simplearchitectures.blogspot.co.uk/2009/09/cost-of-it-failure.html [Accessed 19/10/2017].

SHEPHARD, D. (2005a). NLP Master Practioner Training Course: The Questions are the Answer. Performance Partnership.

SHEPHARD, D. (2005b). NLP Master Practioner Training Course: Values Elicitation and Intervention. Performance Partnership.

SHEPHARD, D. (2005c). NLP Master Practioner Training Course: Values Levels. Performance Partnership.

SHEPHARD, D. (2017). Interview with David Shephard: State of the Art Neuroscience. *In:* DAVIES, R. (ed.).

SHIM, J. P., WARKENTIN, M., COURTNEY, J. F., POWER, D. J., SHARDA, R. & CARLSSON, C. (2002). Past, present, and future of decision support technology. *Decision support systems,* 33**,** 111-126.

SHORE, J. (2004). Fail fast [software debugging]. *IEEE Software,* 21**,** 21-25.

SIEGEL, D. J. (2012). *Pocket Guide to Interpersonal Neurobiology: An Integrative Handbook of the Mind (Norton Series on Interpersonal Neurobiology)*, WW Norton & Company.

SIEGEL, E. (2016). *Predictive analytics: The power to predict who will click, buy, lie, or die*, John Wiley & Sons Incorporated.

SIERRA, C., OSMAN, N., NORIEGA, P., SABATER-MIR, J. & PERELLO-MORAGUES, A. (Year) Published. Value alignment: a formal approach. Responsible Artificial Intelligence Agents Workshop (RAIA) in AAMAS, 2019.

SILVER, N. (2012). *The signal and the noise: the art and science of prediction*, Penguin UK.

SIMON, H. (1957). *Administrative Behaviour: A Study of Decision-Making Processes in Administrative Organizations. 2nd edn.,* New York, Macmllan.

SIMON, H. A. (1992). What is an “explanation” of behavior? *Psychological science,* 3**,** 150-161.

SINEK, S. (2009). *Start With Why: How Great Leaders Inspire Everyone to Take Action,* London, Penguin Books Ltd.

SIX SIGMA DAILY. (2019). *What is Value Add vs Non-Value Add?* [Online]. Available: https://www.sixsigmadaily.com/what-is-value-add-vs-non-value-add/ [Accessed 03/06/2019].

SIZER, J. (1978). *An insight into management accounting,* England, Penguin.

SLYWOTZKY, A. J., MORRISON, D. J. & ANDELMAN, B. (1997). *The profit zone: How strategic business design will lead you to tomorrow's profits,* Chichester, UK, Wiley.

SLYWOTZKY, A. J., MORRISON, D. J., MOSER, T., MUNDT, K. A. & QUELLA, J. A. (1999). *Profit Patterns: 30 Ways to Anticipate and Profit from Strategic Forces Reshaping Your Business,* Chichester, UK, Wiley.

SMF (2016). A Switch in Time: The evolution of Britain's personal current account market. Social Market Foundation.

SMITH, A. (1776). *Wealth of Nations,* Hertfordshire, Wordsworth Editions.

SMITH, A. (1998). *Accelerated learning in practice*, Network Educational Press.

SMITH, D. (2003). *Free lunch: Easily digestible economics*, Profile Books.

SMITH, M. (2013). *Chris Argyris: theories of action, double-loop learning and organizational learning* [Online]. Available: http://infed.org/mobi/chris-argyris-theories-of-action-double-loop-learning-and-organizational-learning/ [Accessed 07/07/2017].

SMT. (2017). *Software Architecture One Tier, Two Tier, Three Tier & N Tier Architecture* [Online]. Available: https://www.youtube.com/watch?v=ccOzcjHQVos [Accessed 05/11/2018].

SNOWDEN, D. J. & BOONE, M. E. (2007). A leader's framework for decision making. *Harvard business review,* 85**,** 68.

SOLE, D. & WILSON, D. G. (2002). Storytelling in organizations: The power and traps of using stories to share knowledge in organizations. *LILA, Harvard, Graduate School of Education***,** 1-12.

SOLOW, R. M. (1956). A contribution to the theory of economic growth. *The quarterly journal of economics,* 70**,** 65-94.

SOLOW, R. M. (1987). We'd better watch out. *New York Times Book Review,* 36.

SONNENTAG, S. & FRESE, M. (2012). Dynamic performance. *The Oxford handbook of organizational psychology.* Oxford University Press New York.

SOWDEN, R. & WOLF, M. (2011). *Managing successful programmes*, TSO (The Stationary Office).

SPATARI, S., YU, Z. & MONTALTO, F. A. (2011). Life cycle implications of urban green infrastructure. *Environmental Pollution,* 159**,** 2174-2179.

SPENLEY, P. (1992). *World class performance through total quality: a practical guide to implementation,* London, Chapman & Hall.

SPETZLER, C., WINTER, H. & MEYER, J. (2016). *Decision quality: Value creation from better business decisions*, John Wiley & Sons.

SPITZER, R. (1992). Virginia Satir and the origins of NLP. *Anchor Point,* 6.

STAKE, R. E. (1995). *The art of case study research*, Sage.

STANDISH GROUP (2014a). Chaos Manifesto 2014.

STANDISH GROUP (2014b). Chaos Report 2014.

STANDISH GROUP (2014c). Chaos Report: 21st Anniverary Edition.

STANDISH GROUP (2015a). Chaos Report 2015.

STANDISH GROUP (2015b). Haze.

STANSBURY, A. M. & SUMMERS, L. H. (2017). Productivity and Pay: Is the link broken? : National Bureau of Economic Research.

STERMAN, J. D. (2000). *Business dynamics: systems thinking and modeling for a complex world,* USA, McGraw-Hill.

STEVENSON, D. (1997). Information and CommunicationsTechnology in UK Schools: An Independent Enquiry.

STIGLITZ, J. E. (2012). *The price of inequality*, Penguin.

STIGLITZ, J. E., SEN, A. & FITOUSSI, J.-P. (2010). *Mismeasuring our lives: Why GDP doesn't add up*, The New Press.

STOCKHOLM RESILIENCE CENTRE. (2019). *What is resilience?*
An introduction to a popular yet often misunderstood concept [Online]. Stockholm University Available: https://www.stockholmresilience.org/research/research-news/2015-02-19-what-is-resilience.html [Accessed 20/06/2020].

STONE, J. V. (2013). *Bayes' rule: A tutorial introduction to Bayesian analysis*, Sebtel Press.

STORR, W. (2019). *The Science of Storytelling,* London, William Collins.

STOULI, S. (2017a). Interview with Sami Stouli: Problem Spcace Value Productivity. *In:* DAVIES, R. (ed.).

STOULI, S. (2017b). Interview with Sami Stouli: State of the Art Causality *In:* DAVIES, R. (ed.).

STOULI, S. (2018). Econometrics, Causal Modelling, and System Thinking. University of Bristol.

STRASSMANN, P. A. (1990). *The business value of computers: an executive's guide*, Information Economics Press.

STRASSMANN, P. A. (1997). *The squandered computer: evaluating the business alignment of information technologies*, Strassmann, Inc.

STUIJFZAND, B. (2018). Bacs Market Dynamics Modelling Coneptual Validity Review.

STURMAN, M. C. (2007). The past, present, and future of dynamic performance research. *Research in personnel and human resources management.* Emerald Group Publishing Limited.

SUBRAMANIAM, V. & HUNT, A. (2006). *Practices of an agile developer: Working in the real world*, Pragmatic Bookshelf.

SUNDHEIM, D. & STARR, K. (2020). Sundheim (2020) Making Stakeholder Capitalism a Reality. *HBR* [Online], January 2020. Available: https://hbr.org/2020/01/making-stakeholder-capitalism-a-reality.

SUTTON, R. I. & STAW, B. M. (1995). What theory is not. *Administrative science quarterly***,** 371-384.

SWAINE, J. (2008). Bank Bailout Alistair Darling unveils £500 billion rescue package. *Daily Telegraph*, 08/10/2008.

SYED, M. (2015). *Black box thinking: The surprising truth about success*, Hachette UK.

SYED, M. (2019). Rebel Ideas: The Power of Diverse Thinking. London: John Murray.

TALBOT, M. (1991). *The holographic universe,* London, HaperCollins.

TALEB, N. N. (2007). *The black swan: The impact of the highly improbable*, Random house.

TANGEN, S. (2005). Demystifying productivity and performance. *International Journal of Productivity and performance management,* 54**,** 34-46.

TAO, F. & ZHANG, M. (2017). Digital twin shop-floor: a new shop-floor paradigm towards smart manufacturing. *IEEE Access,* 5**,** 20418-20427.

TAYLOR, C. (2018). Summary Report on the Market Dynamics Model Evaluation. University of Bristol.

TAYLOR, C., HUANG, S., LI, J., DAVIES, R., BEIGI, S. & CARHART, N. (2020). Theoretical Framing of the Seismic Robustness and Resilience of Smart Cities and Infrastructure. *17th World Conference on Earthquake Engineering, 17WCEE.* Sendai, Japan.

TAYLOR, D. A. (1998). *Object Technology: A Manger's Guide. 2nd. edn.,* US, Addison-Wesley.

TECHTARGET. (2016). *gig economy* [Online]. Available: https://whatis.techtarget.com/definition/gig-economy [Accessed 03/02/2019].

TETLOCK, P. E. (2017). *Expert political judgment: How good is it? How can we know? New Edn.,* US, Princeton University Press.

TETLOCK, P. E. & GARDNER, D. (2016). *Superforecasting: The art and science of prediction*, Random House.

TETT, G. (2015). *The Silo Effect: Why putting everything in its place isn't such a bright idea*, Little Brown UK.

THE GUARDIAN. (2014). *Sacked Baby P chief Sharon Shoesmith won payout of more than £600,000* [Online]. Available: https://www.theguardian.com/society/2014/jul/23/baby-p-chief-sharon-shoesmith-won-payout-over-dismissal [Accessed 23/06/2020].

THIRY, M. (2010). *Program Management,* Farnham, UK, Gower.

THIRY, M. (2013). *A framework for value management practice, 2nd ed.*, Project Management Institute.

THOMPSON, J. M. T. & STEWART, H. B. (1989). *Nonlinear dynamics and chaos*, John Wiley & Sons.

THOMPSON, M. (2018). *Cultural theory*, Routledge.

TNS (2016). Current Account Switching: The Consumer Reality.

TOSEY, P., VISSER, M. & SAUNDERS, M. N. (2011). The origins and conceptualizations of 'triple-loop' learning: A critical review. *Management Learning***,** 1350507611426239.

TRACY, H. (2013). *Making it a great and effective place to work: Co-creating the conditions for happiness and success.* University of Bristol.

TRACY, H. (2018). Interview with Helen Tracy: State of the Art Learning. *In:* DAVIES, R. (ed.).

TREACY, M. & WIERSEMA, F. (1995). *The discipline of market leaders: Choose your customers, narrow your focus, dominate your market,* London, Harper Collins.

TRUMP, D., KIYOSAKI, R. T., MCIVER, M., LECHTER, S. L., BOGGS, J., DOSSETT, J. & SUDDUTH, S. (2006). *Why we want you to be rich*, Simon & Schuster Audio.

TURNEY, P. B. (2005). *Common cents: The ABC performance breakthrough: How to succeed with activity-based costing,* NY, McGraw-Hill.

TVERSKY, A. & KAHNEMAN, D. (1974). Judgment under uncertainty: Heuristics and biases. *science,* 185**,** 1124-1131.

TVERSKY, A. & KAHNEMAN, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty,* 5**,** 297-323.

UHLEMANN, T. H.-J., SCHOCK, C., LEHMANN, C., FREIBERGER, S. & STEINHILPER, R. (2017). The digital twin: Demonstrating the potential of real time data acquisition in production systems. *Procedia Manufacturing,* 9**,** 113-120.

UKRN (2014). Consumer engagement and switching.

UNIVERSITY OF UTAH HEALTH. (2018). *Value Equation* [Online]. Available: https://uofuhealth.utah.edu/value/value-equation.php [Accessed 24/08/2018].

VAN LIER, L. (2008). Agency in the classroom. *Sociocultural theory and the teaching of second languages,* 163**,** 186.

VANHOUCKE, M. (2012). *Project management with dynamic scheduling. 2nd edn.*, Springer.

VOCABULARY.COM DICTIONARY. (2019). *Definition of Convergence* [Online]. Available: https://www.vocabulary.com/dictionary/convergence [Accessed 24/10/2019].

VYAS, V. & RAITANI, S. (2014). Drivers of customers' switching behaviour in Indian banking industry. *International Journal of Bank Marketing,* 32**,** 321-342.

WAGNER, G. D. & FLANNERY, D. D. (2004). A quantitative study of factors affecting learner acceptance of a computer-based training support tool. *Journal of European Industrial Training*.

WALDROP, M. M. (1994). *Complexity: The emerging science at the edge of order and chaos,* London, Penguin.

WANGENHEIM, V. F. & BAYÓN, T. (2004). The effect of word of mouth on services switching: Measurement and moderating variables. *European Journal of Marketing,* 38**,** 1173-1185.

WARD, J. & DANIEL, E. (2006). *Benefits management: Delivering value from IS & IT investments*, John Wiley & Sons Chichester.

WARREN , K. (2008). The failure of statistical methods to explain business perfromance.

WARREN, K. (2008). *Strategic Management Dynamics*, John Wiley & Sons.

WARREN, K. (2012). The trouble with strategy: The brutal reality of why business strategy doesn't work and what to do about it. *Strategy Dynamics Ltd, Princes Risborough, UK*.

WARRIOR PROGRAMME. (2015). *Randomised Control Trial* [Online]. Available: http://www.warriorprogramme.org.uk/files/Warrior_Programme_RCT_brochure-LR.pdf [Accessed 02/08/2017].

WATKINS, A. (2014). *Coherence: The secret science of brilliant leadership,* London, Kogan Page Publishers.

WATKINS, A. (2016). *4D leadership: competitive advantage through vertical leadership development,* London, Kogan Page Publishers.

WATKINS, A. & WILBER, K. (2015). *Wicked & wise: How to solve the world's toughest problems*, Urbane Publications Croydon.

WATZLAWICK, P., WEAKLAND, J. H. & FISCH, R. (1974). *Change: Principles of problem formation and problem resolution*, WW Norton & Company.

WEBB, A. (2003). *Using earned value: a project manager's guide,* UK, Gower.

WEBER, T. A. (2014). On the (non-) equivalence of IRR and NPV. *Journal of Mathematical Economics,* 52**,** 25-39.

WEILL, P. & ROSS, J. W. (2004). *IT governance: How top performers manage IT decision rights for superior results*, Harvard Business Press.

WEST, G. B. (2017). *Scale: the universal laws of growth, innovation, sustainability, and the pace of life in organisms, cities, economies, and companies,* London, Weidenfeld and Nicolson.

WHEATLEY, M. (2006). *Leadership and the new science: Discovering order in a chaotic world. 3rd ed.,* CA, Berrett-Kochler.

WHITE, W. R. (2012). Ultra easy monetary policy and the law of unintended consequences. *real-world economics review,* 1.

WILSON, B. (2017). *What is the gig economy?* [Online]. BBC. Available: https://www.bbc.co.uk/news/business-38930048 [Accessed 24/08/2018].

WINDSOR, D. (2006). Corporate social responsibility: Three key approaches. *Journal of management studies,* 43**,** 93-114.

WING, J. M. (2006). Computational thinking. *Communications of the ACM,* 49**,** 33-35.

WINSTON, W. L. (2008). *Financial models using simulation and optimization: a step-by-step guide with Excel and Palisade's DecisionTools software. 3rd edn.*, Palisade Corporation.

WOLSTENHOLME, E. (2004). Using generic system archetypes to support thinking and modelling. *System Dynamics Review,* 20**,** 341-356.

WOLSTENHOLME, E. F. (2003). Towards the definition and use of a core set of archetypal structures in system dynamics. *System Dynamics Review,* 19**,** 7-26.

WOMACK, J. P. & JONES, D. T. (2003). *Lean thinking: banish waste and create wealth in your corporation*, Simon and Schuster.

WOOD, D. O. (Year) Published. MIT model analysis program: what we have learned about policy model review. Proceedings of the 18th conference on Winter simulation, 1986. ACM, 248-252.

YEARWORTH, M. (2013). 'From Paradigms to Research Strategies'. *RM1: Problem Structuring and Research Methods*. University of Bristol. Unpublished.

YIN, R. K. (2009). *Case study research design and methods. 4th ed.*, Sage Publications.

ZAFFRON, S. & LOGAN, D. (2011). *The three laws of performance: Rewriting the future of your organization and your life*, John Wiley & Sons.

ZINKGRAF, S. A. (2006). *Six Sigma--The First 90 Days*, Pearson Education.

ZITELMANN, R. (2018). *The Power of Capitalism: A journey through recent history across five continents,* London, LID Publishing.

ZIYASH, A. (2018). Earned Value Management and its Application: A Case of an Oil & Gas Project in Kazakhstan. *PM World Journal,* Vol. VII.

ZUKAV, G. (1991). *The seat of the soul,* London, Random House.

Appendix A Interviews

Appendix A1 contains interviews with subject experts to develop elements of the proposed new theory and to subject the conclusions and thinking synthesised from the research to expert authority and scrutiny. Key insights from the interviews are cross-referenced and corroborated against literature research. Appendix A2 is devoted to an in depth interview of the principal client for the Bacs developmental case study.

A1 Subject Expert Interviews

Subject expert interviews are categorised into Problem Space, State of the Art and Development in order to provide mapping with areas covered under Chapters 2, 3 and 8 respectively, as shown in Table A1. 1. In practice, there is significant overlapping between the subject areas and associated interviews. Material is presented as approved by interviewees. All interviews include: Context, Interviewee Background, Purpose of the Interview, Key Points from the Interview and Conclusions, together with some specific items where needed.

Table A1.1: Interview Mapping

Chapter	Subject	Appendix A1 Ref
Chapter 2 Problem Space Review	Value Meaning	A1.1
	Value Sustainability	A1.2
	Value Productivity	A1.3
	Value Potential	A1.4
	Value Delivery	A1.5
Chapter 3 State of the Art Review	Strategy Focus	A1.6
	Investment Focus	A1.7
	Implementation Focus	A1.8
	Performance Focus	A1.9
	Change Focus	A1.10
Chapter 8 Developmental Case Study	Agile Learning	A1.11
	Causal Precision	A1.12
	Causal Certainty	A1.13

A1.1 Problem Space: Value Meaning

Interview with Tom Gilb

Context

This interview (Gilb, 2017a) was conducted on 21st September 2017 in the context of determining the most advanced methods for quantifying and delivering stakeholder value from transformational change programmes. It is important to include Gilb's work for three key reasons: parallels with Value Management as defined for this research, demonstrable success in depth and breadth of application and level of following earned purely on merit of the methods.

Key parallels with Value Management are:

- Focus on value and emphasis on quantification
- Rapid value delivery
- Simplicity of reporting and value tracking
- Rigorous and perpetual quality control

Gilb's methods have been applied successfully across a wide diversity of applications spanning major private sector organisations, government and defence, which is a similar mix to Value Management application.

Of particular interest is the degree of following which Gilb's methods have earned at the highest levels, in many cases against strong resistance, through demonstrable proof of value delivered.

Interviewee Background

Tom Gilb https://www.gilb.com/ is an engineer and independent consultant, trainer, author and speaker whose mission is to disseminate the best possible methods for extreme problem solving, software development and project management, all focusing on the delivery of value. Gilb is the author of three books of particular relevance to this research (Gilb, 1988; Gilb, 2005; Gilb, 2017b).

Purpose of the Interview

There are two aims of this interview:

- Determine the core essence of Gilb's philosophy, methods, tools and engagement which account for his success with the aim of incorporating these distinctions in the new value theory

- Challenge the case for assigning financial measures to all factors

Key points from the interview

Philosophy

The importance of Gilb's work to this research centres on five key elements encapsulated in his philosophy, methods and tools:

Value Quantification

Quantification is centred on selecting 10 key objectives framed around value. Gilb contends that anything 'variable' can, and must, be quantified. This view is consistent with (Hubbard, 2014) in the context of measuring things which are critical but conventionally considered to be intangible. This includes all values, performance, resources but not binary items such as functions, designs, binary constraints etc.

Value Tracking

Programme value is reported and tracked focusing on what is considered to be 10 key objectives for the programme using a single reporting sheet. This approach combines simplicity with rigour.

Feedback and Learning

Feedback and learning involves dynamic design linked to the 10 key objectives. This is consistent with the 'fail fast' approach being applied in the case studies of this research.

Rapid Value Delivery

Real, measurable value is delivered to one or more stakeholders in increments of two weeks. In fact, Gilb's normal practice is weekly value delivery increments. Alternatively, Gilb proposes about 2% of total time to deadline; up to about a month as a cycle. The point is to time-box, and discipline people to get something simple done, to fail fast and learn early, This discipline, which Gilb enforces whatever resistance is afforded, is consistent, albeit at a more extreme level, with the concept of Value Alignment in Value Management (Davies *et al.*, 2011)..

Specification Quality Control

Rigorous Specification Quality Control is maintained throughout to ensure that the programme remains on value. This element is consistent with a key conclusion emerging from the research concerning criticality of precise specification of purpose, the why?

Quantification of all Benefits in Monetary Terms

Gilb advocates that attribution of measures should be expressed as directly as possible, regarding their nature, for example, security or reputation. It can be useful in some cases to understand the financial consequences of changes, such as improvements, degradation etc. However, direct financial quantification, and using financials as a surrogate, is in Gilb's opinion a bad, unnecessary and avoidable practice because it shifts focus and motivation from the essential characteristic, like security, safety, usability. For example, he questions, ‘how do you put a monetary value on life?’ This view of not quantifying all benefits financially is similar to that held by (Jenner, 2017; Hoverstadt, 2017).

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Critical Distinctions Accounting for Success

There are five distinctions which Gilb attributes to the success of his approach: value quantification, value tracking, feedback and learning, rapid value delivery and specification quality control.

The credibility of Gilb’s methods is corroborated through the strategic application and engagement at senior levels, including Intel, the Pentagon and UK government.

The radical nature of Gilb’s approach necessitates commitment at a level of seniority that commands the authority and perseverance to deal effectively with the resistance and discomfort typically associated with the level of mental model shift.

Quantification of all Benefits in Monetary Terms

There is a caution relating to the quantification of all benefits in monetary terms, which will require reconciliation with the hypothesis, challenged by Gilb, that money is a surrogate for energy. For many critical items any attempt to force a monetary value detracts from defining a more meaningful quantification which facilitates effective tracking and management.

A1.2 Problem Space: Value Sustainability

Interview with Carolyn Hassan

Context

This interview (Hassan, 2017) was conducted on 3rd August 2017 in the context of determining the most effective means to achieve transformational change which delivers sustainable value to stakeholders through strong collaborative learning and action. Knowle West is large public housing estate built in the 1930's and represents one of the most economically disadvantaged and excluded communities in Bristol. However, very importantly, social networks are strong, for example, as a result of several generations of family living close to each other.

Regeneration money has been pumped into Knowle West. However, it is often perceived by residents that very little positive change has been realised despite some significant changes, such as south Bristol hospital and new academy schools. The Knowle West Media Centre (KWMC) promotes and leads citizen led programmes in the local area using a radical and successful approach founded on trust which involves an integrated value chain of stakeholders in the form of citizens, suppliers, authorities and financial investors. This creates a highly resilient, repeatable win-win model. Of particular interest in the context of value sustainability, is the balance between financial, societal and environmental imperatives; the essence of Raworth's 'Doughnut Economics' (Raworth, 2017). There are also strong links to Learning Journeys and Learning Power, together with Value Management.

Of special interest from a Value Management perspective are stakeholders, in this case citizens, who co-create value through volitional interaction with, and influence upon, affordances offered by their environment which can be facilitated through change programme. For example, a change programme may offer new capabilities, such as social housing or a bridge, but value can only be derived by user stakeholders through their application of the affordance. In effect, KWMC transforms learning into value through actionable change.

Interviewee Background

Carolyn Hassan is founder and Director of the award winning Knowle West Media Centre (KWMC) located in South Bristol: an arts and media centre (built of straw bales) that delivers socially engaged media arts projects contributing to a wider understanding of the role of the arts in communities and cities. www.kwmc.org.uk

Purpose of the Interview

There are three aims of the interview:

- Explore the KWMC philosophy, in particular the Bristol Approach to the Citizen Sensing Framework
- Model distinctions which account for their success in winning trust, eliciting engagement and delivering value to stakeholders through change
- Map the Bristol Approach to the new Value Management framework with the aim of applying key distinctions in the new theory

Key points from the interview

KWMC Philosophy

No Blame Values

The KWMC philosophy is founded on no blame values of social justice, inclusion and diversity. The framework always starts with and retains focus on citizens and generates energy within the community which can be transformed into value.

Partnership

A key element is immersion in the process by the citizen as an equal partner stakeholder. The investment is in people experiencing real problems with a focus on doing through actionable change.

Creativity

There is a strong emphasis on creative digital engagement; creativity and KWMC's arts practice is very important, being the key driver of engagement both as a practical means for effective communication, creating the conditions for co-creation of value through innovative thinking and cost effectiveness.

Sharing

This leads to the concept and real application of shared information across the stakeholders. Hassan stresses the critical importance of sharing, stating, "Sharing is not a technical solution but a mindset".

Distinctions which Account for Success

Living Labs

Rather than traditional focus groups, engagement is achieved through living labs; real people addressing real problems within a manageable local area. Emphasis is placed on how to use city infrastructure effectively.

Learning

Reflection and learning are fundamental components and prerequisites for success. The approach and problems being addressed demand authentic cross-disciplinary skills and learning.

Technology

Technology, such as the Internet of Things (IOT) is used when this can add value and usually involves bringing in new skills and capabilities, locally where possible.

Support

Support from relevant bodies, such as Bristol Council, is also critical. Support from the University is welcome but has often been of limited value as they only engage while research funding is available and usually leave before the job is done.

Mapping of Bristol Approach to the Value Management Framework

The KWMC Bristol Approach to Citizen Sensing (KWMC, 2017a) maps closely to the IMPACT Value Management Framework and comprises six highly interrelated phases as defined below, reference to equivalent phases in the Value Management Framework are shown in (parenthesis):

- Identification: Define problem and purpose – Why is this important? (Intention)
- Framing: Define the deep seated causal issues – How – is the problem cause? (Model)
- Design: Define the intervention with a strong focus on innovation where the role of artist/arts very important – What? (Programme)
- Deployment: Integrating skills, networks and incentives (Alignment)
- Orchestration: Centres around success (Certainty)
- Outcome: Consolidate results, learning and repeat success (Track)

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

KWMC Philosophy

The culture of equal stakeholder partnership, the need for shared values and learning are critical and supported through complete openness, transparency and sharing of information. This will only work where there is sufficient trust.

Distinctions which Account for Success

Distinctions for success can be encapsulated as authentic cross-disciplinary engagement of all stakeholders in the programme. This means not only cross-disciplinary professions and trades, such as planning, architecting and building trades, but also the integration of engineering and social sciences.

Mapping of Bristol Approach to the Value Management Framework

There is a close mapping between the IMPACT Value Management Framework and KWMC Framework (KWMC, 2017a). A key take-away for Value Management is the need for inclusion of citizens as equal partner stakeholders in the programme. For KWMC this goes beyond stakeholder representatives but people who are completely committed to the outcome, for example, real house owners and tenants at the point of power where the highest purpose will be fulfilled and associated value realised.

Interview with Anita Bradshaw

Context

This interview (Bradshaw, 2018) was conducted on 1st August 2018 to explore how the emerging value principles and framework is applicable to the question of sustainability, specifically for the green energy industry, using shipping emission as a real case. Of particular interest concerns the framing, definition and quantification of causal linkage between new capabilities provided by green energy solutions in relation to financial viability and stakeholder value. The specific example for this interview concerns shipping emissions, the target for products offered by the start-up company which Bradshaw co-founded and runs, Green Sea Guard https://greenseaguard.com/.

95% of our visible trade in the UK comes to us by sea and shipping emissions constitutes the sixth largest polluter worldwide. Coastguards currently enforce UN regulations by manual inspection of fuel tanks and by inspecting paper fuel receipts. These methods are time-consuming, impacting ship profitability. The manual inspections can take up to four days, so the ship will be incurring additional operating cost and schedule delays. Further, fuel receipts are often inaccurate and can be forged relatively easily, a known problem for regulators. EU guidelines require coastguards to inspect one ship in ten, but even the most conscientious coastguards currently inspect less than one in seven hundred. The Green Sea Guard SEEC system allows ship owners to avoid fuel and receipt inspections, benefiting coastguards and port authorities the benefits of automation.

75 countries signed the MARPOL Agreement requiring ship owners to reduce their emissions of SOx and NOx from January 2015. MRV (Monitoring, Reporting and Verification) regulation entered into force on 1 July 2015. The requirement is for ship operators to monitor, report and verify CO2 emissions for vessels annually. This applies to ships whose gross tonnage is greater than 5,000 entering any EU or EFTA port. Data collection is on a per voyage basis and started on 1st January 2018. Green Sea Guard has developed the SEEC systems to help coastguards monitor emissions and make their job easier; the system also helps ship owners to monitor their CO2 emissions and subsequently report these data to their customers.

Interviewee Background

Anita Bradshaw is the Chief Executive Officer of Green Sea and was previously responsible for Operations. Green Sea Guard is established in the UK, with subsidiaries in the Netherlands and Portugal. Bradshaw graduated in Natural Sciences from Cambridge University, qualified as a member of the Institute of Bankers in 1981 and pursued a career in international banking. She was an advisor to the Bank of England during the run-up to the introduction of the euro, and represented Deutsche Bank AG London where she was Head of Strategic Planning, Transaction Services Division, on a number of industry groups under the auspices of APACS. As a management consultant with Computer Sciences Corporation and later with Logica, Bradshaw created a number of risk models and worked on dynamic strategy modelling with corporate customers, banks and quasi-sovereign entities. A number of these models were created in collaboration with the Author using different iterations of the Value Management technique for a number of Fortune 100 banks and other enterprises. The technique was also used in a more limited fashion in contracts with a major Government ministry, a major global financial services provider and a major US investment bank. In 2012 Bradshaw moved into the Cleantech sector, as COO of EnergyBank and in 2014 joined the founding team at Green Sea Guard.

Purpose of the Interview

There are two aims of the interview:

- Frame and define key technical, political, commercial and economic challenges for sustainable green energy in the context of value
- Explore how the new value approach can address the challenges

Key points from the interview

Key Technical, Political, Commercial and Economic Challenges

While there is general international agreement concerning the ecological, political and economic need for the transition to non-fossil energy, Bradshaw identifies four major barriers to embracing and harnessing green technologies: education, recognition, ideology and vested interest:

Education

Concerning education, there is considerable ignorance, misunderstanding and consequential inappropriate application of green technologies. For example, a Welsh hospital intended to invest in a wind turbine; Bradshaw demonstrated that changing the lights to LED technology, a much simpler and less expensive alternative, was far more energy effective.

Recognition

Recognition relates to an inability to identify opportunities. For example, in the case of the UK, off-shore wind energy offers potentially six times the capacity of current electricity consumption but this and similar statistics remain largely unknown.

Ideology

Closely related to the problem of recognition is ideology. Bradshaw presented the case for off-shore wind energy to a previous UK government administration which, fixated on nuclear energy, showed no interest to consider alternatives.

Vested Interests

Arguably, vested interests represent the most difficult barrier, especially where there is a direct financial disincentive to invest in green energy. The six major power companies in the UK benefit from high energy prices despite the fact that 10% households are in fuel poverty, i.e. spend more than 10% of their income on energy. A similar pattern exists within the Current Account market where exclusion from the most cost effective payment methods is driven in part by financial gain on the part of providers faced with only a low customer switching rates (Hartfree *et al.*, 2016). Vessel owners view regulation intended to encourage green energy practices as a cost and game the system in order to circumvent the expense rather than embrace the potential value opportunities of sustainable energy.

Application of the New Value Approach

Bradshaw argues that the key to countering all the barriers to adoption of green energy lies in demonstrating the financial value to key stakeholders with the power and incentive to realise potential benefits. Using marine commerce as an example, there are essentially two categories of benefit, efficiency and effectiveness. The first step in all cases is the capture, analysis, reporting and application of data relating to sulphur dioxide, hydrogen dioxide, nitrogen oxides and particulates emitted from engines.

Efficiency benefits can be categorised under administration and operational streamlining. Administration benefits include savings in compiling data demanded by regulators. Conversely, for regulators, there is a saving in inspection time and effort. For ship owners there is a significant efficiency premium through engine tuning facilitated through measurement of exhaust. A high level estimate for a fleet of 100 vessels is €40K per day.

Effectiveness savings for ship owners include reduced delays caused through current manual inspections. Wave Dragon http://www.wavedragon.net/ technology potentially enables vessels to operate under electrical power in and around ports, which would greatly reduce emissions, currently a major issue for these areas. SMART data collection and inspections would not only save administration cost, an efficiency outcome, but also increase the overall effectiveness of compliance, with the consequential ecological benefit. Bradshaw argues for a path starting with compliance with a transition to super-compliance, which returns hard financial outcomes for ship owners. A similar strategy was used in the financial sector, where super-compliance resulted in greater trust, thereby attracting additional business and new customers.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Key Challenges for Sustainable Green Energy

There are four key barriers to green energy: education, recognition, ideology and vested interests. Quantifying stakeholder value is the key to providing the hard financial motivation needed for engagement and harnessing of green energy technologies.

Applicability of the Value Management Approach

The Value Management approach provides the means to quantify the magnitude and timing of value attributable to the adoption of green energy technologies. Significant levels of both efficiency and effectiveness benefits can be clearly identified.

A1.3 Problem Space: Value Productivity

Interview with Sami Stouli

Context

This interview (Stouli, 2017a) was conducted on 9th November 2017 to challenge the core contextual framework for this research from an expert economic perspective, with particular emphasis on the causal creation of value, drawing on his expertise in Econometrics and causal inference. Specifically, it is contended that a systemic linkage exists between productivity and stakeholder outcomes through value. Although economics is not the principal focus of the research, there is a relevant relationship between the ability of change programmes to influence productivity, both at micro organisational and macro national levels, with stakeholder value outcomes; the highest purpose of Value Management. Conversely, productivity can release resources, for example through elimination of waste, which can be reinvested in initiatives that further improve productivity, thus forming a potential virtuous reinforcing cycle. The research also draws on the work of William Lewis, who evidenced through extensive research that the key to prosperity lies first and foremost in productivity (Lewis, 2005). However, many of Lewis' findings contradict conventional economic thinking; most notably that economic wealth is primarily driven by capital and education in order to improve productivity. Lewis argues that the causation between these factors works in reverse.

Interviewee Background

Stouli is a lecturer in economics within the Department of Economics at the University of Bristol. Of particular importance is Stouli's research into causation of economic behaviour using multi-variable regression and related techniques (Chernozhukov *et al.*, 2017). Also of special relevance is the application of statistical causal inference to the Bacs Market Dynamics Model (MDM) which demonstrated the feasibility and potential value for combining econometric and systemic modelling techniques in the context of stakeholder value creation.

Purpose of the Interview

There are three objectives for this interview:

- Confirm definitions of economics and productivity
- Challenge the claim that productivity is the key to prosperity
- Explore incorporation of stakeholder outcomes into the definition of productivity

Key points from the interview

Definition of Economics and Productivity

Definition of Economics

Economics is defined as the theories, principles, and models that deal with how the market process works, attempting to explain how wealth is created and distributed in communities, how people allocate resources that are scarce and have many alternative uses, and other such matters that arise in dealing with human wants and their satisfaction (Business Dictionary, 2017a). There are two aspects to this definition of particular relevance to this research. First, economics concerns both the creation and distribution of wealth. Secondly, economics uses models and statistical methods. These two aspects of economics are summarised as how the economy works and as a way of doing social science using particular tools (Rodrik, 2015, p. 7). Smith quotes Alfred Marshall, “economics is the study of people in the ordinary business of life” (Smith, 2003, p. 7).

Definition of Macro Productivity

Through exhaustive research over 12 years across 13 countries to determine how the global economic landscape is the way it is and how to change it, Lewis and his team at the McKinsey Global Institute concluded that the key determinant of national wealth is productivity (McKinsey Global Institute, 2002). National productivity is measured in relation to Gross Domestic product (GDP). GDP is the total cost to produce the entire output from that production, more specifically, the aggregate of all the value added during the production process. This is difficult, if not impossible to determine. However, the same value can be determined through total spend, in which case GDP is defined mathematically as: $GDP = C + G + I + X – M$. C is consumer spending, G government spending, I investment, X exports and M imports (Smith, 2003, p. 62). National productivity is measured as GDP per capita, defined by Lewis as production with a given amount of workers multiplied by the fraction of people who work (Lewis, 2005, p. 9). This results in the GDP per head of population.

Definition of Micro Productivity

Micro productivity refers to output efficiency of specific organisations, industries and sectors, measured as production for a given number of employees or total hours worked. For example, productivity for a manufacturing facility can be measured as the cost or sales per worker or unit hours worked.

Relationship between Micro and Macro Productivity

It follows that national productivity is the aggregation of productivities across all the sectors in the economy, duly weighted in order to take account of differences size. An important finding from Lewis’ work is that to compare productivity across countries and the reasons for differences, it proved necessary build the research bottom up, finding and quantifying causes at individual industry level (Lewis, 2005, p. xvi). Consequently, the method was founded on causal thinking.

Productivity as the Key to Prosperity

Lewis concludes from his research that conventional wisdom concerning the causal drivers of prosperity, capital and education leading to higher productivity and consequential wealth, is diametrically incorrect. His research indicated that increased productivity both attracted and facilitated necessary capital and level of education to support the economy created by increased productivity (Lewis, 2005). Stouli is not familiar with Lewis' work but agrees that productivity has a significant bearing on GDP growth. However, the potential connection between increased productivity and improved stakeholder outcomes raises the challenge of wealth distribution aspects of economics and corporate social responsibility. As Stouli points out, supporting people rendered unemployed through productivity enhancing automation is called welfare. It can be argued that this is an instance of the systemic architype 'Shifting the Burden' (Senge, 1990).

Relationship between Productivity and Stakeholder Value

It is important to note that both micro and macro productivity are measured in terms of output and not outcomes. The implications of this distinction are that it is possible to have high productivity without delivery of real value to stakeholders. For example, automation can result in greater productivity of outputs of less benefit to customers and at the cost of loss of self-supporting incomes to the displaced workers. There is also evidence that inequality is increasing with advances in technology, for example (Mazzucato, 2018b). Conversely, high employment of relatively cheap labour on zero hour contracts, the so called 'gig economy' (TechTarget, 2016), tends to reduce the published productivity measures. This is arguably the case for the UK; high employment at the cost of low wages..

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Definition of Economics and Productivity

Economics includes both wealth creation and distribution under conditions of limited resources. Micro economics covers productivity of organisations, industries and sectors whilst macroeconomics relates to entire economies. When considering national productivity it is necessary to build the macro picture from micro components. Other key references for economics include: Journals of Economic Perspectives and Literature ((American Economic Association, 2017b; American Economic Association, 2017a) and The Economist.

Productivity as the Key to Prosperity

The potential connection between increased productivity and improved stakeholder outcomes raises the challenge of wealth distribution aspects of economics and corporate social responsibility. Productivity is essential in order to create prosperity. The question then shifts to how to share the wealth fairly and sustainably, which is the essence of 'doughnut economics' (Raworth, 2017).

Incorporating Stakeholder Outcomes into the Definition of Productivity

Despite the growth and productivity impacts of globalisation and technology, the capitalist system tends to work increasingly against many stakeholders, particularly those with the least; the market economy does not work for many. Leading authors concerning the problems associated with wealth distribution under capitalism are Thomas Piketty (2014) and Samuel Bowles (2017).

One potential approach to achieving fairer wealth distribution is to measure productivity in terms of stakeholder outcomes rather than focusing on output, which does not necessarily result in desired outcomes. Stouli cautions that changing the definition of productivity to take into account stakeholder outcomes may be problematic and contentious. It is more likely to be effective by complementing stakeholder value with existing definitions.

A1.4 Problem Space: Value Potential

Interview with Jon Collins

Context

This interview (Collins, 2018) was conducted on 18rd January 2018 in the context of how the innovation and evolution of technology will drive change and can be driven to create sustainable and equitable value across stakeholders. The contextual framework of the research comprises four interconnected threads. First, the current economic model of perpetual GDP growth is unsustainable. Second, there is an imperative to grow prosperity through higher productivity of resources: more from less, which is the essence of value. Third, the potential for greater value productivity is offered through effective application of parallel advances in technology and neuroscience, the latter concerning capacity of people to realise afforded opportunities through the former. Finally, realising inclusive, flourishing and sustainable economies and societies demands radically greater success rates for transformational change programmes, the principal vehicle for intentional strategic change but which have a very poor record of value delivery.

Interviewee Background

Jon Collin is an entrepreneur, consultant, author, publisher, speaker and innovator in the field of technology. He devotes much focus on patterns of technological innovation, particularly IT, and the effective application of advances across sectors and industries. Collins is a high level philosophical thinker and frames technology in both wide and deep perspectives, spanning economic, social and political contexts. This quality is particularly valuable for challenging the research contextual framework. Collins and the Author have collaborated in this area for over twenty years.

Purpose of the Interview

There are three aims of the interview:

- Challenge the contextual framework for the research and the role of technology
- Explore key current and future technological advances and their likely social, cultural and economic impacts; of particular interest is Artificial Intelligence, Blockchain and Digital Twin.
- Define what is needed from change programmes to develop and apply new capabilities in order to optimise viably distributive and ecologically sustainable value creation across stakeholders, whilst containing negative impacts of the transition
- Define laws which govern causality and can be used to create value in the Information Age

Key points from the interview

Contextual Framework for the Research

Collins agrees with the statement that perpetual GDP growth is unsustainable due to the finite limits imposed by the carrying capacity of the planet. However, he points out that this is contrary to a strong and widely held view that the virtual nature of the digital economy offers infinite opportunities which can provide the basis for a utopian economy. Collins counters this argument by posing a simple question, 'Why has this not happened already?' His answer concerns complexity. Whilst it is true that the data availability through digital technology is increasing and cost decreasing exponentially, so is the complexity needed to process this additional data. The result is that value creation through technology sees only linear growth, lagging the already available potential. Systemically, this is a 'Limits to Growth' archetype where data availability is a reinforcing loop constrained by a balancing loop of capacity to manage the increased complexity.

This observation, through Collins' direct experience and research, is consistent with Ashby's law of requisite variety (Ashby, 1956) which states that in order to survive a system must possess similar or greater variety as the environment with which it interacts. For practical purposes, variety translates into flexibility and agility. A corollary of this law is that the part of a system with greatest flexibility has greatest influence over the other parts and overall system. For example, a business with greatest flexibility to address, or drive, new market trends will tend to dominate a market or niche. As Christensen shows, market leaders can be toppled by agile new entrants through the pursuit of profit (Christensen, 2013a). In general, says Collins, market disruptions result from identification of areas of high potential difference in value, which can be tapped more effectively using digital technologies than by traditional means. Given that such technological tools are available to all, it is the relative lack of agility of incumbent organisations that makes them (appear) so easy to topple.

Collins proposes that we need to consider not only whether we have the right measure, in GDP, but also if we are measuring the correct range of things to give a fuller picture of prosperity growth. The key point here is that money, the unit of GDP, is a symptom of the need to transact, which it does very efficiently. However, money provides poor information about value. This limitation is exposed in GDP as a measure of value because it does not include anything that is not recorded as a transaction. For example, people undertaking unpaid charity or caring for a family member are not included in reported GDP but can be of immense value from our definition of value as the relationship between outcomes and inputs. Collins notes that criteria such as long-term loyalty and trust are also important measures.

Consequently, conventional economic thinking is wedded to a 'golden cow' which does not serve our purpose of measuring the entire value story. A critical need, therefore, is to connect money to energy, as a means of converting energy into wellbeing, i.e. stakeholder outcomes, using the strengths that money offers, whilst recognising its limitations. Research is needed to improve the route to achieving a facilitated environment in which the transaction efficiency of money can be harnessed to transform energy to deliver effective, equitable and sustainable value. The efficient and effective transformation of energy, where money is a high quality form of information, is proposed by (Odum, 2007).

Key Current and Future Technological Advances

Collins stresses that from a value perspective advances in Information Technology represent a 2-edged sword. On the one hand they connect more people with more information more quickly, enabling new and low entry level business models which offer the prospect of levelling the playing field through innovation. Conversely, these same attributes facilitate the proliferation of fake news, trolling, and indoctrination. Therefore, any initiative to create value must be balanced with containment of risk through misuse.

Information Technology has three pillars: process, storage and communications. All these dimensions are finite, driving specific architectures and working practices as they are used in combination, with the result that we tend to stick with older ways of doing things for longer than we need, even when advances become available. For example, many people still prefer text messaging over voice. This is also true of databases, where SQL remains the dominant language despite the limitations that it imposes as data volumes and processing capabilities increase. For example, the open source Hadoop adopts unconventional data handling for advanced analytics (Halper, 2014).

There are three technologies of particular relevance to Value Management due to their potential in shifting economic and social landscapes: Artificial Intelligence, Blockchain and Digital Twin:

Artificial Intelligence

Artificial Intelligence (AI) is of specific relevance to this research in the context of better prediction of in influence upon outcomes through Learning Journeys and Learning Power. A principal capability afforded by AI is cheaper prediction (Agrawal *et al.*, 2018). A Learning Journey is a process by which an agent transcends from a defined purpose to manifestation of that purpose through performance. Learning Power is the frame by which an agent transforms energy from the environment in the service of a Learning Journey, and measured using seven dimensions which determine and overall orientation to learning: Sense Making, Creativity, Curiosity, Belonging, Collaboration, Hope and Optimism and Mindful Agency (Deakin Crick *et al.*, 2015).

Under these definitions, both Learning Journeys and Learning Power can apply to Machine Learning. For example, an autonomous vehicle agent undertakes a Learning Journey with a purpose of reaching a defined destination which it performs to achieve within a given time. Similarly, it can be argued that machines can exhibit most of the Learning Power dimensions, such as curiosity, creativity, collaboration and agency. For example, an autonomous vehicle agent can be curious in acquiring knowledge about the best route and possess the agency to act upon that intelligence.

Blockchain

Blockchain is most associated with new crypto currencies through its facilitation of the distributed ledger, which is essentially another way of architecting resources. However, arguably the most important aspect of Blockchain concerns self-determining truth, whereby the system introduces two key attributes. First, the technology builds resilience, secondly by imbedding integrity into the system it creates trust; critically both attributes increasing with use. In their HBR article Iansiti et al stress the importance of recognising that Blockchain is not a disruptive, but rather a fundamental, technology (Iansiti *et al.*, 2017). Using the example of TCP/IP in relation to the internet, they argue that that Blockchain will not involve a sudden market shift but that its application will evolve over time requiring the removal of economic and social barriers.

Digital Twin

Since its inception in 2002, the concept of Digital Twin has advanced considerably, largely due to increased analytical power and developments in simulation tools, most recently Agent Based Modelling (ABM). A Digital Twin is based on the idea that digital information constructed about a physical system could be created as an entity on its own. This digital information would be a "twin" of the information that was embedded within the physical system itself and be linked with that physical system through the entire lifecycle of the system. The importance to this research is its application to Complex Adaptive Systems (CAS) which exhibit emergent dynamic behaviour which, whilst not precisely predictable, can be anticipated through quantification of dominant causal patterns, usually in the form of feedback loops (Grieves *et al.*, 2017). It is also important to recognise that learning journeys can be incorporated within a Digital Twin; one of the key concepts tested through the Bacs Market Dynamics Model development.

Imperatives for Driving Change to Optimise Stakeholder Value

Collins contends that the key to value productivity lies not in how much more data can be generated but how this additional data can be used more effectively to create value through SMART applications, such as SMART cities, manufacturing and logistics.

The other dimension which will distinguish winners from losers is the rate at which data can be turned into value. An example is UBER. The business model is essentially very simple, make it easy for customers to talk directly with providers through a mobile app and eliminate the main barrier to entry, qualification based on memorising routes, through the use of readily available and free satellite technology. The model also builds in a reputational trust element, as both drivers and passengers are 'scored'.

The starting point is not so important because this process is cyclic by nature. For example, it is possible that free exploration of technical possibilities can lead to value creating advances without a specific purpose in mind. In effect, purpose becomes clear by challenging how technology will cause change and why outcomes of this change are important. This is similar to the concept proposed by Hoverstadt, where strategy is an emergent property of a complex system and should be enabled through harnessing dynamic patterns, which are often archetypal, rather than imposing rigid top-down planning (Hoverstadt *et al.*, 2017). However, it is also important to operate from a high level purpose, which Frankl proposal as the most fundamental human need (Frankl, 1985).

Collins makes a distinction between augmentation and transformation. The former is concerned with how we use technology to improve what we already do and focuses on physical outcomes. Augmentation involves improvement of product and or process and relates to double loop learning (Argyris *et al.*, 1974). Transformation includes a fundamental shift in mindset, constituting triple loop learning (Tosey *et al.*, 2011). In the context of innovation, Christensen articulates the distinction between augmentation and transformation as sustaining and disruptive technologies respectively (Christensen, 2003; Christensen, 2013b).

The Seven Laws of the Information Age

Drawing on material used for his blogs, Collins provides a valuable summary of his thinking in the context of technology:

The law of falling thresholds

Advances in the fundamental building blocks of technology, i.e. processing, storage and communications, reduce bottlenecks and make new things possible due to falling cost, power and size needs, in parallel with increased capacity, capability and bandwidth. The Internet of Things (IOT), for example, is a manifestation of how sensor-based remote management and control can apply to whole new areas, once it becomes affordable that is. In turn, this enables new practices and models such as pre-emptive maintenance or competitive fitness apps.

At an infrastructure level, falling thresholds are enablers to new approaches for storage and processing, driving specifics such as in-memory Apache Spark, and more general trends like cloud computing. As 5G becomes commonplace, so we will see vastly increased bandwidth, making such things as streamed augmented and virtual reality possible.

The law of self-fulfilling prophecy

Like the technology it creates, the technology industry is constrained by both financial and engineering limitations, which means it has to set priorities. Frequently, these are put in place based on supply and demand: if the market for RAM increases, so will finance be found to create more of it. At the same time, priorities can be influenced by agendas, charisma, personal drive and other forms of influence.

A positive example of this is Moore's Law: when an entire industry gets behind a single theme, putting the necessary research behind it, so it is possible to maintain a steady level of progress across decades. We've also seen the single-mindedness of people like Steve Jobs, who drove the market for tablet computers through seeming force of will, and other pattern breakers such as Elon Musk and Jeff Bezos. Another, more generic, instance of this pattern is the way in which increases in productivity attract the necessary capital and educational resources (Lewis, 2005).

The law of potential differences

Over recent decades, many of the most exciting breakthroughs in technology-led business models have resulted from spotting new connections to enable value exchange. That is, I give you something in return for money. These are dressed up in clever economic terms but boil down to the same set of questions: what can I give you that you are prepared to pay for, and/or how can I short-circuit existing business models, i.e. the means by which energy is converted to create value?

The result plays to the agile startup: given just how slowly old corporations move; if I can do something new quickly, I will be able to siphon off money and grow to such an extent that I will have established myself by the time incumbents catch up. E-business, disintermediation, Uberisation and the Network Economy are all manifestations of this same principle.

The law of inflating expectations

A counter to the law of falling thresholds is that a technological advance can very quickly become a default, rather than an exception. We only have to look at the progression of video, from a minority owning expensive, tape driven camera equipment, to a situation where capturing and uploading video have become a blight on music gigs, and indeed a disappointment if it is not possible for whatever reason.

In turn this drives the law of exponential complexity, as our default behaviours result (for example) in generating far more video content than we can fit on our two-year-old smartphones. Again, this is a law which can be 'leveraged' by technology companies: by getting the customer base to see the new as the norm, it drives new spend as the old very quickly becomes inferior.

The law of exponential complexity

This can be formulated in a number of ways. For example, that the amount of data that we create will always exceed processing capacity we have available. Or that the needs of the devices we need to manage, in terms of volumes, rate of update or upgrade, will always exceed our capacity to manage them. Or that the attack surface will always be greater than our ability to secure it. Or that the photos we take will never be tag-able in a meaningful way.

However it is framed, the consequence is always the same: that the hopes we have, as business, IT management, or home user, live in a constant state of forlorn hope, that the next generation of technology will solve what remain some pretty fundamental issues (manageability, security, insight delivery). Only to find that next-generation technology creates as many new challenges as it purports to solve. This is a perpetual cycle.

The law of unintended consequences

Innovation is no longer in the hands of the technologically savvy few, as individuals create whole new ways of using technology that were never part of the plan. Often these are positive, such as geocaching; equally, they might drive the use of a new technology to its absolute limit, driving designers to distraction and feeding the law of inflating expectations.

Also they can frequently have negative consequences. Each new generation of technology creates new ways to extricate money from people, which is why we have a whole industry around cybersecurity, to counter an entire industry around cybercrime. This pattern also relates to both cause and potential remedy to inequality. Unfettered, markets tend to exploit technology for the few, increasing the gap between rich and poor. Conversely, purposeful learning combined with agency can empower people to engage with the market affordances, for example freely accessible knowledge, to co-create their own value and prosperity.

The law of innovation decay

Any innovation has a sell-by date as, over time, contextual requirements will move to a state which makes the innovation a poor fit to the situation at hand. Individual solutions can never change as quickly as the problem spaces they serve, in many cases as hardware, software and communications are overtaken by the very complexity that they create.

In part, this is a consequence of the law of self-fulfilling prophecy: the push to create new innovations inevitable drives things out of date more quickly. It also results from the laws of both inflating expectations and unintended consequences. Some device vendors have exploited this law through designed obsolescence, accelerating the point at which a device will become redundant.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Validity of the Research Contextual Framework

The contextual structure of the research is borne out by the examination of technology from a value perspective. A key insight is that despite efficiency of data from advances in information technology increasing exponentially, the effective conversion of the data into stakeholder value is only increasing linearly because of the inability to keep pace with the complexity which comes with the advances.

Impact of Technology

The economic and social impact of technology is driven by transformation of value creating opportunities into reality. Importantly, learning plays a critical role in the effectiveness of this conversion process and the rate at which this is achieved.

Fundamental Requirements of Change Programmes

Advances in technology are an emergent property of complex systems and therefore cannot be predicted precisely of planned rigidly. However, positive stakeholder outcomes are more effectively realised through clear purpose framed around value, which can be reflected in strategy and associated change programmes, the coupling of which is a central tent of the interview with (Nieto-Rodriguez, 2017).

Laws Governing the Information Age

The magnitude and time of value creation through the integration of strategy and delivery can be increased by collaborating with causal patterns driven by technology. In practical terms this means exploiting advances in technology to: reduce barriers, attract essential resources, increase rate of energy exchange into value and lock in expectations through the network effect whilst respecting complexity, potential negative consequences and delay between availability and value delivery which has a shelf-life.

A1.5 Problem Space: Value Delivery

Interview with Antonio Nieto-Rodriguez

Context

This interview (Nieto-Rodriguez, 2017) was conducted on 3rd November 2017 in the context of a consistently dominant finding from this research, that the widespread failure of change programmes to deliver intended value to stakeholders is in large part attributable to a disconnect between strategy and implementation. Nieto-Rodriguez corroborates this observation through experience and research, arguing that there are three interrelated factors driving the problem. First, is a general lag in recognition for the necessity to rebalance focus from business as usual, "Run-the-Business" focus to a strategic change, "Change-the-Business". Secondly, implementation is afforded less status compared to strategy across leading business schools, journal articles and management consultancies. Thirdly, organisations do not have the maturity of culture or governance to manage project-driven processes essential to focus investment and resources implementing strategic change, with the result that too many initiatives are taken on, with poor coherence and linkage to strategy.

Interviewee Background

Nieto-Rodriguez is an expert in strategy execution and project, programme and portfolio management with real-life experience spanning strategy management and consultancy, in addition to holding posts in several universities across Europe, UK and USA. Nieto-Rodriguez is author of The Focused Organization (Nieto-Rodriguez, 2012) in which he explains the causal explanation for poor linkage between strategy and implementation, through wide experience and extensive research. His research includes the first global survey on the current state of project management maturity in organisations across the world, which he co-authored while leading the portfolio management practices for PricewaterhouseCoopers (Nieto-Rodriguez *et al.*, 2004). Nieto-Rodriguez also details a proven framework and associated processes for correcting the problem involving the focus on fewer, more critical activities.

Purpose of the Interview

There were two objectives of this interview.

- Confirm complete, correct and consistent understanding of Nieto-Rodriguez's definition, causal explanation and proposed solutions relating to the disconnection between strategy and implementation in the context of value
- Challenge critical and contentious elements of the emerging Value Management Framework, most importantly the quantification of all benefits financially

Key points from the interview

Tactical Perception of Project Management

Strategy implantation, as opposed to strategy formulation, is generally afforded a tactical perception and associated status. This thinking is reflected in the very different professional fraternities supporting what are considered to be separate disciplines. Strategy is the domain of leading business schools, business journals, such as Harvard Business Review (HBR), and management consultancies. Conversely, implementation is championed by the project management bodies, and supported by frameworks, such as PRINCE2 and Project Management Professional (PMP) certification from the APM and PMI in the UK and US respectively. These are viewed as tactical level certifications and implementation is not well represented at Board level in most organisations.

Project Overload

In the absence of mature governance and processes supporting Change-the-Business imperatives, organisations tend to take on too many projects, with poor cohesion between them and lack of connectivity to strategy. The key theme in Nieto-Rodriguez's book is focus. This requires that organisations terminate low or non-value adding projects so that resources can be directed on only the most essential initiatives and render these effective in the context of strategy. The implication of this prioritisation is an ability to quantify the relative value of competing projects; a key element of Value Management.

Changing Recognition

Nieto-Rodriguez stated "Things are changing". Since the book was published in 2012, he has identified a general shift in the recognition for greater focus and linkage between strategy and implementation. This is driven through the necessity for more effective value creation and delivery. Greatest interest in this respect is evident from China.

Quantifying and Tracking Benefits

A key challenge cited by Nieto-Rodriguez is measurement and tracking of benefits. He argues that performance management, including the global leading tool, Balanced Scorecard, is primarily concerned with Run-the-Business. This focus on precise and active performance measurement is corroborated by . He considers that the contention underpinning this Value Management research, that all benefits can not only be quantified but also measured in financial terms, ambitious but worth exploring. The emphasis on precise and active performance measurement is corroborated by (Hudson, 2018).

Conclusions

There are two key conclusions from this interview in the context of the Value Management research and purpose of the interview:

Disconnect between Strategy and Implementation

Nieto-Rodriguez confirms the key messages interpreted from his work, namely the disconnection between strategy and implementation. The key underlying cause is lack of focus on implementation, manifested in poor representation relative to strategy from leading business schools, journals and consultancies and low level of maturity in organisations.

Quantification of Benefits

There is generally close consistency between key findings and approaches across our respective experience and research. In particular, Nieto-Rodriguez cites the measurement and tracking of intangible benefits as a major challenging but invaluable objective.

A1.6 State of the Art: Strategy Focus

Interview with Patrick Hoverstadt

Context

This interview (Hoverstadt, 2017) was conducted on 30th November 2017 in the context of applying the Viable System Model (VSM) principles in Value Management for transformational change programmes. Notably, VSM places strong emphasis on attribution of true causality. The VSM was developed by Stafford Beer, who was a British theorist, consultant, professor at the Manchester Business School and visiting professor at around ten universities and business schools, most recognised for his work on cybernetics in management. Beer authored three key books covering the VSM in an organisational context (Beer, 1979; Beer, 1985; Beer, 1994) and several papers, of particular relevance (Beer, 1984). In the VSM, Beer applied Ross Ashby's Law of Requisite Variety (Ashby, 1956) to define a generic set of structural rules for an organisation to survive by being inherently stable through effective adaptability to change, the meaning Beers assigned to viability in this context.

The relevance to this research is threefold. First, Value Management is concerned with transformational change programmes, which invariably involve organisational design, for which the VSM provides a powerful and well proven generic template. Secondly, the research is converging on a need for overwhelming resourcefulness derived through resilience, both for a system to be sustainable and individual stakeholders of the system to define and realise their purpose. This draws in critical aspects of viability, notably recognition of and respect for requisite variety and fractal autonomy. Thirdly, the VSM provides the foundation for developing value principles in the context of Value Management.

Interviewee Background

Patrick Hoverstadt has extensive experience in organisation design, strategy, business architecture and organisational change using systemic methods and engages in academic work, including Manchester Business School, the Open University and visiting research fellow at Cranfield University. He also developed a set of methodologies that provide different approaches for organisational change, performance management, strategic risk, strategy, partnership governance and organisational agility.

Hoverstadt possesses particular expertise in the theory and practical application of the VSM, related to which he authored two books. The Fractal Organisation (2008) provides clear direction concerning the practical application of the VSM by combining theory, case studies and analytical process. Of particular relevance are his definitions of archetypal organisational failure patterns relating to specific aspects of the VSM. Patterns of Strategy (2017) defines eighty common patterns of strategy, drawing on the work of five global leaders in systemic thinking, Stafford Beer, John Boyd, Nigel Howard, Humberto Maturana and Gregory Bateson, together with thought leaders in management, notably Henry Mintzberg.

Purpose of the Interview

There are four objectives for this interview:

- Explore how the VSM can be applied within Value Management generally
- Challenge contentious aspects of Value Management from a VSM perspective
- Determine any necessary changes, specifically the equitable balance of value across stakeholders and quantification of stakeholder outcomes in financial terms
- Elicit clear working explanations of Autopoiesis and Structural Coupling with the objective of incorporating these concepts within the new value theory

Key points from the interview

General Application of the VSM within Value Management

The cybernetic principles upon which the VSM is grounded provide wide application within Value Management generally. More specifically, key elements of how cybernetic laws are applied in practice form the basis for defining generic value principles in the context of transformational change programme, including:

- Value as energy exchange between the system and environment, respecting requisite variety
- Balancing value across stakeholders for viability with reference to structural coupling and physiological limits
- Strategy as an emergent property
- Need for rapid, precise feedback and correction and the power of trust in this process
- Causal linkage to value through performance measurement and management
- Distinction between value and non-value activities and waste
- Manner in which the VSM integrates intuition and scientific method.

Under the right circumstances it is appropriate to use speed in applying VSM for diagnosis and strategy formulation. Hoverstadt cited a case where he equipped a workshop of economists with just five systemic laws with which to explore causes for the 2008 financial crash, which they previously maintained could not have been predicted. Within a short time they were able to articulate the problems and causes systemically. The speed element is consistent with the Value Breakthrough approach in Value Management.

The VSM consolidates many different views of organisation, for example the multiple perspectives articulated by Gareth Morgan (1997) into a coherent, holistic approach with direct practical analytical diagnosis of problems and intervention design needed for Value Management.

Viable Balance of Value across Stakeholders

A principal tenet of this research concerns the creation of sustainable value for stakeholders. One aspect of sustainability relates to the ecological limits on finite natural resources in the context of economic growth. Another, equally critical, challenge is how to organise our businesses, bureaucracies and economic societies in order to survive by preparing for, and adapting to, future risks. Beer calls this organisational capacity to survive viability. The penalty for violating viability includes relational conflict, which at best impairs value creation and delivery and in extreme cases leads to crime, terrorism and war. The challenge is to create sufficient value and balance how it is shared equitably across stakeholders, ideally through win-win relationships, not only for ethical or ideological reasons, but also to respect stakeholder value viability.

The VSM provides a powerful generic framework for understanding how organisations work, diagnosing problems and designing interventions around the concept of viability, which means capacity to survive. At the core of VSM is Ashby's Law of Requisite Variety which relates to energy exchange between a system, such as an organisation, and its environment.

There are two issues of particular concern in relation to Value Management. The first is the challenge of realising benefits (outcomes) by stakeholders over which there is no direct control by change programme management. Most notable in this context are customers, which include citizens in the context of social provision of healthcare, transport and education etc. For example, a change programme may deliver capabilities, such as improved service, for all or selected customer segments, but cannot control that these will be applied in order for potential benefits to be achieved. It was proposed by the Author to Hoverstadt that customers could be included within the organisational system rather than part of the environment. Hoverstadt rejected this proposal on two grounds: customers would have to behave in a consistent way, which they do not, and the varied nature of energy exchange. He proposes that a far more appropriate approach is through Maturana's structural coupling which provides a means of understanding and addressing the true causal relationships between stakeholders (Maturana *et al.*, 1987).

The second issue of key relevance to Value Management relates to effective market functioning for all stakeholders, in particular those currently excluded and/or exploited. For example, left entirely to a profit supremacy motivation, providers will serve most profitable customers. Usually this means people with the greatest disposable income and propensity to spend it. This leads to segments excluded from products and services which most suit their needs and/or are exploited through lack of choice. For example, in the Current Account market, providers 'buy' affluent customers through relatively high interest on balances, whilst excluding people with high credit risk from cost effective payments, such as direct debits, and charge them excessive overdraft charges. Again, Hoverstadt proposes the application of structural coupling supported by patterns of strategy (Hoverstadt *et al.*, 2017).

Quantification of all Stakeholder Outcomes in Financial Terms

This research is exploring the validity of defining all stakeholder outcomes in financial terms with the aim of providing a coherent means to quantify business cases and facilitate decision making based on financial criteria without compromising casual logic and precision. The motive behind this journey is that, in reality, critical decisions are based primarily on monetary grounds. However, it must be recognised that other experts interviewed, whilst strongly advocating quantification of all benefits, counselled caution against measuring all outcomes in monetary units (Jenner, 2017; Gilb, 2017a).

Hoverstadt strongly advises against artificially assigning monetary measures to factors inappropriately. For example, an important outcome may be increased trust and to use a surrogate measure, such as money, would violate the law of requisite variety, which from a VSM perspective is unacceptable. However, Hoverstadt does agree that the impact of non-financial factors, such as trust can be translated into financial terms through understanding and quantification of causal relationships linking trust to financial outcome. For example, reducing conflict in relationships within an organisation can reduce both the effort and duration of value delivering processes, resulting in simultaneous cost reduction and increase in sales revenue through improved service to customers. The VSM places great store by clear and precise attribution of cause and effect.

Hoverstadt further explained how the conventional approach to Social Return on Investment (SROI) is inverted destructively. SROI measures the financial return of people benefiting from social investment, for example, how social care provides an economic return. From a VSM perspective, the starting point is contribution to systemic viability of social investment, followed by consideration of the most efficient deployment of resources to achieve the outcome. This argument is a corroboration of the value principle, ‘Do the right things then do things right’. The research explores how to achieve social outcomes which are self-funding through economic viability, a proven instance being Citizen-led Housing covered in Chapter 9

Meanings of Autopoiesis and Structural Coupling

Both autopoiesis and structural coupling are critical concepts in the context of VSM. More specifically, autopoiesis concerns the link between Systems 1 Operations and 3 Delivery, while structural coupling relates to relationships between Systems 1 and 4 Development and the Environment. Both concepts were introduced by Maurana and are covered in The Tree of Knowledge (Maturana *et al.*, 1987). It is important to note that every connection in the VSM represents a feedback loop which can be modelled using System Dynamics or other simulation paradigms.

Autopoiesis

Autopoiesis is the process by which a system takes energy from the environment and converts it into energy to form itself under balance. Autopoiesis is a characteristic of living systems. When balance is absent pathological autopoiesis is the result, where there is no shut off mechanism and the process becomes uncontrolled. Instances include cancer and, from an organisation perspective, scope creep where a department takes on greater and greater roles without directive priority and control. Pathological autopoiesis is also similar to the 'waste creates waste' archetype, which the Author identified through direct experience in major defence and aerospace programmes, where nugatory work, rework, duplicated work and management of this waste creates additional waste until some balance is injected, usually in the form of expensive exceptional level of management. In this case, some form of steady state is reached but at the cost of a large waste content. In the Author's experience, steady state is often mistaken for optimal operation. However, running crisis reviews and/or imposing special monitoring measures may prevent further waste but they are not value-added activities in their own right but necessary essential redundancy to respect the requisite variety needed to deal with a suboptimal system.

In the context of autopoiesis, Hoverstadt stresses the distinction between available energy and the ability of an organism to use that energy in order to create and reproduce its own organisation. Autopoiesis refers to the latter. The implication of this from a value perspective is that autopoietic capability has a direct bearing on the value which an agent, process or organisation can create from a given energy source and, conversely, for a given level of autopoietic capability, what level of energy and resource is needed to deliver a defined outcome. It follows that autopoiesis is a measure of value generation capability. There is a close link between this definition of autopoiesis and Collin's observation that advances in technology exceed our capacity to deploy the potential due to complexity (Collins, 2018).

Structural Coupling

Structural Coupling is the structural relationship between an organism and its environment whereby the organism changes the environment and the environment changes the system. In biology, structural coupling occurs at the cellular level. In organisations it can be seen in relationships between providers and customers in the supply chain. For example, a provider may do all that is deemed necessary to satisfy a customer, but value greater could be released if both parties respected and adapted to each other's particular needs, limitations and timescales. This kind of cooperation is referred to as trust in the supply chain.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

General Application of the VSM within Value Management

The VSM provides a powerful template for transformational changes programmes. Of particular practical application is the decomposition of organisational structures which enable precise causal diagnosis of problems and clear direction for effective interventions.

Viable Balance of Value across Stakeholders

The VSM combines Systems Thinking with scientific method for organisational design and strategic change. The archetypal perspective on organisational structure is particularly well suited to building value viability between stakeholders into strategic change programmes.

Quantification of all Stakeholder Outcomes in Financial Terms

VSM principles provide a compelling argument against attempting to assign financial measures to stakeholder benefits where this is inappropriate. However, linking non-financial measures to financial outcomes through precise causal tracing is both strongly advocated and effectively facilitated by VSM.

Meanings of Autopoiesis and Structural Coupling

Autopoiesis can be framed as a measure capability to create value through transformation of energy. Structural Coupling provides both the scientific foundation and practical application of building mutually supportive relationships between stakeholders with the aim of optimising viable, i.e. sustainable, value between them.

A1.7 State of the Art: Investment Focus

Interview with Joseph Lowe

Context

This interview (Lowe, 2017) was conducted on 12th July 2017 in the context of strong corroborative evidence from experience and research that transformational change programmes have a very poor record in delivering intended, or any, benefits to stakeholders. A core purpose of this research is to explore the development of a generic learning framework for creating sustainable stakeholder value, together with principles derived from natural law that when combined can substantially improve the magnitude, timing and certainty of successful value outcomes. This interview explores Lowe's previous and current experience concerning the degree to which Business Case and Benefits Realisation disciplines are practiced and successful within Government and test against this experience the overall viability and practical application of the proposed Value Management approach.

Background

Joseph Lowe is the author of the latest version of the UK Government Green Book

- Strategic Case – Overall viability - the big why?
- Economic Case – Stakeholder value and NPV
- Commercial Case – Procurement
- Financial Case – Fundability
- Management Case – Deliverability

Lowe also has considerable experience with barriers to customer switching in the financial sector, including inertia and loyalty factors, from experience in Northern Ireland in 2004/5, which caused him to refer the banks involved to the competition commission. This is of direct relevance to our work in the current account market for Bacs.

Purpose of the Interview

There are two aim of this interview:

- Explore key challenges concerning the delivery of value from government change programmes
- Define key aspects of the new government Green Book

Key points from the interview

Delivering Value from Government Change Programmes

Government change programmes are subjected to the disciplines of business cases mainly for authorisation purposes. Government departments are under great pressure from Government for programmes that increase efficiency and save money under their overall austerity policy. This has contributed to several negative consequences:

- There are too many programmes to manage effectively
- Business Cases are mandated for authorisation and include projections of savings which are linked to budget targets rather than true causation
- Consultants are brought in support programme design and business case development at significant cost but are not accountable for realisation of value
- Cost Benefit Analysis (CBA) projections tend to be focused on satisfying Government pressures to improve efficiency but there is limited accountability for delivery against projections; there is a level of gaming in response to the need to a promise of meeting of government targets
- Programmes are often progressed against implicit assumptions concerning the purpose; the why?
- Programme design is generally centred on a defined output and associated implementation, rather than a clear specification of the need (why?) or the causal linkage between programme outputs and stakeholder value. Joseph quoted an extreme but typical example of the Connecting for Health programme which wasted around £12Bn
- Post implementation reviews confirm a general pattern that a small fraction, if any, of value projected in business cases is delivered

Green Book

The Green Book (HMT, 2011) is the single most important control document for development of business cases within the public sector. The latest version incorporates the Five Case Model (HMT, 2013) comprising:

- Strategic Case – Overall viability - the big why?
- Economic Case – Stakeholder value and NPV
- Commercial Case – Procurement
- Financial Case – Fundability
- Management Case - Deliverability

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Delivering Value from Government Change Programmes

The main barriers to delivering value from government change programmes centre around: lack of clear purpose, focus on authorisation and imposed budgets and poor causal cohesion. These defined problems derived from experience in the public sector provide a powerful steer for the new value theory. Conversely, given the intended new focus on true causality, the systemic approach and dynamics modelling underpinning Value Management have potential value for government programmes

Green Book

With the aim of addressing issues relating to government change programmes, Lowe is integrating the Five Case Model within the next version of the Green Book, scheduled for release autumn 2017. There is an imperative for much greater emphasis on specifying the why? – Strategic Case – and how? in terms of the precise linkage between programme outputs to defined criteria for meeting the why? – Economic Case. This is in recognition of decoupling between strategy and implementation.

A1.8 State of the Art: Implementation Focus

Interview with Tim Pontin

Context

This interview (Pontin, 2017) was conducted on 26rd and 30th August 2017 in the context of successful delivery of large change programmes and the role of development frameworks, application of development methods. Of particular relevance is the viability and role of the V-Model, which forms a primary foundation for the new value theory framework.

Interviewee Background

Tim Pontin is responsible for major change programmes, principally human resources and payroll, within a global pharmaceutical company of 138,000 employees across 80 countries. Tim has a background in advanced manufacturing technology, management consultancy, innovation leadership, major software development and line and programme management.

Purpose of the Interview

There are two aims of this interview:

- Define key distinctions which determine success or failure in major business transformation programmes
- Explore development frameworks and role for the V-Model as a generic framework for verification and validation.

Key points from the interview

Distinctions for Successful Programmes

There are four key distinctions which influence the success of major, business critical change programmes:

- Committed and engaged sponsor with appropriate level of authority and willingness to use it.
- Capable project/programme manager and this prerequisite cannot be substituted through process or development method.
- An appropriate development method for the programme, for example, where requirements are fixed, functional deliverables business critical and timing less so, waterfall is usually more appropriate than agile approaches.
- Both business and IT architectures must be aligned and integrated, recognising the full implications of change on the business. Pontin has experience of situations where sound business architecture was not mirrored by the IT architecture, with catastrophic consequences.

Development Methods and V-Model

Business and IT Architectures

IT Architecture must reflect the business needs, demanding a deep understanding of, often apparently insignificant, details. For example, Pontin cites a case where basic reconciliation functions were not adequately covered by the IT, yet clearly defined in the business requirements, due to understanding or willingness to acquire it on the part of IT.
In the case of payroll, regarded as non-core but is nonetheless business critical, business architecture must reflect the need for functional accuracy, timeliness and legal compliance. It must be country specific and, whether in-house or outsourced, control must be retained with the business. A rigorous programme launch/start up is required to ensure that all implications of change are defined and appropriately owned. There is also a strong emphasis on learning.

Local vs Centralised Services

Centralisation of services is another major issue. Intuitively logical from an economy of scale perspective, over-centralisation renders serving country specific requirements more difficult and introduces a single point of failure where the fate of a global company is in the hands of a single supplier. Pontin cites examples in the pharmaceutical sector where a shift from local to central control cost billions of dollars

Development Methods and V-Model

Agile

Ag/ile is ideal for dynamic requirements where rapid deployment is important. However, Pontin has experience of agile being dangerously miss-sold as the solution for all development. User Stories used in agile methods, such as SCRUM, are the same as Use Cases and can prove powerful in eliciting real requirements.

Testing

In Pontin's experience testing is crucial yet often performed inadequately. It is also an area subject to human limitations, such as biases. For example, Pontin cites a case where business critical software was assigned for release with problems known to the business. When asked how testing could be passed with known issues, the reply from IT was, 'We don't test what we know doesn't work'. Test Driven Development (Harding, 2018) can be powerful but is not generally practiced.

PRINCE2

PRINCE2 (Axelos, 2013) provides an effective framework and is particularly strong in three areas: risk management, deliverable (rather than task) focus and start up discipline. However, the approach can become too prescriptive and must not be used as a substitute for capable project management.

Project, Programmes and Portfolios

By conventional definition, projects focus on functional outputs, whereas programmes contain logical groups of projects to deliver benefits. This distinction is unhelpful; the highest purpose of both programmes and projects is to deliver value, even if output from a project enables other projects to deliver benefits. Portfolios represent an entire structure of initiatives designed to deliver the business vision and strategy.

V-Model

The V-Model is mandated by the Food and Drug Administration (FDA) for validating IT in pharmaceuticals, whatever development method is used. This corroborates other bodies, such as (INCOSE, 2010) the view that the V-Model provides a fundamental generic framework independent of the development lifecycle or method.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Distinctions for Successful Programmes

The four most important determinants of programme success are: committed sponsor, strong programme management, sound development framework and appropriate business and IT architectures.

Development Methods and V-Model

Whilst powerful where there are unavoidable dynamics requirements, agile as a method can be sold inappropriately, for example, comparing relative costs with very different types of programme, which leads to a dangerous deception concerning the potential value of agile development and management.

Testing is a critical prerequisite for successful software development but often performed badly, even negligently. Test Driven Development provides a power approach to assurance.

Definitional differences between projects and programmes are unhelpful from a value delivery perspective. The important distinction is that all change initiatives are managed holistically as an integrated portfolio focused on stakeholder value.

The V-Model is a powerful, generic framework which is applicable to any programme development and management approach. Very importantly, the V-Model spans extremes of waterfall and agile frameworks.

Interview with Stephen Jenner

Context

This interview (Jenner, 2017) was conducted on 1st September 2017 in the context of increased interest surrounding Benefits Management. Over the last 25 years Project, Programme and Portfolio Management have received increasing recognition and been professionalised, together with related areas such as Management of Value and Risk Management, through various accredited frameworks'. Professionalisation has also resulted from the efforts of relevant professional bodies such as the Project Management Institute (PMI) and Association for Project Management (APM) and the Institute of Value management (IVM). Benefits Managements provides an important integrator by focusing on the highest purpose, delivery of value to stakeholders, and importantly, shares similar concepts, principles and application to the definition of Value Management used for this research.

Interviewee Background

Stephen Jenner has a background in benefits delivery for large government programmes and portfolios. He co-authored the OGC/Cabinet Office (now Axelos) Management of Portfolios (Jenner *et al.*, 2011). He is also author of the book/manual Managing Benefits (Jenner, 2012) , revised 2014, and Chief Examiner for the APM Group (APMG) courses in Benefits Management. Jenner also lectures in a range of 3PM subjects on the Masters in Complex Project Leadership at Queensland University of Technology (QUT), Graduate School of Business, Australia.

Purpose of the Interview

There are three aims of this interview:

- Define the contextual positioning of Benefits Management in relation to other approaches focusing on value delivery

- Explore key distinctions in delivery of stakeholder benefits from major change programmes and portfolios with the objective of incorporation within the new value theory
- Determine the role of advances in systemic, neuroscience and agile methods in delivering stakeholder value from change programmes

Key points from the interview

Contextual Positioning of Benefits Management

It is important to recognise the distinction between two parallel paths of development to the challenge of delivering value from change: Management of Value and Benefits Management. Management of Value (MoV) (Dallas, 2010) also often termed Value Management, but with a narrower definition than used for this research, evolved from Value Engineering and Value Analysis (Thiry, 2013, p. xi). Whilst the definition includes reference to stakeholder value (Institute of Value Management, 2017), Value Management focuses on providing the best quality output most economically and is driven mainly from the construction, manufacturing and engineering industries where this emphasis can provide significant leverage on cost effectiveness.

Benefits Management, also referred to as Benefit Realisation (Bradley, 2010), evolved from a recognition of the dire track record of change programmes in delivering benefits to stakeholders. This problem was, and still remains, of particular concern for IT programmes which is reflected in early proponents, including John Ward of Cranfield University (Ward *et al.*, 2006). Consequently, Benefits Management has been championed by the project and programme management fraternity (ref APM Benefits management SIG and PMI has commissioned research in 2016 & 2017). Originally of only niche interest, Benefits Management gained greater global prominence also from accredited courses provided by the APM Group (APMG) largely through Jenner, who authored key subject matter (Jenner, 2012) and as Chief Examiner. Jenner's conviction to the approach stemmed from his work with the UK Government where he studies the pattern of 'fraud', what (Flyvbjerg, 2006) refers to as 'strategic misrepresentation', concerning fabrication of benefits to meet business case approval criteria, rather than commitment to real delivery of value to stakeholders.

Although arguably an oversimplification, the distinction between the two streams can be summarised as Management of Value being output focused, where outputs are defined as functional programme deliverables, whilst Benefits Management is much more concerned with outcomes, i.e. benefits, which stakeholders derive as a direct result of utility facilitated by the outputs.

Distinctions in Benefits Delivery

Jenner cited three aspects of Benefits Management which constitute important prerequisites for successful application, which are of particular relevance to Value Management:

- Quantification of non-financial benefits
- Incorporating Benefits Management into BAU rather than as a separate discipline and embedding benefits within project and programmes management rather than treating it as a separate 'wrapper' to apply to existing projects and programmes
- Linking strategy with delivery through benefits

Quantification of Non-financial Benefits

In many cases, benefits that are considered to be intangible not only can be quantified but also translated into financial outcomes. For example, staff satisfaction can result in less internal conflict with consequential increases in productivity. However, Jenner stresses the necessity to determine the causal paths through which these benefits will be realised, rather than make woolly assumptions and also consider the extent to which changes in outcomes are affected by other factors. Whilst being important to quantify for measurement and realisation purposes, Jenner does not advocate that all benefits are expressed in financial terms – in fact he strongly argues that non-financial benefits should be expressed in non-financial terms.

Benefits Management as Business as Usual

Many organisations view and organise Benefits Management as a separate function. This thinking is flawed because it projects the message that the realisation of benefits is someone else's responsibility, much in the same way as quality was once practiced in the UK. This leads to Benefits Management being siloed, when it should be imbedded in Business as Usual (BAU). This shift requires clear accountability for benefits. It should also be noted that part of the cause for this treatment of Benefits Management as a specialism is due to so-called 'benefits management specialists'.

Linking Strategy with Delivery

There is still a disconnection between implementation and strategy, largely because it is deployed at the tactical, project and programme levels in organisations, without due recognition in the boardroom. However, Jenner's view is that spreading the application of Benefits Management in implementation programmes, and particularly portfolios, is the most pragmatic way in which the mindset and methods will be adopted strategically. Jenner supported this by citing the work of Nieto-Rodrigues who, through extensive research, attributes the poor linkage between strategy and implementation to, among other factors, failure of organisations and universities to recognise the shift from core capability focus to the need for implementing strategic change (Nieto-Rodriguez, 2012).

Role of Systemic, Neuroscience and Agile Advances

Systems Thinking and Complexity

Jenner considers Systems Thinking and complexity important in the context of Benefits Management and includes these subject areas in his coursework. He cited the work of John Seddon in the UK (Seddon, 2003; Seddon, 2008) and Ken Miller in the US (Miller, 2010; Miller, 2011b) which are particularly relevant and accessible to practitioners, although Masters level course materials are based on more ‘academic’ sources such as Michael Jackson (Jackson, 2003).

Neuroscience

Neuroscience offers powerful insights which are of direct relevance and application to Benefits Management, which Jenner also includes in his authored material and coursework. Of particular importance are cognitive biases in the context of wishful thinking in business cases, where benefits are overestimated and costs inadequately provisioned, and cited the work of Daniel Kahneman (Kahneman, 2011). Particularly in this respect, like the Author, Jenner is trained to Master level in Neuro Linguistic Programming (NLP).

Agile

Agile methods are important in the context of Benefits Management for two reasons. First, agile methods are being increasingly used and ‘sold’ on the grounds that their application results in stakeholder benefits through customer focus and speed of delivery. Secondly there is evidence, corroborated by (Pontin, 2017), that flexibility is being used as a substitute for discipline in defining true purpose of initiatives and causal tracing between initiatives. Whilst the former provides significant potential for the self-funding portfolios, this will only realise benefits if flexibility is balanced with essential discipline. This balance is encapsulated within the concept of Precise Simplicity (Davies *et al.*, 2011).

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Contextual Positioning of Benefits Management

Benefits Management is similar to, and complements, Value Management as defined for this research. The power of the approach lies in its outcome focus which deals with the numerator in the relationship of value expressed as the ratio of benefits to inputs. It also provides a management framework in which Value Management can be managed; ultimately there is little point in realising benefits if the cost exceeds the value of those benefits.

Management of Value is also applicable to Value Management as defined in this research, with the nuance that the emphasis is on the denominator, i.e. the cost of producing outputs.

Portfolio Management is particularly important in the context of Benefits Management because it provides the structure for aligning value across all initiatives in an organisation and reduces the risk and waste associated with double counting of benefits.

Distinctions in Benefits Delivery

There are three key distinctions in the Benefits Management approach which are of particular relevance to and corroborating findings from this research: quantification of non-financial benefits, incorporation within BAU and linkage between strategy and delivery.

Role of Systemic, Neuroscience and Agile Advances

Systemic methods are relevant to Benefits Management and included within associated academic course materials delivered by Jenner. Advances in neuroscience are also incorporated, in particular with reference to biases which can lead to false and/or inaccurate benefits. Applying the flexibility of agile is valuable, with the caution that it must not be used as a substitute for rigorous and precise causal disciplines in the context of benefit quantification.

A1.9 State of the Art: Performance Focus

Interview with Andrew Hudson

Context

This interview (Hudson, 2018) was conducted on 18th April 2018 in the context of stakeholder value delivery from change programmes through rigorous Benefits Realisation Management with a strong focus on realising high performance through rigorous, precise measurement.

Interviewee Background

Andrew Hudson is a pioneer and leader in the field of benefits realisation, undoubtedly the most challenging aspect of Value Management. Hudson has 30 years' experience working with organisations to improve their management of strategy, operations and change by introducing and applying leading management and governance practices & tools, specifically:

- **Performance objectives** : Working with leaders to define and cascade performance objectives
- **Measurement**: helping teams to apply better measures to drive performance improvement
- **Process: Ensuring** operations are slick, with effective controls and governance
- **Risk**: Minimising the likelihood and consequences of operational and project risk
- **Benefits**: Helping beneficiaries to maximize the value of change investment
- **Initiatives**: Keeping initiatives aligned with the strategy and maximizing ROI
- **Governance**: Ensuring that appropriate controls and reporting is in place to support better decision making

Hudson's software company, ChangeDirector http://www.changedirector.com/ , recognised by Gartner as a 'Cool Vendor', provides an application toolset of the same name supporting benefits realisation. As speaker, he inspires people to adopt better practices in effective strategy execution and value realisation. Hudson is currently developing a community of practice with people who recognise the importance of measurement to inspire performance improvement.

Purpose of the Interview

There are two aims of the interview:

- Elicit the current state of Benefits Realisation Management
- Establish key Limitations and Corrective Requirements with the objective of incorporation within the new value theory

Key points from the Interview

Current State of Benefits Realisation Management

Hudson summarises his view of Benefits Realisation Management as comprising three key elements, strategy, projects and programmes and operations, which are related as shown in Figure A1. 1.

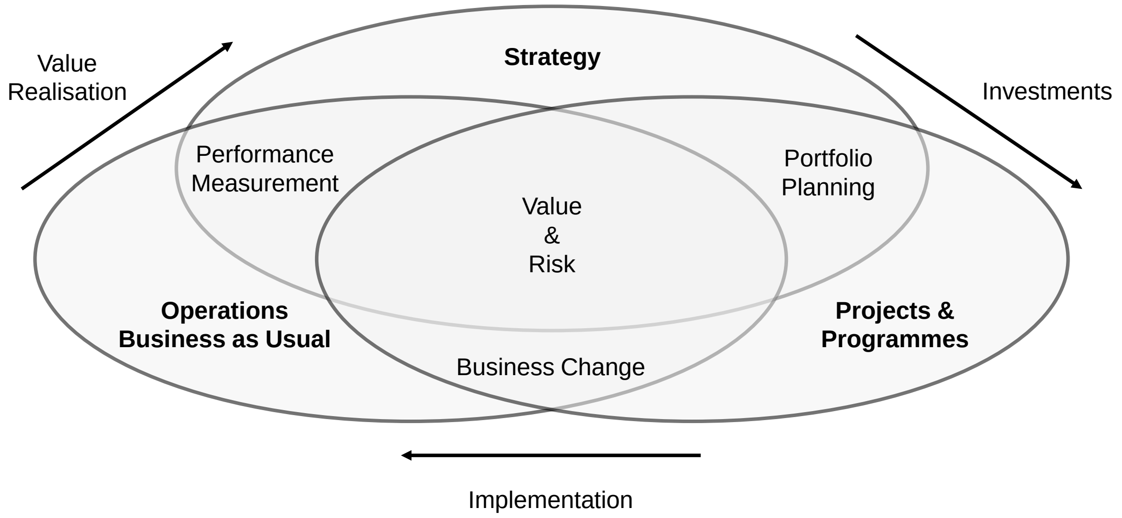

Figure A1. 1: Benefits Realisation Reproduced with Permission

Investments relate to the flow from strategy to projects and programmes; the principal vehicles for intentional business change. There is increased recognition of the need to coordinate multiple initiatives as a coherent whole aligned with strategic vision. This function is provided by portfolio planning and the recognition of its importance has led to structured approaches, notably Portfolio, Programme and Project Offices, shortened to P3O (OGC, 2008).

Implementation concerns delivery of new or enhanced business capability from change initiatives intended to provide the means by which stakeholder benefits are realised. Therefore, implementation is the transition of a current state of business as usual (BAU) into a desired new operational state, involving business change. An important point is that even if all business changes are implemented as specified functionally, this is no guarantee that intended stakeholder outcomes will be realised. This transformation involves utilisation of capability to cause benefits, which requires appropriate behaviour.

Value Realisation refers to the translation of capabilities delivered by programmes into delivery of beneficial outcomes for stakeholders. The emphasis in this transformation is performance measurement and management.

The common ground for all three elements of Benefits Realisation Management concerns value and risk. Value is the degree to which stakeholders benefit from change in relation to cost, whilst risk comprises the probability and impact of circumstances which have a negative effect on stakeholder value, known as exposure.

Key Limitations and Corrective Requirements

Hudson cites the most fundamental limitation in current thinking and practice as much greater focus devoted to the Investments thread, manifested as the definition of strategy on one hand and project and programme management on the other. Further, there is a disconnection between strategy and programmes. Strategy is copiously served through leading business schools, research thought leadership and strategy consultancies, with many diverse models but no definitive standards. Strategy as a subject area has not been professionalised. Conversely, implementation is championed by the professional ‘project management’ fraternity focusing on the process of project and programme management, with an emphasis on accreditation. There is much less academic interest in programme delivery than strategy. This decoupling between strategy and implementation is corroborated by Nieto-Rodriguez who, in researching reasons for the high rate of strategies which fail to deliver intended outcomes, found only two world class business schools teaching project management as a core course (Nieto-Rodriguez, 2012, p. 55). A key consequence of the disconnection between strategy and programme management is failure to translate change into intended business stakeholder value. The observation concerning the decoupling of strategy and implementation corroborates a core finding from this research.

Hudson stresses that there is a general lack of focus on performance management, specifically in relation to benefits measurement and tracking. Despite structured frameworks and methods, notably the Balanced Scorecard (Kaplan *et al.*, 1996; Niven, 2002) and OKR, Operations and Key Results, (Niven *et al.*, 2016), Hudson’s experience is that businesses default to the easier option of measuring tasks and associated functional outputs, rather than stakeholder outcomes intended to result from the delivered outputs. Hudson’s observation concerning this focus on inputs and outputs corroborates the Author’s own experience and research.

Further, Hudson confirms the Author’s own experience that business cases, which are almost always mandatory for programme approval, tend to become the main vehicle for justifying an initiative on financial criteria. This imperative leads to manipulation of financial quantification; typically manifested as understated costs and risk and overestimated benefits. What is needed is for business cases to become a live control tool against which actual value realised is tracked and variances corrected, in conjunction with strong management of risk.

In the same way that strategy and implementation are disconnected, disciplines relating to programmes and realising value in the business are also decoupled, and championed by different bodies; which do not interact and hold very different mental models in relation to value. All fraternities share the same intention, to deliver business value. The programme perspective has consolidated in recent years into Benefits Management (Ward *et al.*, 2006), which is also called, and derived from, Benefits Realisation Management (Bradley, 2010). Accreditation of this approach is provided by APMG-International through Managing Benefits (Jenner, 2012) which draws on various contributors and links to related project and programme management accredited frameworks. Important in this respect are PRINCE2, which focuses on project management (Axelos, 2013), Managing Successful Programmes (Sowden *et al.*, 2011), Management of Risk (OGC, 2007a). Also of interest is Management of Value, which represents both convergence and competition with Benefits Management, originating from a Value Engineering cost benefit analysis foundation (Dallas, 2010, p. 39).

Key Leaders and References

Mike Bourne of Cranfield is leader in performance measurement and management (Bourne *et al.*, 2005; Neely *et al.*, 1997). Other key papers are (Cocca *et al.*, 2010) in relation to SME's and (Buglione *et al.*, 2014) concerning performance measurement standards.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Current State of Benefits Realisation Management

Meaning of the terms Benefits Management, Benefits Realisation Management and Value Management are synonymous to the extent that they share a common purpose of delivering greater stakeholder value from change programmes and all include the development of business cases, using some form of benefit mapping, and subsequent tracking of benefit delivery.

There is a major imbalance in focus on investments and implementation of functionality compared with realisation of business stakeholder value from the capability delivered from change programmes.

Key Limitations and Corrective Requirements

Despite the focus on investments, there is a fundamental disconnection between strategy and implementation of strategy through programme management. Strategy and programme management are championed by different bodies of interest, thought leadership and standards which are not connected through coherent research and improvement. The result is that these key aspects of business change have become, and currently remain, fragmented.

A critical consequence of the bias on investments over benefits measurement and decoupling between strategy and implementation is weak translation of deliverables from change programmes into business stakeholder value, through a failure in performance management. As a result, the strategy is not realised; the loop between strategic intention and delivery is broken. The key to reconnecting strategy to implementation and closing the loop to deliver intended business stakeholder value is to manage clear and precise performance measures linked to value and risk.

Operational areas lack the time and skills to drive and coordinate project outputs across multiple project delivery channels, for example, IT, change programmes, finance etc. As a result, operational areas tend to react to what is being delivered by projects, whether it's adding value or not to their operational areas; in effect hostages to project outputs rather than custodians and customers. To address this, operational teams need to have their own performance and improvement managers to handle this. There is potential for project managers to be retrained to work as performance improvement managers, a potentially far more rewarding and value adding role.

A1.10 State of the Art: Change Focus

Interview with David Shephard

Context

This interview (Shephard, 2017) was conducted in 2nd August 2017 in the context of an imperative to determine the credibility of Neuro-linguistic Programming (NLP) for the purpose of reference in this research. NLP has earned world-wide recognition for transformational change in both individuals and business over the forty years since its inception by Richard Bandler and John Grinder. Between 2005 and 2007 the Author was trained to Master Practitioner levels, by Shephard, in NLP, Time Line Therapy (TLT), Hypnosis and Archetypal Branding, and has practiced since this time focusing on the Breakthrough, involving major shifts. Most relevantly, specific concepts, principles and techniques have been incorporated into the Value Breakthrough approach of rapid transformation for organisations, which is a hypothesis to be challenged by this research. However, despite personal experience and extensive anecdotal evidence of successful application, NLP as a subject is very poorly served by academic research papers and consequently open for challenge of credibility. The solution adopted for this work is to research beyond the specific techniques to the underlying theoretical and academic sources upon which NLP is founded; between which exists significant convergence and corroboration.

Interviewee Background

David Shephard is a Master Trainer in NLP, TLT and related areas concerned with transformational change and is the founder of The Performance Partnership http://www.performancepartnership.com/ He has shaped, honed, combined and delivered training in a wide range of transformational change techniques, including spiritual and esoteric areas, whilst keeping their application firmly grounded in pragmatism. More specifically, Shephard developed the Breakthrough approach to transformational change. Critically for this work, Shephard researched and incorporated original sources upon which the techniques were based into his practice and training.

Purpose of the Interview

There are two objectives for this interview:

- Determine the original sources, relationship between and credibility of original sources underpinning NLP
- Explore relevant aspects of NLP and related subject areas needed for inclusion in this research

Key points from the interview

NLP Origins

Earlier books authored by the creators of NLP, Richard Bandler and John Grinder, do contain useful bibliographies relating to their original sources, but these dry up in their later work. However, subsequent practitioners, including David Shephard, have researched the origins and extensive related authors from which credible referenceable material can be identified. In particular, Shephard was trained by and worked closely with Tad James, who created Time Line Therapy (TLT), and co-authored a book in which there are source references to NLP and related areas (James *et al.*, 2001).

NLP is essentially Cognitive and Behavioural Psychology with a strong emphasis on process (Atkinson, 1990). Core NLP principles are drawn from the work of Korzybski (1994) who referred to the Structural Differential, subsequently named as Chunking, and Neuro Linguistics. The essence of Korzybski's work is presented in more concise form by Falcanar ((Falconar, 2000).

Bandler and Grinder also modelled precise linguistic patterns used by practitioners considered to be the best in their field, including Milton Erickson for hypnosis, Fritz Perls for Gestalt Therapy, Virginia Satir for Family Therapy, Naom Chomsky for linguistics and the work of Gregory Bateson around anthropology. Bandler recalls how NLP evolved in the book he co-authored in 2012, The Origins of Neuro-linguistic Programming (Grinder *et al.*, 2012).

Relevant Aspects of NLP and Related Subject Areas

This part of the interview focuses on those aspects of NPL and related subject areas deemed most relevant to this research and application to Value Management.

Chunking

Chunking is critical to NLP and value creation in that it represents one of the core tenets which link other areas, particularly Erickson's hypnosis patterns for chunking up to establish purpose and the Meta Model for drilling down into performance. Chunking concerns the hierarchical structuring of problems to ensure that they are addressed at the appropriate level. Chucking was derived from Korzybski's Structural Differential (Korzybski, 1994; Falconar, 2000).

Reframing

Reframing is used in NLP to transform meaning. Bandler and Grinder made a distinction between Meaning and Context Reframes (Bandler *et al.*, 1982). Other key references to reframing comes from Paul Watzlawick and Tad James (Watzlawick *et al.*, 1974; James *et al.*, 1988). James uses reframing in TLT which he developed.

Meta Model

The Meta Model was developed by modelling Virginia Satir, (Satir, 1988) and combining this with the work of Chomsky (Chomsky, 2014). Bandler and Grinder built Satir's language patterns into the Meta Model which provides increasing levels of precision by addressing the three main into the Meta Model to identify and correct three categories of error injected through communication: Distortions, Deletions and Generalisations. (Bandler *et al.*, 1976; Grinder *et al.*, 1976). The Meta Model is particularly important for eliciting the deep structural nature of a presenting problem. A variant is the Meta Model III (Dilts *et al.*, 2000) which involves directed questioning for a specific result, which forms a critical element of the Value Breakthrough approach and is incorporated into the Value Power Framework.

Time Line Therapy

Time Line Therapy (TLT) combines the neural arrangement of memories with reframing and intense learning to eliminate negative emotions, such as fear, anger, hurt etc., and limiting decisions, expressed linguistically as 'I'm not good enough' or similar. As such, it is one of the most powerful techniques for transformational change because no end of motivation or SMART goal setting will be effective until negative emotions and limiting decision are removed. TLT was developed by Tad James (James *et al.*, 1988).

Values and Values Levels

Closely linked with TLT are values and value levels. Values refer to those things that are most important to, and motivate, us individually and as groups or societies, in which case they form cultural norms and expectations. Values are expressed as non-physical nominalisations, such as freedom, trust, integrity, love etc. Value Levels relate to the work of Clare Graves and concern the evolution of existential states of man (Graves, 1970).

For practical purposes, it is important to know from what values level a person or organisation is operating from, for example, command and control or entrepreneurial, and for values to be aligned within an individual for personal growth and organisations and teams for group effectiveness. The practical application of values and value levels is covered by Tad James (James *et al.*, 1988). Graves published very little on Values Levels and it fell to his associates to continue his work (Beck *et al.*, 2014; Cowan *et al.*, 2005; Cowan *et al.*, 2000). There are strong links between values levels and the VSM (Hoverstadt, 2017) in the context of transformational change in organisations.

Meta Programmes

Meta Programmes are the most unconscious filters to our perception and were developed by Tad James and Wyatt Woodsmall (James *et al.*, 1988). Meta Programmes are closely linked to Jungian personality archetypes which form the basis of the widely used Myers Briggs Type Indicator (MBTI), against which the four most basic Meta Programmes map. A powerful and accurate extension on Jungian archetypes is covered by David Keirsey (Keirsey, 1998). The work of Shelle Rose Charvet (Charvet, 1997), who introduced the Language and Behaviour profile (LAB Profile), refers to Meta Programmes.

NLP Communications Model

The NLP Communication Model, developed by Tad James and Wyatt Woodsmall from the work of Bandler and Grinder, is one of the key structures in NLP, drawing heavily on concepts in Cognitive Psychology and the ground-breaking work of linguistic analysts Alfred Korzybski and Naom Chomsky. The NLP Communications Model can be mapped to other leading neurological frameworks, for example (Baars *et al.*, 2013, ch 2).

4-MAT Learning Cycle

The 4-MAT Learning Cycle was developed by Bernice and Dennis McCarthy (McCarthy *et al.*, 2005) for educational learning and provides a structure for including the four key learning preferences as a set of questions: Why, What, How and What-if. The preferences also relate closely to Kinaesthetic Audio Visual (KAV) and Audio Digital (AD) learning styles used extensively in NLP, which can also be mapped to Jungian personality archetypes. The 4-MAT approach provides a particularly powerful structure for training (all Shephard's training courses adhere to the 4-MAT structure) and presentations: frame, why?, what?, how? and what-if? (James *et al.*, 2001).

Logical Levels

Logical Levels was developed by Robert Dilts (Dilts, 1990) and refers to the levels of brain processing within individuals and organisations. Although Bandler and Grinder do not agree with the model, it is used extensively and very successfully within NLP because it provides a powerful tool for explaining the relationship between values, beliefs, capabilities and behaviour. These distinctions are critical for value creation.

Archetypal Branding

Archetypal Branding (AB) proposes a number of character archetypes possessing defined strengths and weaknesses which relate closely to Jungian archetypes. AB was developed from the original work by Joseph Campbell (Campbell, 1993). AB can be applied to both individual and organisational change and has parallels with Learning Journeys in that shifts occur as a cyclic learning process.

Acting As-If

Acting as-if involves behaving congruently with a desired projection and/or outcome, even and particularly when this is not supported by underlying personal confidence. The neurological basis for the technique concerns the feedback between beliefs, states and behaviour as encapsulated in the NLP Communications Model. It is generally accepted that beliefs drive states and consequential behaviour, which then causes outcomes. However, the reverse is also true; states and beliefs can be changed through behaviour. Therefore, it is argued, state and beliefs are conscious choice through behaviour, or what Assagiloi termed as “ the act of will”. Assagiloi proposed the act as-if technique in his book of the same name (Assagioli, 1994). Acting as-if is greatly enhanced using linguistic patterns containing the present tense and absolute commitment. For example, “How are we ***certain*** that the outcomes ***are*** realised?” rather than the more usual, “How ***will*** be ***assess*** progress?”

Goals

Shephard cautions against popular distortions of the Law of Attraction in the context of goal theory and practice. In particular, the recent phenomenon, The Secret, proposes that the causal driver of outcomes concerns universal energy which is attracted through thought; we manifest what we focus on good or bad (Byrne, 2008). However, very importantly the book does not stress the need for action. Whilst, agreeing with the Law of Attraction in principle, Shephard stresses that manifestation of intended goals can only be realised through action. He combines SMART goals with the precision of the Meta model in order to provide the degree of specificity required to imbed goals in the unconscious mind and energy to act. He also claims that many of the contributors of The Secret included strong referenced to the need for action but the publishers omitted them to emphasis the ‘cosmic’ contribution over human responsibility.

Breakthrough

Shephard combined many of the key NLP and related techniques into a process for rapid, significant change, which he named Breakthroughs and covers in his Master Practitioner course. Three aspects are particularly relevant to the new value theory. First, the entire change process is completed in one go, typically around six hours. Secondly, the techniques are conducted uncomfortably quickly so that the conscious mind does not have time to constrain the flow; most of the change is accomplished at the subconscious level. Where the slower, conscious mind plays a critical role is in specifying precise goals at the end of the breakthrough process after values alignment. Thirdly, the process requires total commitment to change and a unconditional, child-like inquisitiveness to find the truth; no subject is excluded on the grounds of personal or political discomfort. Another strong theme underlying successful change is respecting the natural laws of cause and effect. In practical terms, this means eliminating blame for failure and focusing on accountability for success.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

NLP Origins

Despite being the subject of scant academic research in its own right, NLP was created and has been honed over the years from highly credible source material and has a proven record of success supported by anecdotal evidence.

In recognition of the need for controlled research Shephard supported the Warrior Programme for veteran servicemen with conflict associated mental problems (on a non-charging basis). This work was a successful Randomised Control Trial incorporating key elements of the Breakthrough process, notably TLT (Warrior Programme, 2015).

Relevant Aspects of NLP and Related Subject Areas

There are many related aspects of NLP and related areas which are of direct relevance and applicable to the new value theory. Furthermore, the underlying theory and specific techniques are highly interrelated and are most effective when integrated holistically. For example, in Value Breakthrough workshops participants are directed to specify intended outcomes to a high degree of measurable precision using the Meta Model III. This is not only to provide a performance framework against which to track progress and correct variances, but to inject strong belief that the outcomes will be achieved, by acting as-if they are already realised. A key to harnessing the power of NLP to effect change lies in total commitment and child-like curiosity for the truth.

A1.11 Development: Agile Learning

Interview with Helen Tracy

Context

This interview (Tracy, 2018) was conducted on 19th January 2018 in the context of realising stakeholder value through the management of change using a strong learning focus. The core research question:

> Can we define and validate a new theory and generic learning framework enabling change programmes to cause intentional equitable and sustainable stakeholder value?

explicitly incorporates learning as the proposed approach for designing and implementing transformational change within an overall value frame. More specifically, the research explores incorporation of Learning Journeys within the framework. A key element of Learning Journeys is Learning Power, both concepts being developed and validated within education. For this research it is necessary to validate their application across a broader business landscape, in particular transformational change programmes. The inclusion of predictability, deemed essential for the research to be of practical value, dictates the need for quantification of cause and effect, more specifically linking initiatives to outcomes. This linkage is through changes in behaviour enabled through the acquisition and application of new capabilities. Therefore, to be of practical use it is essential to link Learning Power with behaviour in order to realise intended outcomes through effective navigation of Learning Journeys. In business this 'so-what' question is manifested as,

> 'What additional value will be realised by stakeholders of the change as a direct result of an investment in Learning Power and Learning Journeys, specifically how much value to whom and is it worth the investment?'

Causal relationships are inherently more difficult when dealing with human aspects of change management, and this interview explores ways to define, quantify and predict causality in the context of stakeholder value creation and sustainability. The interview also contains the consolidation of a number of previous meetings concerning the viability of the proposed Value Power Framework.

Interviewee Background

Helen Tracy is a learning solutions consultant. Through her company, Tales of Leadership Limited, she provides consulting services for the design, creation and delivery of strategic and tactical learning solutions to support organisational growth and change across a broad international client base. Tracy has considerable experience spanning theory and practice in both Learning Journeys and Learning Power, obtaining a PhD from the University of Bristol. More specifically, her work includes the development of archetypes which provide the basis for predicting agent behaviour under defined contexts. To this end, Tracy applied Learning Power archetypes within customer segments used in the Bacs Market Dynamics Model, the main case study for this research covered under Chapter 8.

Purpose of the Interview

There are three aims of the interview:

- Agree practical definitions and application of Learning Journeys and Learning Power, beyond education to broader business for value creation
- Challenge the proposed application of Learning Journeys and Learning Power in the Value Power Framework, specifically, the use of Internal and External Learning Journeys
- Explore the role of causality in the context of value creation from change programmes, specifically the linkage between satisfaction of values and delivery of value

Key points from the interview

Practical Definitions and Implications for Learning Journeys and Learning Power

Learning Journey Definition

A Learning Journey is what it takes to make the transformation from where an agent is now to where they intend to go. Tracy stresses that whilst this journey comprises internal aspects such as changes to mindset, beliefs and identity, along with external aspects such as planning and taking purposeful action to achieve a goal, these are two sides of the same journey and cannot be meaningfully divided or investigated separately.

Learning Power Definition

Learning Power is a way of expressing and measuring the dispositions (Purdue University, 2019) an agent possesses in relation to those it needs in order to navigate a Learning Journey effectively in order to achieve a purpose. It comprises seven dimensions, which are evaluated independently and contextually, offering dynamic insight into an agent's likely efficacy in navigating the Learning Journey they have set for themselves. By understanding their own Learning Power, an individual agent can undertake development activities which purposefully develop their Learning Power, thereby enhancing the efficacy of their Learning Journey. Similarly, understanding an individual's Learning Power offers an intervention framework for those wishing to support an individual on their journey. For example, if it is essential for an individual to be innovative, interventions might focus on developing the creativity and curiosity dimensions of their Learning Power. It is also important to recognise that many of the Learning Power dimensions, for example, curiosity, sense-making, collaboration, and even creativity can be performed through machine learning

Broader Business Application

Although developed and validated within education, Learning Journeys and Learning Power have a wider business application. In particular, there is an increasing imperative to navigate change and create value effectively in a VUCA (volatile, uncertain, complex and ambiguous) world. This demands improved ways, not only of acquiring and applying knowledge, skills and behaviour, but also for re-conceptualising how and what it means to create. The change required to re-conceptualise how value is created is an example of a triple loop Learning Journey.

Tracy conceptualises Learning Journeys as having three fundamental processes, which are underpinned by Learning Power. These are:

- **Identifying and Clarifying Purpose**
- Iteratively **Investigating** the knowledge, skills, behaviours and resources required to achieve the purpose and **Structuring** this **Knowledge** in order to take purposeful action
- **Evaluating Performance** against personal and public criteria to determine whether the purpose has been achieved

These are shown in the diagram below and can be overlaid with single, double and triple loop learning as shown in Figure A2. 2.

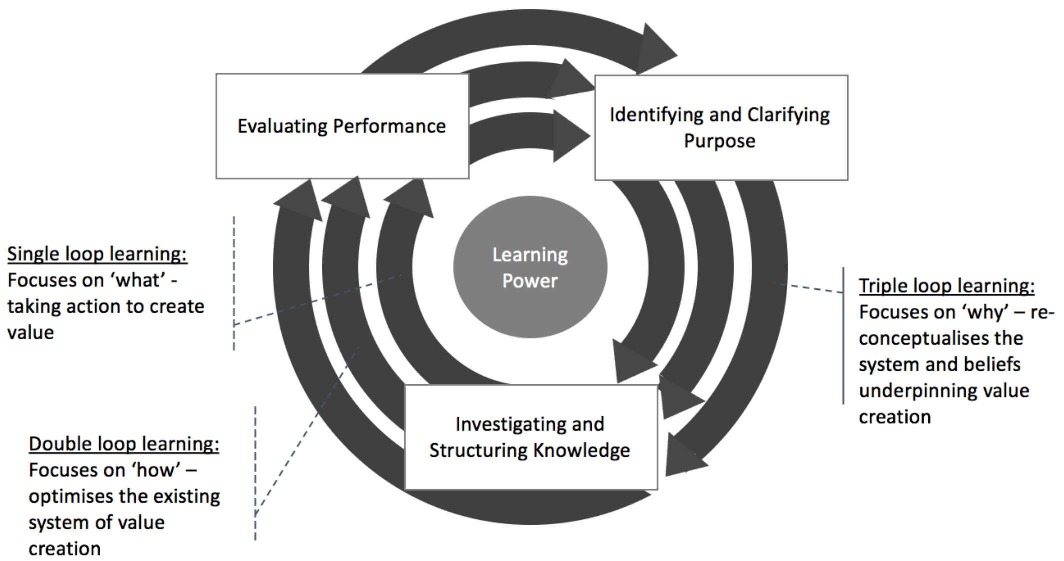

Figure A1. 2: Learning Journey Processes (Reproduced with Permission)

This is in contrast to Deakin-Crick who incorporates Learning Power as a station within the Learning Journey, and who overlays single and double loop learning on to the journey (Crick, 2009; Crick, 2017). The problem with this, argues Tracy, is that Learning Power is a measure of learning disposition as opposed to an active process in its own right. This distinguishes it from Identifying and Clarifying Purpose, Investigating and Structuring Knowledge and Evaluating Performance. Deakin Crick summarises single loop learning as, 'doing the job' without challenging the process. Double loop learning involves ‘reflectively stepping back’ from the existing process and undertaking a Learning Journey to improve it. Tracy builds on this to describe triple loop learning as reconceptualising the system of value creation and the beliefs that sit behind it, essentially undertaking a Learning Journey which changes the system, and constituent processes of value creation.

Conceiving a Learning Journey as comprising independent processes, overlaid with single, double and triple learning offers a pragmatic and actionable framework for supporting transformational change. Tracy argues that this approach builds on the heritage of change methodologies such as Action Learning (Revans, 1982; Revans, 2011), process improvement practices such as PDCA (Deming, 1994) and on recent research into Leadership, (Ibarra, 2015) and Teaming (Edmondson, 2012). Conceiving of a Learning Journey in this way positions every working experience as potentially contributing to a Learning Journey. The effectiveness is determined by the Learning Power of the agent and opportunities afforded by the environment; an interaction the Author refers to this as ‘co-creation of value’.

Framing a Learning Journey as a process, comprised of processes associated with purpose, knowledge structuring and performance can be related to Odum’s concept of ‘transformity’ (Odum, 2007). ‘Transformity’ describes the effectiveness of a given transformation in harnessing energy. A Learning Journey can therefore, by Odum’s definition, be seen as a structured process of harnessing energy from the psycho-social realm which, allegorically, can be seen as propelled by Learning Power. A similar link can be made to the concept of autopoiesis, which Hoverstadt defines as a measure of capability to generate value from the environment (Hoverstadt, 2017).

Proposed Application using the Value Power Framework

Internal and External Facets of Learning Journeys

A Learning Journey comprises internal and external facets. Some of these facets can be observed or inferred from behaviours, others can be expressed by the agent through a reflective process. Others may occur out of consciousness, only becoming visible over time. A crucial point, emphasised by Tracy, is that the internal and external facets of a Learning Journey cannot be separated or explored independently as they are most effectively viewed as the different ‘faces’ of a single process. For example, if the intended outcome of a Learning Journey involved the mastery of a specific skill, such as giving a presentation, the external performance of the skill would be paired closely with internal sense, decision making and evaluation processes. These would include considering actions to take in the world, self-talk to build self-belief, and real time monitoring and behavioural adjustment against a co-constructed perception of what effective performance looked like. This relationship between internal dispositions and external results has strong parallels with the NLP concept of Logical Levels (Dilts, 1990).

Whilst external, co-constructed measures exist and are an important factor in the journey, the transformation is from ‘a person who can’t / is not sure they can’ to a ‘person who can, and does’. For those wishing to support others during their Learning Journey, having an appreciation of what happens internally is vital to offering effective support. However, we cannot focus exclusively on internal aspects because performance is ultimately measured in the world through observation. For this reason, a Learning Journey can be seen as a psychosocial process towards the embodied performance of capability, resulting in the creation of value.

Learning Power and Learning Journeys are paired concepts, and operate recursively to create virtuous cycles. For example, an individual’s experience of effectively navigating Learning Journeys will build their Learning Power which can be transferred to other contexts. Their Learning Power will still vary over time and context, but they have the dispositions required to navigate the Learning Journey that they have set themselves autonomously. Similarly, an individual’s efforts to develop their Learning Power is itself a Learning Journey, which has the potential to initiate a virtuous circle whereby the likelihood of effectively navigating future Learning Journeys is enhanced and transformational change more likely.

The transformational potential of pairing Learning Journeys and Learning Power can be seen in learning contexts in the work of Deakin-Crick through CLARA and the Learning Power platform (Deakin Crick *et al.*, 2017a). Deakin Crick frames the Learning Journey in a form which is similar to the Deming Cycle (Deming, 1994, p. 131)., and overlays single and double loop learning. In contrast, Tracy overlays, single, double and triple loop learning, but frames the Deming Cycle as informing Knowledge Structuring, a process within a Learning Journey. Taken together, Deakin Crick and Tracy’s different framing of Learning Journeys provide a practical means of incorporating the paired concepts of Learning Journeys and Learning Power within the Value Power Framework.

Applicability across Contexts

The specific steps that an agent may take in a Learning Journey will be unique to an individual, their purpose and their context. For example, the specific stages that an agent will go through to move from a desire to get a bank account that better meets their needs, to switching their banking provider, will be different. However, at a Meta level, the stages are generic and together with an understanding of an individual’s Learning Power can be used to support an agent’s effective navigation of a specific journey or specific type of journey. Whilst each individual’s Learning Power is unique to them and to their context, there are patterns which can be inferred from their context, their values and their behaviours. This offers the potential for inferring Learning Power from multiple data sets relating to an individual, and for the creation of Learning Power archetypes, defined as typical examples of a person or thing. These can be used to support organisations to plan the products, services and support that an individual is likely to require in a more personalised way. They could also be used to provide critical insight into how a given market is functioning e.g. identifying how a market serves the needs of advantaged and disadvantaged individuals.

Role of Causality in Human Aspects of Change Management

Causality

In her research thesis (Tracy, 2013) Tracy uses the term 'patterns of prediction', drawing on the work of Kay and Goldspink (Kay, 2012) in the context of resilience. She argues that patterns of prediction indicate the degree of correlation which can be anticipated in a system by observing patterns of relationships and associated behaviour. An important point is that correlation does not guarantee causality. We cannot, for example, say that stronger Learning Power causes more effective navigation of a Learning Journey. Instead, we can say that we have evidence of correlation between strong Learning Power with effective navigation of a Learning Journey. On the basis of this, we are able to predict, as discussed previously, that:

- Enhancing an agent's Learning Power will enhance their ability to effectively navigate a Learning Journey
- Effectively navigating a Learning Journey will enhance an agent's Learning Power

Conversely, Value Management places great emphasis on quantifying true causality. This is deemed necessary in order to provide a secure basis for directing interventions, ensuring that they are mutually supporting and prioritising them by value. This process is referred to as TAP (Target, Align and Prioritise). This need is encapsulated under the 'so-what?' question posed under Context. Causal linkage is derived though behaviour. Therefore, it follows that whilst not precise, it may be possible to quantify the causal connection between investment in Learning Power and Learning Journeys to stakeholder outcomes by measuring shifts in behaviour which contribute to those outcomes. Whilst not totally equivalent to causality, patterns of prediction can be applied to infer, corroborate and quantify causality for practical purposes.

Value and achievement of purpose

In the context of Learning Power and Learning Journeys, Tracy argues for the importance of purpose and purposeful action. However there is an important connection between 'purpose', values and value. Values are those things which are most important to people expressed as non-physical nominalisations, such as trust, integrity, security and love. Therefore, values closely relate to purpose (Cambridge Dictionary, 2019j). In coaching and therapy, money is also treated as a value in that it relates to wealth, a value in its own right. Value is the degree to which outcomes exceed the cost of realising the benefits. Outcomes relate to the satisfaction of values. Therefore, value is a measure of the attainment of values in relation to the associated input. Tracy proposes that the intersection of values and value is 'valued', the point of power where values are satisfied effectively, efficiently and authentically. This concept can be expanded to map against the Why? How? What? structure of the Value Power Framework.

Values relate most closely to purpose, why?, value to manifestation of performance, what?, whilst valued reflects how and the process of creating value. This is shown in Figure A1. 3.

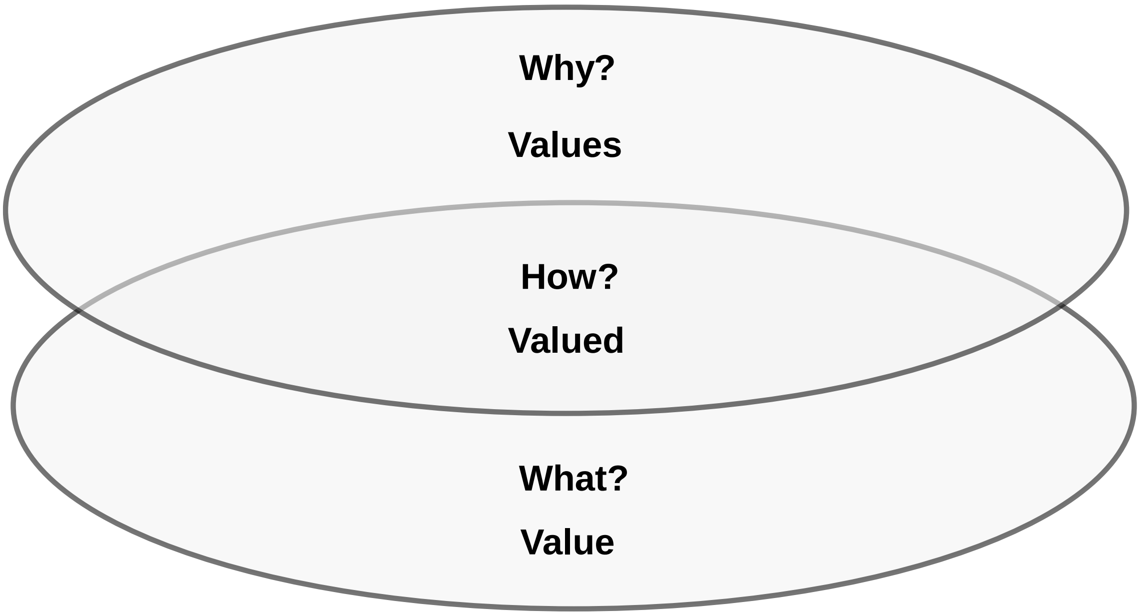

Figure A1. 3: Relationship between Values and Value Reproduced with Permission

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Practical Definitions and Implications for Learning Journeys and Learning Power

A Learning Journey can be seen as a psychosocial process towards the embodied performance of capability, resulting in the creation of value. Learning Power is a way of expressing and measuring the dispositions an agent possesses in relation to those it needs in order to navigate a Learning Journey effectively in order to achieve a purpose, manifested as internal change and external outcomes. Learning Power and Learning Journeys are paired concepts, and operate recursively to create virtuous cycles. The internal and external aspects of a Learning Journey as two sides of the same process and most effective when integrated.

Proposed Application using the Value Power Framework

Learning Journeys and Learning Power are applicable for wider business application. The concepts provide strong support to, and are supported by, the Value Power Framework through framing of a Learning Journey within single, double and triple loop learning. A Learning Journey can be framed as a Deming Cycle incorporating triple, double and single loop learning which translate closely to why? how? and what? respectively. The Value Power Framework provides a strong structure for integrating the concepts of values, value and their intersection, valued, which refers to how values are translated into value and value assessed in relation to values.

Role of Causality in Human Aspects of Change Management

The inference, corroboration and quantification of causality is provided through patterns of prediction, which provides a firm basis for linking Learning Journeys and Learning Power to the causal creation of value; an essential capability for wider business application. Learning Power archetypes can be defined to represent typical examples of a person or thing.
Patterns of prediction can therefore be applied to infer, corroborate and quantify, whilst not being taken as being equivalent to causality. It may be possible to quantify the causal connection between investment in Learning Power and Learning Journeys to stakeholder outcomes by measuring shifts in behaviour which contribute to those outcomes.

Interview with Shaofu Huang

Context

This interview (Huang, 2018a) was conducted on 23rd November 2018 in the context of eliciting further corroboration concerning the correct definitions and appropriate application of Learning Journeys and Leaning Power. A critical frame for the new Value Power Framework combines the concepts of Learning Journeys, learning levels and Deming Cycle, the validity of which requires challenge through both research and subject expertise. Huang possesses research and practical expertise in learning generally and Learning Journeys and Learning Power in particular, so is in a strong position to provide such a challenge from asocial science academic perspective.

Interviewee Background

Shaofu Huang is a social scientist in learning and learning infrastructure, with a particular interest in the dynamics between people intending to teach and those who are supposed to learn. He has a dual background of education and civil engineering by training, with a speciality in data modelling and analytics design. He was a member of the Centre for Systems Learning and Leadership and contributed to the development of the Crick Learning for Resilient Agency assessment tool in 2015. His work in the Learning Framework work stream of the International Centre for Infrastructure Futures project has informed the development of the learning framework for the UK Collaboratorium for Research in Infrastructure & Cities, which has continued to develop through the Urban Integrated Diagnostics project looking at the community learning journey in developing citizen-led housing solutions. Huang was initially involved in the Bacs Market Dynamics Model (MDM) project to support its data collection and transformation processes and has subsequently taken the responsibility of developing and coordinating the delivery of a methodology for evaluating the validity of the MDM.

Purpose of the Interview

There are two aims of the interview:

- Define single, double and triple loop levels of learning and their application in the context of the Bacs MDM by way of examples using a real case study in this research

- Explore the validity of framing a Learning Journeys and associated levels of learning as a Deming Cycle process, forming a critical element of the new value theory

Key points from the interview

Learning Levels

Huang defines the three learning levels from an individual's learning perspective and their significance in the context of Bacs as follows:

Single Loop Learning

A person reacts to circumstances, changing their cognition and behaviour in response to the environment without necessarily being aware of what is going on. This leads to formation of habits. In the context of Bacs, a customer continues to experience push, pull and publicity events and maintains a mental score until a certain point at which they are triggered into some response. However, the customer does not challenge the process or their own behaviour in relation to it. Single loop learning is the behavioural layer, 'What I think and act, or not, in relation to a given set of circumstances and process."

Double Loop Learning

A person will reflect on their experience and reasons behind their response, or absence of response, to the circumstances, considering the potential value. Therefore, double loop learning is a Meta process in which the person is self-reflective on their engagement in the learning process. In the context of Bacs, a customer reflects that if they need to realise better value from their current account provider, it will be necessary to acquire greater understanding of how the system works and how they must change their behaviour in relation to the process. Double loop learning concerns, "How I manage the change process and change both myself and the process."

Triple Loop Learning

Huang acknowledges that triple loop learning is a difficult concept and his understanding is that it is an emergent outcome from the effect of single and double loop learning. In the context of Bacs, a customer changes the way in which they perceive their relationship with their bank and how they influence other people, for example, through Word of Mouth (WoM). Therefore, triple loop learning involves a relational change, a systemic transformation, i.e. triple loop learning is a systemic transformation through changes of relationships.

Huang states that the customer journey modelled within the MDM is confined to single loop learning on the grounds that there is no explicit self-reflection. However, the Author disagrees with this assessment, arguing that double loop learning is included in three key ways. First, the impact on customer cognition level as a result of push, pull, publicity and other events, is driven with reference the value gap in relation to their needs. For some customers, this can include a conscious self-reflective process. Secondly, each month customers can consciously reflect on whether the value proposition from their current provider is meeting their needs and learning from this evaluation impacts their cognition. Thirdly, the switching decision includes reflection of the best value proposition within their consideration set, and a decision made on both emotional (single loop learning) and conscious evaluation (double loop learning).

The Author also proposes that the MDM simulates elements of triple loop learning through the provision for customers to transcend between segments as they progress through their lives, often triggered by significant life events, such as going to university, buying a house, getting married etc., which can involve a structural shift in their mental model and relationships in the context of their current accounting needs. Although not implemented, the intention is to adjust this progression based on their Learning Power profiles which are used for a second level of segmentation and inject greater individualism between customers. However, it is also acknowledged that there is no feedback between learning through the customer journey and Learning Power. (Further application of Learning Power dimensions is dependent on permissions in relation to the Creative Commons licence for this work)

Learning Journey as a Process

Validity of the Value Power Framework is dependent upon valid application of the Deming Cycle at all three levels of learning. The cycle is most commonly regarded as a continuous improvement process in business and manufacturing. Therefore, it is important to subject underlying thinking behind the framework structure from a learning perspective to rigorous expert challenge. Huang provides the second such expert assessment, the other being by Helen Tracy, also covered as an interview under this research (Tracy, 2018).

Crick defines the four processes comprising a Learning Journey as: Forming Identity and Purpose, Generating Learning Power, Structuring Information and Energy and Performing and Evaluating Purpose, in the context of single and double loop learning (Crick, 2017, pp. 298-299). She depicts these processes as a sequential flow, whilst stressing interaction between them. However, in the recent development of CLARA, a platform designed to support the generation of Learning Power, Crick structures the Learning Journey as a cycle: Choose my Purpose, Diagnose and Plan, Do the Job and Measure and Evaluate (Deakin Crick *et al.*, 2017a). The latest development in Learning Journeys draws on the work of Daniel Siegel who purports that the mind, brain (body) and relationships operate as an emergent whole in a 'Triangle of well-being' (Siegel, 2012, p. 4-1).

Huang observes that this learning cycle maps quite closely to the Deming Cycle: Plan, Do Study (Check), Act (Deming, 1994, p. 132), more commonly abbreviated to PDCA, as in Table A1. 2.

Table A1. 2: Deming Cycle and Learning Journey Mapping

Deming Cycle and Learning Journey Mapping	
Deming Cycle	**Learning Journey**
Plan	Diagnose and Plan
Do	Do the Job
Study (Check)	Measure and Evaluate
Act	Choose my Purpose

Whilst Huang cautions that the Deming cycle is essentially a single loop learning tool in the context of the definition stated in the previous section, he acknowledges that the two cycles share the same role of improving performance. However, in order for the learning and Deming cycles to be equivalent, Huang stresses that double loop learning must be included. The Value Power Framework incorporates single, double and triple loop levels of learning.

An important distinction for a Learning Journey concerns purpose and outcomes. Huang argues that for a Learning Journey clear purpose is essential, whilst the outcomes of achieving that purpose are not defined explicitly but are an emergent property of the learning process. He cites by example that his own purpose is to become and academic in the area of learning. However, the manifestation of this purpose can take many forms, such as working within academia through sponsored funding and/or through private enterprise. Whist agreeing with the power and critically of self-selected purpose, the Author disagrees that outcomes are completely emergent; arguing that advances in neuroscience, covered under the literature research, stress the need for specificity of outcomes for realisation of intention; what success looks, sounds and fells like.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Learning Levels

Single loop learning involves an individual reacting to the environment without reflecting on processes involved or the individual's consideration of how their learning and behaviour can influence internal and external outcomes. The focus is on ***what*** to do.

Double loop learning is a Meta level process whereby an individual reflects upon both the processes and an individual's engagement in and influence on the process and consequential outcomes. The focus is on ***how*** to do it.

Triple loop learning is an emergent result of combining single and double loop learning, the critical distinction being that it involves a shift in relationships; in systemic terms this means a structural change in mental models. The focus is on ***why*** it is important to do it.

Learning Journey as a Process

There is sufficient common purpose and structure between learning levels and the Learning Journeys and the PDCA Deming Cycle to combine these concepts into the Value Power Framework. However, for Learning Journeys it is important to include double loop learning; the process of self-reflection and internal change in order to optimise value which is essential for increasing Learning Power.

The definitions of single, double and triple learning levels are consistent with the context within which they are incorporated in the Value Power Framework in combination with the Deming Cycle. In particular, the focus on what?, how? and why? questions for single, double and triple levels of learning respectively are valid.

A1.12 Development: Causal Precision

Interview with Rich Harding

Context

This interview (Harding, 2018) was conducted on 6th November 2018 to explore key disciplines applied by Rich Harding during the transformation of the Market Dynamics Model (MDM) from Proof of Concept (PoC) to an operational strength tool. There are three aspects of any model which must be correct in order to render it fit for purpose. First, the logic must reflect the real world with sufficient fit to achieve the intended purpose of the model. For the MDM high level logic is defined in the Causal Tracing Document (CTD). Secondly, the data must be valid and of sufficient detail and precision to support the purpose. Data is covered through the model input and output files, together with the data transformation process, which traces parameter values from source. Thirdly, the model's logical and mathematical code must operate correctly with respect to the CTD and data. The first two prerequisites relate principally to validation, ensuring that the model is doing the right thing with respect to the real world purpose; the third concerns verification, ensuring that the model operates as intended.

Logic and data validity were assured throughout the entire modelling process, including all PoC phases, through transparency provided by declaration of issues and implemented resolutions, well commented code and structured reviews. However, verification of the model code and computation for the agent-based PoC model presented a significant problem, for two reasons. First, poor architectural structure and documentation of the code, which incorporated computational algorithms, rendered the model difficult to document technically. Secondly, modest test coverage, using manual scripts and a small number of optional run-time tests, provided only relatively low certainty that the model was operating correctly. Although structured tests were conducted against formally documented test scripts for PoC phases, the Author remained dissatisfied that this provided the level of confidence needed for the increasing reliance that the client, Bacs, placed upon output from the model. From February 2016, Harding assumed control of MDM architecture and coding, addressed these shortcomings by injecting three key disciplines that provided a credible level of confidence in results used by Bacs: Object-Oriented Programming (OOP), 3-Tier Architecture and Test Driven Development (TDD).

Interviewee Background

Rich Harding is a System Architect, with twenty-five years' experience, beginning as a Technical Analyst for British Telecommunications PLC, before moving to freelance Analyst/Programmer work in 1998. Specialising in all areas of database interaction and manipulation, Harding single-handedly devised and built an entire, and revolutionary, insurance underwriting and management system, in 2004/5, for Southern Rock Insurance, and spent several years thereafter contracted (on a part-time basis) to further develop the system on behalf of Brightside

PLC. Having already collaborated with Impact Dynamics on their website since 2004, Harding's degree in Economics & Politics (University of Bristol, 1987), made him an ideal partner to collaborate on developing the Value Management Toolset. Taking an unwieldy 20,000 lines of largely procedural Visual Basic for Applications (VBA) code, with no formal test coverage and a confused, non-scalable architecture, Harding strictly applied TDD to separate the application's layers, significantly extend its functionality, and rationalise its code. These disciplines resulted in a far more robust toolset, enabling rapid implementation of advanced functionality. Critically, Harding's immediate application of the same principles to the MDM, allowed him to adopt the model quickly, whilst highlighting and prioritising areas for improvement, and implementing already required enhancements.

Purpose of the Interview

There are five aims of the interview:

- Define Object-Oriented Programming and how it has been applied to MDM development
- Define 3-Tier Architecture and how it has been applied to MDM development
- Define Test Driven Development (TDD and how it has been applied to MDM development
- Consider how transparency and collaborative working were applied and how well these processes operated in practice as rapid development
- Review the verification and validation process and how this can be improved

Key points from the interview

Object-Oriented Programming

Historically, a program has been viewed as a logical procedure that takes input data, processes it, and produces output data (Rouse, 2008). Object-oriented programming (OOP) is a programming language model organized around objects rather than actions and data rather than logic.

The programming challenge was seen as how to write the logic, not how to define the data. Object-oriented programming takes the view that what we really care about are the objects we want to manipulate rather than the logic required to manipulate them. Examples of objects range from human beings (described by name, address, and so forth) to buildings and floors (whose properties can be described and managed) down to the small widgets on a computer desktop (such as buttons and scroll bars).

The first step in OOP is to identify all the objects the programmer wants to manipulate and how they relate to each other, an exercise often known as data modelling. Once an object has been identified, it is generalised as a class of objects which defines the kind of data it contains and any logic sequences that can manipulate it. Each distinct logic sequence is known as a method. Objects communicate with well-defined interfaces called messages.

The concepts and rules used in object-oriented programming provide four important benefits:

- The concept of a data class makes it possible to define subclasses of data objects that share some or all of the main class characteristics. Called inheritance, this property of OOP forces a more thorough data analysis, reduces development time, and ensures more accurate coding.
- Since a class defines only the data it needs to be concerned with, when an instance of that class (an object) is run, the code will not be able to access other program data accidentally. This characteristic of data hiding provides greater system security and avoids unintended data corruption.
- The definition of a class is reusable not only by the program for which it is initially created but also by other object-oriented programs (and, for this reason, can be more easily distributed for use in networks).
- The concept of data classes allows a programmer to create any new data type that is not already defined in the language itself.

Application to the MDM

The PoC Agent-Based Model (ABM) was largely contained and configured within AnyLogic, a market leading modelling application, written in Java, and allowing additional Java code to be included by the user. It is, itself, intrinsically Object-Oriented, both in terms of its underlying code, and its organisation using Agents, which are also Objects. It will also be appreciated that the CTD lends itself very easily to OOP.

When Harding inherited the MDM there were, however, a number of methods within the bespoke code which were overly monolithic, and therefore did not make full use of OOP principles, which also made them more difficult to test. Certain objects, for example the Central Service Provider, were also missing, with their methods handled via other Objects. There were also mismatches between the storage of input values (in particular) in the Excel files that configure model operation, and the Objects in the MDM itself. Whilst overhauling and developing the MDM, Harding addressed the above issues, successfully aligning the conceptual model with the logical organisation of the data model.

3-Tier Architecture

Most modern software applications comprise three essential, separate, capabilities. First, there must be provision for users to input to, control and obtain output from the application. Secondly, the system must verifiably process data to transform input into output. Thirdly, the data must be stored, organised and accessed securely. These three levels are referred to as the Presentation, Business Logic and Data tiers (or layers) respectively and may operate in various configurations under client server architectures.

Implementing 3-tier architecture involves separation of these three capabilities within the application. The PoC MDM had all input data and output results embedded within the AnyLogic model. However, AnyLogic provided poor functionality for presenting output, and as the volume and complexity of input increased it became impractical to manage this wholly within the application. An early solution utilised MS Excel for inputs and outputs and offered some data separation. However, this remedy was somewhat clumsy, and the reconciliation between input and output, essential for causal tracing, proved difficult, as separate files were used. Consequently, in transcending the MDM from PoC to operational, Harding restructured the model - as far as practicable whilst retaining the benefits of AnyLogic's in-built functionality - using 3-tier architecture principles, key aspects of which are now discussed.

Presentation Tier

Harding consolidated use of Excel as the presentation layer platform for three reasons: ease of syndication (everyone has access to Excel), ready-made functionality for building tables and graphs – also easily embedded into MS PowerPoint for presentation purposes - and the ease with which new outputs can be added, providing the means for causal traceability and analysis. The only aspects of the Presentation Layer retained in AnyLogic are, necessarily, those concerned with actually running experiments, principally a simplified screen from which to choose input files and name output files, plus the built-in monitoring screen that shows the progress of an experiment.

Business Tier

The business layer is contained within the AnyLogic application itself, and bespoke Java contained within the MDM AnyLogic model file. The main deficiencies inherited by Harding on taking over control of MDM development, were inadequate documentation and test quality and coverage. For PoC documentation, the Author maintained a live Model Description document comprising diagrams and text covering key concepts, with cross referencing to functions as these developed. However, the Model Description documentation did not provide an adequate Technical Specification from which to develop an operational model, principally because it did not include a structured view of all of the logic. To address this deficiency, the Author experimented by enhancing the Causal Loop Diagram (CLD), originally developed for synthesis of the literature research, to represent the entire PoC model as it reflected the real world.

Harding found that this view provided sufficient definition of the logic to fulfil the role of a Functional Specification, from which he was able to use his considerable experience to derive the individual elements of a Technical Specification necessary to refine and extend the MDM. This CLD approach was formalised by the Author into the Causal Tracing Document (CTD), which, in addition to providing a Functional Specification, fulfilled the requirements for a Conceptual Model, consistent with Sargent's verification and validation approach for simulation modelling (Sargent, 2013).

Data Tier

AnyLogic has its own database and related functionality that Harding was originally minded to use for the Operational Model. However, as with the Presentation Tier, the practicalities of the wider project again meant that, whilst this would have been the "architecturally correct" decision, it would have conflicted with the Rapid Application Development (RAD) requirements of the project (Covered later in the interview).

Instead, Harding combined the two separate input and output templates inherited from the PoC model into a single Excel file, to provide a standardised pseudo-database, which both contains the input parameters for the MDM and receives its results. The major advantage of this enhancement was clear traceability between inputs and outputs, whilst retaining the ability for others to more easily understand those, as well as collaborate in model development. Harding also rationalised the layout of the data tier, in a manner analogous to database tables and views, whilst removing any unnecessary complexity and business logic.

The data tier also differs from a classic database in that it is experiment-specific, the previous approach of aggregating multiple outputs in a single Excel file being dropped, as it was too unwieldy for the significantly extended set of available outputs. In other words, each experiment is its own, self-contained database, which will never be overwritten or otherwise altered by subsequent experiments. This enables full exploitation of the modelling functionality contained within the AnyLogic Business Logic tier, where multiple experiments are intended to produce varying outputs, due to significant stochastic elements. Also, it could not have been achieved as successfully or simply had AnyLogic's own database functionality been used.

Summary

The overall result is an architecture that utilises the strengths of the two off-the-shelf applications, Anylogic and MS Excel, to deliver a clear separation of the Business Logic from the Presentation and Data Layers. Each of the latter happens to reside in each experiment run's Excel file but is otherwise entirely separate from the other.

Test Driven Development

Test Driven Development (TDD) creates software in very short iterations with minimal upfront design and involves writing automated tests of a program's individual units; the smallest possible testable software components (Janzen *et al.*, 2005). (Harding suggests that the word "often" is missing from the above, after "iterations". He says that, as written, the authors are, entirely incorrectly, ignoring the use of TDD by developers who know exactly what they want to do and have a very good idea of how they will achieve it.) TDD is the discipline of creating production and test code in tandem and provides a highly effective and productive framework for developing software, including modelling. It is founded on three rules which focus resource on one thing at a time to ensure synchronisation between the production and test code:

- You can't write any production code until you have first written a failing unit test
- You can't write more of a unit test than is sufficient to fail, and not compiling is failing
- You can't write more production code than is sufficient to pass the currently failing unit test

(Reid, 2018)

Beck cites two criteria for effective software development: the environment must provide rapid response to small changes and designs must consist of highly cohesive, loosely coupled components, in order to make testing easy. He defines the TTD mantra for order of programming as Red/Green/Refactor, which can be restated as fail – pass - optimise. Red involves writing a small test which may not even compile at first. Green ensures that the test works quickly, committing any necessary 'sins' in the process. Refactor eliminates all duplication injected in getting the test to work (Beck, 2003, p. x). In practice, the process is fractal; all three rules operate at Red, Green and Refactor levels. Very significantly in the context of TDD processes, Beck also applies Systems Thinking using Influence Diagrams, i.e. Causal Loop Diagrams (CLD), which include feedback (Beck, 2003, p. 207), and fractals using Fibonacci series which relates to the Golden Ratio (Beck, 2003, p. 211).

The major challenge in taking on the MDM was the absence of technical documentation. Harding used the power of TDD in six key ways. First, TDD provided the means to determine what the existing code was doing, and whether this matched the functional intention. Secondly, tests were developed for essential but omitted functionality by ensuring failure of these tests. Thirdly, integration tests were written to cover compound functionality. Fourthly, monolithic and obscure existing code was refactored into smaller, readily testable functions. Fifthly, tests were created for some of the in-built AnyLogic functionality, to verify its precise operation. Finally, tests were extended iteratively to ensure constantly improving coverage, across both existing and new functionality.

Unit and Integration Testing

Two types of test were created, unit and integration. Unit testing involves individual tests for individual functions, which latter are condensed to the smallest units of code. AnyLogic calls were reduced to stubs, calling standalone functions that are easier to test. Integration testing involves verifying behaviours through more complex processes - particularly important when using a modelling engine such as AnyLogic - to ensure integrity of functionality. For the MDM, Harding wrote tests for feedback loops defined in the CTD and also extended test coverage to code within AnyLogic itself.

TDD is very closely related to Fail Fast principles, often associated with agile software development, where failure is reframed as learning. Fail Fast can render effective code early, fast, and often and better (ArrkGroup, 2015). TDD and Fail Fast are all the more critical in supporting advances in Digital Twins to ensure that the model reflects the territory more precisely. TDD is particularly relevant to Value Management because it represents direct, practical application of value principles: 3 eliminate waste and respect redundancy, 4 optimise value in space and time and 7 combine right first time and feedback.

Transparency and Collaborative Working

Concerning transparency, Harding stresses that TDD is an inherently transparent process because, combined with structured and detailed commenting, it renders code operation and criteria for success explicit. For the MDM, TDD was used to reverse engineer the Technical Specification to produce two built-in test suites, unit and integration. In addition, the process of extending outputs in the Presentation Tier exposed anomalies in the code, which is an example of the benefits of transparency in action. Harding notes further that, for an undertaking such as modelling, where the software's purpose is inherently dynamic, additional outputs in the Presentation Tier, if competently conceived and implemented, themselves constitute a visual integration testing resource.

A key advantage which TDD brought to the MDM development process was facilitation of Rapid Application Development (RAD), which manifested in three ways. First, it enabled what Harding explains is a crucial point of RAD, not to create architecturally "perfect" code, but to produce output which is fit for purpose as soon as possible, whilst enforcing accuracy in code, which may then be continually refined. (In Value Management this important approach is referred to as being 'essentially right rather than exactly wrong'). Secondly, TDD supported the appropriate level of flexibility needed for collaborative development, where it is essential to know who is contributing and with what. Thirdly, TDD used in a RAD environment proves that code is operating as intended, so providing the confidence for resources to focus on creative innovation.

Verification and Validation

TDD enabled independent and repeatable code verification. Throughout development, Harding maintained detailed notes concerning issues and decisions, which were consolidated into highly structured questions for the team as a perpetual validation process. However, Harding cites two major frustrations, the first concerning validation and the second verification. Despite declaring and formally requesting advice on known issues relating to how the model represented the real world, very little feedback was received from the academic partners, and never within the necessary timescales. It proved necessary for Harding to implement his proposed solutions reviewed and supported and authorised by the Author. Similarly, no structured, independent verification of the code has been completed by the University of Bristol, despite repeated requests - and the fact that all of the model and test code that constitute the AnyLogic Business Logic tier are saved in XML format, so readily interrogated and transformed. In order to contain risk (for submission of results from the MDM to the Bank of England et al.) it proved necessary for another team member, who was sufficiently distant from the code to satisfy the criteria for independence, to conduct detailed code verification.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Object-Oriented Programming, 3-Tier Architecture and Test Driven Development

The combination of OOP, 3–tier architecture and TDD proved to be an ideal environment for modelling complex systems for immediate real world application, by facilitating a RAD approach, delivering deployable code quickly, and providing certainty through extensive, built-in unit and integration test coverage.

TDD, using OOP, is ideal for backporting, in the case of the MDM, from PoC into industry strength code; each iteration increased understanding of the existing application. In parallel, the techniques generate well-structured and documented code with built-in tests which can be rerun automatically, saving significant time and effort compared to use of manual test scripts.
TDD also supports agile approaches to enabling RAD, and proved particularly suitable for the fail-fast approach to model development.

A further unanticipated advantage, highlighted through the fail-fast approach, is that by exposing anomalies and omissions and providing insights for potential improvements, TDD allows the coding process to lead the conceptual modelling, which then informs the OOP. In this way the CTD served two purposes. First, it could lead development in its role as a functional specification. Secondly, it could be used to capture enhancements led through the TDD process as formal documentation of the Conceptual Model.

The TDD process of fail - pass - optimise is inherently fractal and corresponds with the flow of structured questions in the Value Management Framework for strategy formulation. Once the purpose (why?) is defined, we explore how are we failing to achieve the purpose now, what specific capabilities are needed to remedy the failure and what configuration of capabilities is optimal in order to align local (unit) level and system (integration) level success.

TDD and OOP support Value Principles 4: Eliminate waste and respect redundancy, in which respect Harding applied the rule, 'write the smallest possible units of code, as they are reusable and reduce overall development timescales', 5: Optimise value in space and time, through the optimisation of code through the fail – pass – optimise process, and 7: Combine right first time and feedback, by coding against purpose and using testing for feedback and correction.

Transparency and Collaborative Working

Collaborative working proved to enable two things, speed and certainty. Speed was achieved through the RAD approach, incorporating agile and fail fast rapid prototyping. Certainty was injected through perpetual challenge from different perspectives, notably business, academic and modelling, and rapid correction. Transparency, in the form of open, truthful disclosure, specification and resolution of issues, was the critical element which facilitated this way of working.

Verification and Validation

The single most significant improvement in verification would be periodic challenge of the code by independent third parties, ideally the academic partners; Harding repeatedly stressing the impossibility of fully reliably testing one's own code. This would include writing additional tests, including for AnyLogic application functionality, Harding noting that, when even critical open source software, completely accessible to independent verification, can still contain the most shocking errors, the importance of verifying the behaviour of closed source code cannot be over-stated.

Interview with Sami Stouli

Context

This interview (Stouli, 2017b) was conducted on 17th July 2018 concerning causal inference, specifically with the aim of reconciling key aspects in The Book of Why by Judea Pearl, a leading author in causal inference (Pearl *et al.*, 2018) with proposals in a report by Stouli, commissioned by Bacs, exploring the role of Econometrics in causal modelling (Stouli, 2018). A further aim from the interview is to determine the practical viability of integrating econometric and systemic approaches through causal inference.

Interviewee Background

Stouli is a lecturer in Economics within the Department of Economics at the University of Bristol. Of particular importance is Stouli's research into causation of economic behaviour using multi-variable regression and related techniques (Chernozhukov *et al.*, 2017). Of particular relevance to this research is the application of statistical causal inference to the Bacs Market Dynamics Model (MDM) which demonstrated the feasibility and potential value for combining econometric and systemic modelling techniques in the context of stakeholder value creation.

Purpose of the Interview

There are three objectives of this interview:

- Define key principles of the econometric approach to causality
- Outline a generic process for econometric modelling of causality
- Determine the potential and value of integrating systemic and econometric modelling of causality

Key points from the interview

Econometric Approach to Causality

Need to Combine Data and External Knowledge

Data on its own will not explain most areas of interest; they provide facts without a schema from which to interpret causal meaning. This is because data alone does not determine causality. In particular, statistical analysis tools, such as regression and Bayesian probability do not confirm the existence or direction of causality. Consequently, statisticians and social scientists are extremely wary of, and often fervently against reference to, causality, instead stressing the mantra, 'correlation is not causation'.

This presents a fundamental problem for policy makers who need to determine counterfactual information, i.e. outcomes of one course of action in relation to one or more others. This involves causality. Econometrics was developed to address the need to quantify cause and effect in economics by modelling causality through equations. The key point is that both data and external knowledge are needed in order to build a causal model from which meaning can be derived and predictions made with a pragmatic level of certainty. This is entirely consistent with systemic modelling approaches.

Causal Diagrams Capture External Knowledge

Causal diagrams are a means of structuring external knowledge concerning the existence and direction of causality. Stouli uses diagrams to demonstrate a fundamental challenge in applying statistical methods to causality, the problem of endogeneity. Pearl refers to the same problem as 'confounding', which refers to a situation when considering the relationship between A and B, a third factor V influences both, thereby creating a correlation between A and B which is a false cause. For example, IQ is a strongly correlated with shoe size but the causal link is age, not size of feet.

Causal diagrams provide a powerful way to structure this kind of problem, together with solutions. Pearl contends that the use of inference diagrams amounts to a ‘causal revolution’ which enables researchers and policy makers to explore causal problems scientifically with a sound mathematical foundation. Stouli agrees that causal inference diagrams are useful and that Pearl provides some valuable insights and methods. However, Stouli uses many of these methods, which are integral to Econometrics. Also, it is important to note that Pearl does not explicitly relate his work to either Econometrics or Systemic Modelling.

Generic Approach to Causal Problems

Stouli proposes three highly iterative steps to causal problems in Econometrics:

Define Causal Hypothesis

The parameters and relationships are defined and associated equations developed. Causal diagrams are valuable for capturing the existence and direction of causal relationships between parameters.

Define Assumptions

Assumptions which are necessary in order that the equations can be solved are defined, which provide the schema through which causality can be quantified. There is an important analogy to the causal storylines and calculations used in the Value Management approach.

Test Relationships with Data

Real data is applied to the model which tests the strength and sign of the relationships.

Integration of Systemic and Econometric Modelling

The prime purpose of the report commissioned by Bacs (Stouli, 2018) was to reconcile systemic modelling and Econometrics and explore ways in which these approaches can be integrated with the aim of providing greater causal precision and predictive certainty. In this report Stouli proposes a method for applying Econometric techniques to validate and strengthen relationships in causal models, which include feedback loops, used in the systemic approach (Stouli, 2018). In this respect, Pearl defines archetypal junctions, one of which is the confounder, which can be mapped against subsets of a complex systemic model. This could potentially provide the basis for some semi-automation of the cross-referencing.

There is an important link between confounders, the problem of endogeneity, and feedback loops. For example, supply can create and demand can drive supply. Price is confounder in the relationship because it can influence both supply and demand. The solution in Econometrics would typically involve holding the confounder, in this case price, constant in order to respect the concept of ceteris paribus (all other things remaining the same).

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Econometric Approach to Causality

A key element of econometric modelling is causal inference which combines statistical principles with mathematical equations to represent cause and effect relationships. Inference diagrams provide a powerful tool for clarifying the true nature of causation and are directly applicable to systemic modelling.

Generic Approach to Causal Problems

A generic approach to defining and resoling causal problems comprises four essential steps: define causal hypothesis, define assumptions and test relationships with data.

Integration of Systemic and Econometric Modelling

The report commissioned by Bacs clearly establishes both the potential value and practical feasibility, through proof of concept, of integrating systemic and econometric modelling. Causal inference provides the essential common link in achieving synergy between these apparently very different approaches. More specifically, causal inference diagrams can cross-reference to and corroborate causal loops.

A1.13 Development: Causal Certainty

Interview with Shaofu Huang

Context

This interview (Huang, 2018b) was conducted on 26th November 2018 to elicit an academic perspective of the development, verification and validation and data transformation processes, together with specific research, tools and techniques relating to the Market Dynamics Model (MDM) which the University of Bristol (UoB) contributed. Importantly, the MDM architecture is structured around a customer Learning Journey and Huang's expertise in this field enabled him to direct his contribution from a learning perspective. At the time this doctorial research commenced, the client, Bacs, was looking for a means to determine future switching levels for the Current Account Switching Service (CASS) more accurately than the forecasting methods previously employed. Funding of CASS is linked to switching volumes and under-estimates from statistical forecasting resulted in inadequate budget provision, without providing any explanation. There was a recognition by Bacs that in order to address this deficiency for future budgeting, it was necessary to obtain a more precise understanding of customer behaviour and underlying causal drivers in the context of current account switching (Core *et al.*, 2018).

As a result of awareness of the Author's research, Bacs authorised a Proof of Concept (PoC) assignment for dynamic simulation model development, founded on the concept of Learning Journeys, with the purpose of informing projected future switching levels. This early work led to a five year evolution of the Market Dynamics Model (MDM), using Rapid Application Development (RAD) in order to satisfy the imperative for immediate application by Bacs of insights provided by each new release of the model (Harding, 2018). MDM development provided the developmental case study for the Author's PhD and was programme managed by the Author. Form the start, it was deemed crucial to Bacs that this work be supported and accredited by the UoB, through the Author's doctorial research and formal partnership with the UoB. Academic support was important to ensure that the latest academic advances were incorporated to create value. Accreditation from UoB was also essential to provide credibility of results submitted to third parties, such as Member providers (banks and building societies), Regulators, HM Treasury and Bank of England.

The imperative for deliverable results from the MDM for defined requirements against business-driven timescales, whilst incorporating sufficient academic rigour to warrant accreditation by the UoB proved to be a significant challenge throughout the five year development. It also injected a conflict of interest for the Author, accountable for contractual deliverables for Bacs, whilst satisfying the academic standards necessary for doctorial research. Shaofu Huang is the Lead Researcher assigned by the UoB to MDM development under the research partnership. Huang engaged with the programme from the start so is particularly well qualified to provide an important academic perspective on the relationship between business and academia and how it can be improved. He also introduced and implemented critical concepts and techniques which are also described in this interview.

Interviewee Background

Shaofu Huang is a social scientist in learning and learning infrastructure, with a particular interest in the dynamics between people intending to teach and those who are supposed to learn. He has a dual background of education and civil engineering by training, with a speciality in data modelling and analytics design. He was a member of the Centre for Systems Learning and Leadership and contributed to the development of the Crick Learning for Resilient Agency assessment tool in 2015. His work in the Learning Framework work stream of the International Centre for Infrastructure Futures project has informed the development of the learning framework for the UK Collaboratorium for Research in Infrastructure & Cities, which has continued to develop through the Urban Integrated Diagnostics project looking at the community learning journey in developing citizen-led housing solutions. Huang was initially involved in the Market Dynamics Modelling project to support its data collection and transformation processes and has subsequently taken the responsibility of developing and coordinating the delivery of a methodology for evaluating the validity of the MDM.

Purpose of the Interview

There are three aims of the interview:

- Define the data transformation process for MDM development
- Define the model validation and verification process
- Provide an academic viewpoint of the development process and determine key ways in which the reconciliation between industry imperatives and academic rigour can be improved

Key points from the interview

Data Transformation Process

An essential requirement for the MDM development was to take data from the real world with which to populate the physical model and ensure validity. A major challenge in this respect was that available data was not directly applicable to model parameters in either content or format. Data transformation refers to the process of this conversion. Although firmly agreed on purpose, in reflection Huang identifies two key differences in understanding from that of the Author in relation to the transformation process: data level and model operation.

Data Level

At the time when data transformation was initiated, data relating to customer behaviour was aggregated at customer segment level. For example, a typical question being addressed was, “What proportion of the population within each segment changed in what way in response to a push, pull or publicity event?” Approaching the same requirement from a Learning Journey research background, Huang considered this level of aggregation failed to model subtle but potentially critical variations between individual customers. This view is consistent with concerns expressed by Rich Harding in regard to the model not being truly agent-based (Harding, 2018). Later versions of the model went some way to addressing this limitation in two ways, segmenting customers more precisely by financial status and acuity and the introduction of Learning Power dimensions as a second level of segmentation by learning disposition.

Model Operation

In a similar vein, Huang concluded that the model did not pay much attention to individual customers’ journey experience in the context of double loop learning. For example, he purports that the customer journey is confined to single loop learning in which the individual reacts to circumstances experienced through the environment, such as push, pull, publicity and life events, through consideration and switching. However, there is no concept of a feedback loop in the customer journey for the individual to reflect on their learning as a Meta process and effect internal change which influences their external behaviour.

The need for this feedback loop between experience and Learning Power was considered at the outset of modelling but deemed to pose unmanageable complexity. Provision for individual transformation is addressed to some extent in later versions by simulating movement between segments as customers progress through their lives, thereby shifting their financial circumstances, life context and learning profile. For example, a young graduate may progress to getting married, starting a family, become increasingly cushioned and financially astute. However, as stated previously explicit double loop learning as part of a Learning Journey is not included and is under consideration for further model development.

Atomised Data using Excel and Bayesian Inversion

The initial approach to data transformation involved decomposing model parameters into ‘atomised’ data components which could be derived from the real world and then reconstructed into the precise format needed for model input. Excel was chosen by the Author as the platform for this transformation process which Huang inherited and developed into a powerful and practical tool. The atomisation process resulted in data metrics which Huang then structured into a requirement specification of externally sourced data, which was obtained through GfK. In some cases, Bayesian inversion was used to transform known atomised data supplied by GfK into unknown but required information, known unknowns (Huang, 2017).

Transition to R

However, as the volume and complexity of data required by the MDM increased, the spreadsheet platform became unwieldy and difficult to scale. Consequently, through his previous experience in working with large datasets, Huang switched the transformation process platform to R, an open source application for data analysis. The great advantage of using R is that transformation algorithms are defined once in code, rather than embedded and duplicated across table cells in the spreadsheet. This rendered the process more efficient and, importantly for validation, transparent and repeatable (Huang, 2017).

Model Validation and Verification Process

Huang proposed Sargent's approach to verification and validation of simulation models (Sargent, 2013). As a direct consequence of budget constraints discussed later, it proved untenable to cover both verification and validation with sufficient rigour, and it was decided that the University focus on validation (Huang, 2018c). Huang articulates the validation process undertaken as an evolution of four distinct waves: Data, Causal Paths, Simulation and Trajectory.

Data

The first wave focused on specification, acquisition and validity of input data for the MDM, with particular regard to variation between customer agents. The intention was to obtain as full coverage as possible with real valid data, thereby rendering greater validity to output from the model. However, it became clear to Huang that even with the significant data procured through GfK, coverage of parameters informed using this material remained limited to approximately 40%, the balance being a hybrid of consultant estimates and partial real data. Huang explored other data sources; including the citizen led housing work through the Knowle West Media Centre (KWMC), which is covered in the capacity of validation case study in Chapter 8. However, at least 20% remained entirely consultant derived.

Causal Paths

The second wave switched focus to causal paths defined in the conceptual model, documented as the Causal Tracing Document (Davies, 2018). An independent review of this document and underlying systemic map, comprising interconnected Causal Loop Diagrams (CLD) providing a foundation for the conceptual model, was conducted by the UoB (Stuijfzand, 2018). This assessment provided a valuable degree of assurance that the conceptual model reflected the real world. Huang explored simplifying the conceptual map in order to facilitate validation of key elements of the structure. The Author acknowledges that this approach was unjustifiably rejected by the team, accepting responsibility for not ensuring sufficient appreciation of Huang's proposal, subsequently adopted through the UoB under the guise of Econometrics (Stouli, 2018) . In addition, there proved to be relatively little academic research covering the application of causal loop techniques in this context. Consequently, validation based on a bottom-up analysis of causal paths in the conceptual model proved impracticable.

Huang then tackled the challenge using a higher level comparison of the overall development approach to similar established models with significant academic credibility, notably the Multiple Goal Pursuit Model (Ballard *et al.*, 2016) and Prospect Theory (Kahneman *et al.*, 1979; Tversky *et al.*, 1992).

Simulation

The third wave approached validation through multiple running of the MDM and determining how the model performed. This was conducted in a number of ways. First, the credibility of relationships was examined by taking pairs of variables. Secondly, a past-past and past-future technique was applied, where the model was calibrated over a known historical period, past-past, then assessing performance over a later known period, past-future, but allowing the model to run naturally without further calibration. Both the Author and developer, Rich Harding expressed concern that the model being used for this wave was a previous version, the fear being that significant differences from the latest release would undermine results from the validation.

Trajectory

After exhaustive consideration and review with Professor Taylor, it was decided that differences between versions could be accounted for and that using the previous version of the MDM is valid. This decision led to the final wave involving evaluation of performance using the previous version, and comparing results with the equivalent runs using the later version, ensuring that key differences are duly taken into account.

Model development Process and Relationship between Business and Academia

Roles and Relationships

Recognising through the experience that success in this work depended upon the integration of consultancy with academic rigour, Huang concluded that he needed greater guidance than was provided by the Author in what it takes to support the consultancy aspects, primarily concerned with reducing uncertainty. The key impact was lack of clarity of roles and relationships between Bacs and the University, resulting in reduced ability to support the overall work in the way Huang wished. After a Bacs Steering Group decision to allow future development of the model to divert between Bacs and the UoB, the Author ceased to direct work by the University team to coordinate with Bacs timescales. This hands-off approach on the part of the Author exposed a gap in programme management for the UoB team which was difficult for Huang to fill whilst attempting to focus on the research aspects.

Academic Resource Constraints

Huang also stresses that the contractual partnership between Bacs and the University, covering direct costs only, allowed for only limited input by key roles performed by academics. The Author agrees. For example, Professors Deakin- Crick and Taylor were particularly limited in their input, a negative impact of which related to the academic review process. After the initial proof of concept stages of the MDM, the Author instigated 'Academic Reviews' at the end of each subsequent tranche of work, chaired by Professor Taylor, who was asked to provide an assessment of the model generally and, more specifically, the appropriateness of application for intended purpose at the time. Professor Deakin Crick strongly objected to use of the term 'Academic Review' for this high level assessment, which she perceived as manipulation by the Author to extract academic accreditation without fair and sufficient opportunity for rigorous academic challenge. Although not the case and categorically refuted by Professor Taylor, this misunderstanding is another symptom of inadequate clarity of roles and relationships, which was the responsibility of the Author in the capacity of Programme Manager, in addition to academic researcher and consultant.

Huang cites another negative manifestation of limited funded resource provision was his inability, due to funding constraints, in responding to the repeated requests to challenge and improvement of assumptions used in the model development , together with verification of the MDM and model code in relation to the conceptual model (Harding, 2018). More specifically, Huang states:

> "A better resourced team would certainly be more able to support the development requirement; however, I thought I attributed this problem much more to the separation between development track (consultants) and the validation track (academics), and less to limited funded resource. As you have summarised below, a better coordinated collaboration will help direct our effort more productively."

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Data Transformation Process

Data validation is a critical element in the overall validation of the MDM, or any simulation model. It is important to provide complete transparency of the transformation of valid real raw data into the format and values needed by the model and this is most effectively achieved through clear, documented coding. In the case of the MDM, the analytics software R was used as the data transformation platform and the code commented to facilitate auditability and inclusion in the User Documentation.

Model Validation and Verification Process

The resulting validation, ensuring the model reflects the real world, and verification, ensuring the model operates as intended, was effectively accomplished using the Sargent model as the architecture and several corroborative approaches (Huang, 2018c).

Model development Process and Relationship between Business and Academia

Significant additional value can be realised through directed collaboration between business and academic research. In particular, such collaboration can ensure the integration of effectiveness, doing the right things through academic rigour, and doing things right, drawing on commercially-driven efficiency. Specific examples in the Bacs case study include data transformation and model validation.

However, there is an inherent tension between business imperative, notably fixed deadlines and need for immediate application, and academic rigour involving research and making new associations which can be translated into practical interventions, a process which cannot be tightly time bound. This distinction can be reconciled by harnessing these tensions in order to create value through the energy of difference.

Key requirement in this regard is clear specification of purpose and roles, demanding greater appreciation of respective parties' needs and commitments. For example, for business a recognition that research by its nature cannot always be time bound. For academia, acknowledgement that the real world of business is constrained to work within committed timescales necessitating decisions and action with insufficient information.

Interview with Elaine Fletcher

Context

This interview (Fletcher, 2018) was conducted on 5th July 2018 to determine the relationship between Business Intelligence (BI) capabilities, in particular Big Data, Predictive Analytics, Artificial Intelligence and Machine Learning, and causal approaches, notably Systems Thinking and Dynamics Modelling. The core aim is to explore how these diametrically different modelling approaches can be integrated optimally in the context of delivering stakeholder value from strategic change programmes. In essence, BI concerns the modelling of causality for the purposes of prediction bottom up using large datasets, whilst systemic approaches model causality top down, also for the purpose of prediction but often with minimal data. The Author postulates, with some experiential evidence whilst previously working with Fletcher, that a 'Point of Power' exists where these two diametric approaches meet, which potentially enable a Digital Twin for business and other complex systems (Grieves *et al.*, 2017). This interview explores latest advances in BI with the aim of determining how this integration can be achieved in practice.

Interviewee Background

Elaine Fletcher is an acknowledged leader in BI Strategy, combining a passion for generating double-digit revenue growth by putting the customer at the centre of corporate strategy with her vision to deliver the best message to each customer at the right time, over the right channel, integrating customer care and marketing interactions across all products. Fletcher has led numerous successful cross-enterprise transition programmes to implement her vision for tier-1 clients in Telecoms, Finance, Retail, and Public Sector. She believes that a successful programme starts with a return on investment (ROI) heat-map to determine the target operating model, the gaps, and feasible options. She uses a cause-effect business model to optimise an incremental delivery roadmap that has short (typically 3 months) increments; each delivers positive ROI and moves the enterprise a step towards the target end state. Importantly, the Author worked for and with Fletcher on many client assignments in which we combined BI with systemic thinking and modelling.

Purpose of the Interview

There are two aims of the interview:

- Determine the latest developments of Business Intelligence (BI) Strategy
- Explore the relationship between BI and causal modelling and how these can be integrated to optimise stakeholder value in magnitude and time

Key points from the interview

Latest Developments of Business Intelligence Strategy

For many years Fletcher has been developing and exploiting advances in BI methods and tools with the aim of enabling rapid specification, design and deployment of strategic solutions, all for and funded by real world revenue generating assignments. A fundamental requirement for this aspiration is to identify, diagnose and eliminate errors as early as possible. The accelerated approach Fletcher innovated and now deploys to achieve this is diametrically opposite to conventional BI methods which focus on actual detailed data. Conversely, Fletcher builds a working prototype using entirely Metadata, i.e. the attributes of the data, not the actual data.

There are four primary advantages of this approach. First, a major hurdle in developing BI solutions, access to confidential data, is eliminated because no real data is needed to build the prototype. Also, because no installation is needed on the client site in order to run the script, there are no security issues. Secondly, data inconsistency, for example where the same entity is defined in different ways, is exposed and eliminated more effectively, resulting in greater ‘right first time’ implementation. Thirdly, the time taken to develop a working prototype processing real data which can be readily refined is reduced dramatically; typically two weeks to reach a build status and quality which normally requires several months using the conventional approach.

Fourthly, the rapid transition from prototype to real data deployment enables performance to be measured on real outcomes rather than functional deliverables; not only output fast but outcome fast. Further, it is very common for additional value to emerge through the transparency afforded as real data is applied.

The accelerated approach comprises three key phases:

- **Prototype**: Build working prototype using Metadata
- **Data Lineage**: Reverse engineer business rules and transformations by mapping the data to people in the organisation, together with associated relationships of people and data, still entirely using Metadata
- **Business Information Model**: The To-Be system is honed, using real-time code generation as real data is systematically introduced

There are a number of key prerequisites for success:

Honest Baseline

Initially, it is essential that a clear and honest baseline is established, to define the current status from which gaps are determined. Often, clients perceive a better As-Is situation than is the case, the correction of which requires a high level of trust and rapport.

Precise Specification of Performance Outcomes

A corollary of this step is that intended performance outcomes must be specified precisely. Paradoxically, this elicitation of what success looks like can prove very controversial and difficult, an observation with which the Author strongly concurs.

Agile and Learning

The approach demands an extreme form of 'fail fast' agile development where the focus is on finding and eliminating errors as soon as possible. Very importantly, Fletcher states that, "success is learning". In particular, this includes client learning which involves eliciting stories which can be translated into the solution architecture and design.

Relationship between BI and Causal Modelling

Sixteen years ago, Fletcher and the Author applied Systems Thinking and Dynamics Modelling to address two major limitations of the then early adoption of BI: poor definition of purpose and precise specification of intended outcomes. Considerable success was achieved in this endeavour where we had sufficient control of the development process and access to key clients. However, we experienced significant, often aggressive, resistance from rank and file BI practitioners who perceived the use of systemic modelling as a 'woolly' unnecessary distraction from the 'real' business of implementation. Often, this position is an instance of Value Inversion, the focus on an assumed solution to an unchallenged and incorrect purpose.

Fletcher reports that she experiences exactly the same resistance now. The conventional approach to BI remains bottom-up, focusing on detailed data. Fletcher uses the analogy of searching for value using a microscope to describe this method. The presupposition behind the approach is that value is contained in the data and this value can only be made apparent and harnessed using the real data. However, this approach can be very inefficient because there is little or no targeting and/or prioritisation and poor quality of data can render it invalid. The consequence is excessive and wasted work which does not result in stakeholder value.

Consequently, there remains a strong case for modelling at a high level with the aim of directing subsequent development of the BI solution by value. The intersection of the top-down 'telescopic' view of the big picture and 'microscopic' analysis represents the 'Point of Power' through which value is identified then quantified and delivered.

Conclusions

Conclusions are categorised by aims stated under Purpose of the Interview:

Latest Developments of Business Intelligence Strategy

By focusing on Meta data rather than relying on the availability of real data, latest advances in BI development increase the speed and certainty of stakeholder value. Causal storytelling is an important element of the approach.

Relationship between BI and Causal Modelling

As with the Value Management framework, the accelerated approach to BI strategy is founded on learning through rapid prototyping using agile and fail fast principles. Performance is outcome focused; measured on value which the new capability of the solution enables. There remains the need for, and immense opportunity in combining, top-down systemic casual modelling with bottom-up accelerated BI development.

A2 Developmental Case Study Client Interview

Context

This interview (Core *et al.*, 2018) was conducted on 26th September 2018 with David Core on behalf of the two key visionaries and champions behind this case study, Anne Pieckielon and David Core. The work with Bacs follows the development and application of the Market Dynamics Model (MDM). The MDM centres on customer engagement through the process of switching current accounts, comprising awareness of need and opportunity, consideration and switching decision, which is modelled as a Learning Journey. Initially focusing on the current account switching, subsequent development included broader application within finance and across other sectors.

The work represents a collaboration comprising consultancy managed by the researcher and academic input provided through the researcher's doctorial research, of which this case study forms a core methodological component, and contractual partnership between Bacs and the University of Bristol. Therefore, it is appropriate to consider the context from both industry and academic perspectives.

Industry Perspective

For Bacs the purpose and consequential direction of the MDM development has matured and changed during the five year duration of this case study as shown in Figure A2. 1.

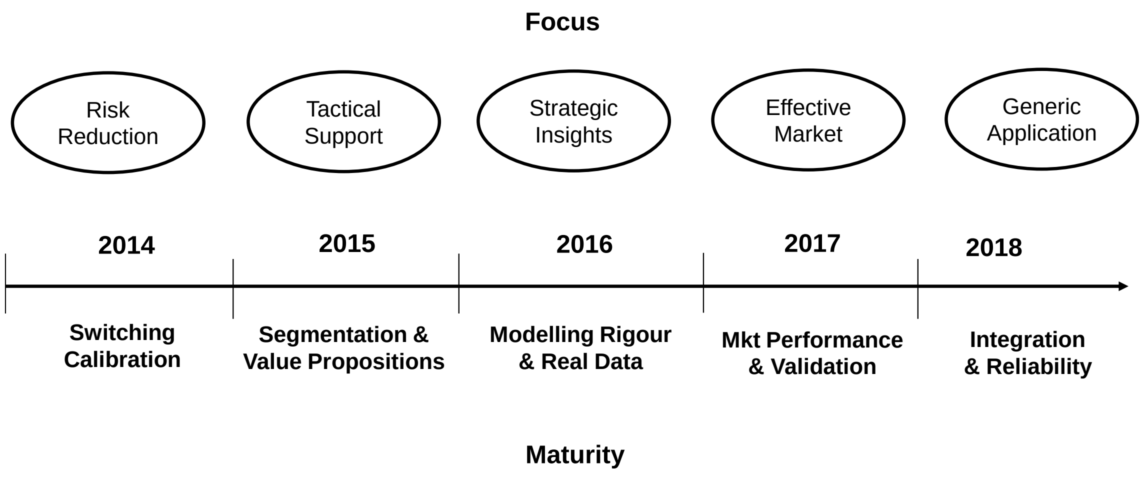

Figure A2. 1: MDM Development

Each focal development, summarised below, enhanced all previous applications and extended functionality to meet the new requirements. For example, the MDM output increasingly precise and dependable switching level predictions, upon which Bacs has placed greater reliance for planning and budgeting purposes, in parallel with other functional capabilities, including strategic insights and market performance.

Risk Reduction

The initial purpose concentrated on reducing risk previously manifested in budgeting for CASS, by developing more precise predictions for switching levels against which Member providers fund the service. The problem originated with the Cash ISA switching service where volume was half the predicted level due to external market developments. The desire was to understand what the main drivers of the market were so we could track and manage potential risks to the budget of externally driven changes.

Tactical Support

In order to enhance budgeting for CASS, the early System Dynamics model was developed into an Agent-based Model which segmented both customers and providers, thereby simulating more precisely changes in switching behaviour and associated causal drivers.

Strategic Insights

Focus then shifted to injecting rigour into both real world conceptualisation and architecture and coding of the MDM, in parallel with definition, acquisition, transformation and input of real data, where this was available to replace expert estimates used for earlier proof of concept versions. The result was ability of Bacs to provide strategic insights to the sector with a pragmatic level of certainly. A notable example was advising against the development of Account Number Portability (ANP), which would have cost between £2bn and £10bn for little real impact on the market.

Effective Market

MDM development responded to increasing regulatory interest in market effectiveness through provision of a Market Performance Framework, comprising precise measures and traceability through causal drivers, based on the customer Learning Journey.

Generic Application

Through the process of developing increasing value maturity, it transpired that the concepts and implementation are essentially generic and applicable across a broader spectrum. Consequently, latest developments included provision for wider application within financial and across other sectors, such as energy and telecommunications. Precision was enhanced through econometric statistical causal inference and overlaying Learning Power profiles to customer segmentation.

Academic Perspective

The case study enabled implementation, testing and validation of the three key components encapsulated within the core research question:

> **Can we define and validate a new theory and generic learning framework enabling change programmes to cause intentional equitable and sustainable stakeholder value?**

Learning Framework

The switching process is framed as a customer Learning Journey from awareness of need to achievement in the form of a service most closely matching the need. It transpired from the case study that this learning framework is structurally generic to any change, comprising two key feedback loops: awareness and definition of purpose and capacity to achieve the purpose through performance. In the context of switching, these components translated into the Trust and Inertia loops respectively. They can be framed as the two core components of value: effectiveness and efficiency, applicable to any level of intentional change, including strategic change programmes.

Intentional Cause

Isolating and quantifying true causation represents one of the greatest challenges and area of contention for social systems involving human behaviour, such as market engagement. The integration of Systems Thinking and dynamics modelling provided a quantitative causal foundation through which to navigate the Learning Journey for a successful intended outcome; matching performance of current account provision with specific customer needs encapsulated within purpose.

Equitable and Sustainable Stakeholder Value

Another primary challenge for any provision of service, including infrastructure of which payment systems is an example, is ensuring equity of value between stakeholders. To this end, analysis of interventions is targeted to the needs of specific customer segments, including financially excluded and/or disadvantaged customers. In a related analysis, the principle of value equity was exercised further by quantifying the distribution of value attributable to proposed strategic central service initiatives for all agents across the entire payments value chain.

Interviewee Background

David Core

David Core is provides expert support covering strategy at Bacs. Originally an Aeronautical Engineer, Core is a business architect and strategist working for Bacs and had a key role in the programme for the successful development of CASS which was launched in 2013. Core is a seasoned consultant with particular expertise in the financial industry, in which he has worked for over thirty five years. Starting his financial sector career with the Inter Bank Research Organisation (IBRO), where he worked on the business base for electronic payments, he subsequently developed card strategy and use of analytical Customer Relationship Management (CRM) techniques for TSB Group. Core has spent over ten years in management consulting, leading strategic advances internationally on payments infrastructure refresh and bank transformations, always seeking to understand how target operating models will add value for stakeholders. Core directed purpose and direction of the market dynamics work throughout this case study and envisioned the application of Learning Journeys as a means to model and influence customer engagement with the aim of improving market effectiveness through customer empowerment. David Core and the Researcher have worked together for twenty years.

Anne Pieckielon

Anne Pieckielon is Director of Product and Strategy, Bacs Payment Schemes Limited, now part of the New Payment System Operator (NPSO), now part of Pay.UK, with responsibility for shaping the future of the UK's retail payment products and services. Pieckielon has specific responsibility for CASS, in which capacity she funded this case study through the development and application of the MDM, at some personal risk. An energetic and committed leader of developments in UK payments, Pieckielon is passionate about making products that work for end users, understanding the needs of both consumers and organisations seeking to serve them. In this regard, a particular focus is leadership of developments in account switching services, helping customers get the best from their financial service providers, including disadvantaged customers excluded from optimal payment methods. Pieckielon is a strong advocate of women's developments in the sector promoted through her role on the Advisory Board of the Emerging Payments Association, leading its Women in PayTech project, and as an active supporter of the Treasury's Women in Finance initiative. Pieckielon's interest in social wellbeing is reflected outside work through her active involvement in the local community, particularly focused on young people.

Purpose of the Interview

There are six aims of the interview in the context of the Current Account market:

- Set the historic context of the drive for an effective market
- Define Bacs and CASS governance and regulatory environment
- Explore the future direction and requirements for an effective market
- Identify key research and reports
- Specify the original purpose and hypothesis for modelling
- Critically assess the relationship between business and academia

Key points from the interview

Historic Context of the Drive for an Effective Market

Technology Driven Competitive and Productivity Shifts

Post the Second World War significant societal changes, notably growing affluence, led to increased competitive pressures in the Banking sector. Banks responded through increasing their branch networks, their main focus being payment processing, cash and cheques; lending was a relatively minor element of their business at this time. A first burst of computer technology shifted the focus of competition to productivity through automation which drove a period of consolidation between the banks and an increase in proportion of eligible adults with current accounts to 50%.

A second burst of technology during the 1970s and 1980s further increased the coverage of current account holding to around 70%. Advances included telephone banking and Automatic Teller Machines (ATM), the motivation for the latter being branch closure on Saturday to save money through the increased use of electronic payments. The increasing societal importance of current accounts raised regulatory concerns regarding access to payment services and a further shift involved the incorporation of building societies and their provision of payment services. It is also important to recognise the parallel further radical increases in productivity and staff reduction through adoption of technology.

Introduction of the Free if in Credit (FIIC) Model

The FIIC model refers to the provision of free basic current account services, principally payments, for customers with a credit balance. The concept was introduced by the Midland Bank, now part of HSBC, during the 1970s as a response to increasing competitive pressures. The model has since become embedded within UK banking and would be extremely difficult, if not untenable, commercially, socially and politically to reverse. Currently, over 95% of people have a current account, including financially disadvantaged customers through the Basic Bank Account. However, the FIIC model creates two significant distortions in the market. First, inability to attract revenue through their primary service, payments, led to providers increasingly positioning themselves as retail businesses with a focus on selling rather than provision of essential societal services. For example, the pressure to cross-sell was a major factor in the Payment Protection Insurance (PPI) scandal. Secondly, a disproportionate share of the cost is loaded onto those least able to pay, principally through transaction charges and overdraft fees for those customers not always in credit. The FIIC market structure motivates providers to acquire and retain affluent customers to whom they can cross sell.

Switching as a Driver of Competition

Competitive pressures and current account coverage continued to the new millennium at which point a major review resulted in the Cruickshank Report, which elevated switching as an issue in the context of competition (Cruickshank, 2000). The work evidenced that customer switching between providers, now including building societies, was low compared with other comparable markets, such as energy and insurance. The premise was formed that the low switching was indicative of lack of competition and, conversely, increased switching would lead to more effective competition by forcing providers to improve their value propositions to customers. A further assumption was that switching could be increased by rendering the switching process easier and less prone to risk. The belief is that the switching process was perceived by customers to be time consuming and error prone and as such represented a disincentive to switch, which in turn reduced competitive pressures in the market.

The case for provision of a central switching service was the subject of further research and reports, leading to two initiatives. The first was a partial solution, Transfer of Direct Debits and Standing Orders (ToDDaSO), introduced in the early 2000s but initially poorly promoted and adopted. Further research identified a significant barrier to customer switching as perceived risk in the event of problems encountered as a result of the switch process, which ToDDaSO against ToDDaSO did not fully mitigate. Consequently, the second solution, Current Account Switch Service (CASS) was initiated in 2011 and launched operationally in September 2013. CASS transfers financial risk to providers, by making the new bank the sole point of contact through the process, and to ensure the Guarantee is honoured, incorporating a three year redirection guarantee for Direct Debits, Direct Credits, Standing Orders and other payments inadvertently directed to the old account. CASS is deemed to be an operational success (FCA, 2015) but that switching rates remain low (Defaqto, 2016). There is also a twist in the story. Under regulatory instruction ToDDaSO was actively promoted by providers which resulted in a doubling of switching rates through the central service between 2008 and September 2012 when intention to launch CASS the following year was announced. Our belief is that there was not a significant increase in overall switching After this announcement switching levels dropped until the operational launch, after which growth resumed but peaked around the same level as achieved through ToDDaSO. The hypotheses behind this data are explored later in this interview under Original Purpose and Hypothesis for Modelling

Open Banking

Open Banking is a response to a major investigation into retail banking by the Competition and Markets Authority (CMA), a key conclusion of which was the imperative for greater customer engagement to achieve an effective market (CMA, 2016a). The purpose of Open Banking is to encourage customer engagement by rendering the relative value of products and services more transparent and enabling customers to obtain the best mix for their needs more easily (Reynolds, 2017). A key requirement to achieving this customer-centric ideal is the use of intermediary Third Party Providers (TPP) who select and arrange the best deal for an individual customer, under regulatory control.

There are three important implications of the shift to Open Banking. First, Application Programming Interfaces (API) will be a core part of the technical solution. Secondly, it will be necessary for customers to share their financial data with the TPPs and there is concern that people will be reluctant for security reasons, especially in the light of increasing high profile hacking incidents. However, informal discussions with the Open Banking team revealed that their own internal research confirms findings from this case study; that the key to overcoming resistance to switching is clear perceived value in, and safe process for, switching. Thirdly, customers may hold multiple accounts, each targeted to specific aspects of their overall needs, necessitating two further capabilities for central services: partial switching and customer knowledge. Currently, CASS is designed for full switching of a customer’s primary account and when used for a partial switch the safeguard guarantee does not apply. In order to develop central services which support this more complex Open Banking market, it will be necessary to acquire considerably greater knowledge concerning the customer product holding and use, together with and underlying casual drivers. The role of switching in the Open Banking landscape is addressed in the white paper, Customer Switching, published by Bacs in September 2018 (Bacs, 2018).

Bacs and CASS Governance and Regulatory Framework

Original Constitution and Governance of Bacs

Bacs was originally constituted as a not for profit company guaranteed by member banks who settled by Bacs, of which there were approximately sixteen. Settlement refers to the movement of funds between banks’ settlement accounts and the Bank of England (BoE). Governance was through the Bacs Board represented by each member bank with voting rights proportional to Bacs transaction volumes. CASS was governed through the CASS Executive Committee (CEC), ring fenced to set its own budget and self-fund through a charge per switch levied on participating providers. This was capped by the Treasury to £5 per switch, which covered operational cost but not development investment. Funding for service improvements was allowed for using separate contractual arrangements; through calls to participants.

Bacs under the New Payment Service Operator (NPSO)

The NPSO was formed in 2017 to combine three key schemes under a single organisation: Bacs, Faster Payments Service (FPS) and Cheque and Credit Clearing Company (C&CCC). The NPSO is constituted as a not for profit company for which the guarantors are the non-executive directors covered by professional indemnity insurance. The Chair and CEO are accountable for performance to two bodies, BoE and the Payment Services Regulator (PSR), the latter being one of four regulators covering the industry discussed in the next section. The Board is responsible for NPSO operating costs, approximately £200M per annum, but not for any financial liabilities relating to the transaction funds. CASS remains ring fenced under the NPSO and the CEC reporting to the Managed Services Committee (MSC) of the main NPSO board.

Regulatory Framework

As a financial service, Bacs is systemically an important market infrastructure provider, and is policed by four regulators: Competition and Markets Authority (CMA), Payment Systems Regulator (PSR) and Financial Conduct Authority (FCA) and Prudential Regulatory Authority (PRA), which is part of the Bank of England of which the Financial Markets Infrastructure Department is the key regulatory function within the Bank Each regulator focuses on specific aspects within a shared overall purpose to promote an effective market for stakeholders. The CMA concentrates on competitive effectiveness of the market to serve customers and other stakeholders equitably; for example ensuring that no single provider enjoys unfair advantage (CMA, 2018). The PSR is concerned with ensuring correct, secure and efficient economic operation within the market (PSR, 2018). The FCA focuses on integrity of providers in adhering to regulatory rules; for example ensuring that customer are treated fairly (FCA, 2017a). The PRA is part of the Bank of England (BoE) and is responsible for financial integrity of players within the market; for example ensuring banks maintain adequate reserves (PRA, 2018). Importantly, Bacs plays a role in all these aspects of the market and, as such, provides support to, and collaborates with, the regulators and BoE. These relationships are profoundly significant in the development and application of the MDM because of the focus on switching and the role of CASS in the market.

Future Direction and Potential for an Effective Market

Market Failures and Future Requirements

The current account market exhibits two significant distortions which manifest at opposite ends. First, as previously stated the necessity to cross sell products, in order to make up for revenue which cannot be realised through payments in the FIIC model, results in more cost loaded onto customers least able to pay, most notably through transaction fees and overdraft charges. Conversely, as cross selling is only effective for people with financial means, providers ‘buy’ more affluent customers with reward accounts, also known as packaged accounts, which typically include interest on balances, mobile phone and travel insurance and roadside assistance. (Premium accounts, targeting high wealth customers, were also tried but these niche products did not work in the mass retail market; such people banked with providers such as Coutts). PPI and 'casino banking' are both symptoms of the FIIC model.

These distortions mean that the most financial disadvantaged customers are effectively subsidising the most comfortable; a situation which is unsustainable commercially, socially and politically in the longer term. The question is how to cause the necessary shifts, in particular to address the problem of financial exclusion. For example, the most cost effective payment methods, such as Direct Debits for energy, are not made available to customers deemed to be high credit risk of non-payment under the associated guarantees. Essentially, interventions can be either supply or demand side driven. Supply side initiatives include regulation and tax regimes aimed at changing provider value propositions and promotion. Demand side measures include promoting customer learning and engagement, in which respect there is the previously cited paradox concerning general distrust of banks, whilst surveys conducted by providers consistently return customer satisfaction scores in excess of 90%. The ideal is to combine supply and demand side initiatives optimise overall market effectiveness and emerging technologies which can play a significant role are discussed.

Big Data

Big Data provides the means to identify emergent patterns through Predictive Analytics, used to direct to whom value propositions are offered and when, and Adaptive Analytics, which informs how to hone value propositions most closely matching customer needs (Bizible, 2018). Prudent application of Big Data potentially enables simultaneous supply and demand side measures through new approaches, such as Next Best Action (NBA). NBA combines predictive and adaptive analytics with business rules to balance what customers need and what the enterprise is trying to achieve (and can afford) as a business within a given context (Pega, 2012). This goes some way to redressing the value inequality currently prevalent across the value chain. Core cites the existence of vast transition payments data from which emergent behaviour relating to product selection, holding, switching and use by customers could be derived. He proposes that this resource be applied to target, align and prioritise future central service development and promotion more precisely.

Digital Twin

The idea of the Digital Twin is to be able to design, test, manufacture, and use virtual versions of complex systems, such as businesses and markets, from which we intend to create value, or mitigate against undesirable emergent behaviour (Grieves *et al.*, 2017). As development evolved from the narrow focus on switching to exploring emergent behaviour driving customers to switch, the MDM has moved some way towards this function and in doing so informed policy choices, such as ANP. Core believes that the emergent nature of the market has exceeded predictive capacity of conventional survey based research for responding to rapid changes. Accordingly, he assigns great importance on the capability to detect and deploy insights from simulating emergent behaviour offered by advanced dynamics modelling, concluding “Do not underestimate the impact of short term change”.

Artificial Intelligence

Artificial Intelligence (AI) is typically defined as the ability of a machine to perform cognitive functions we associate with human minds, such as perceiving, reasoning, learning, and problem solving. Machine Learning algorithms detect patterns and learn how to make predictions and recommendations by processing data and experiences, rather than by receiving explicit programming instruction. AI is achieved by applying Machine Learning to large data sets (McKinsey, 2018b). In the context of current accounts, Core envisages a key role for AI in front and back office processes. Examples for the back office include fraud and money laundering detection and for the front office robotic advice to customers engaging with the provider through on line and mobile banking and/or their contact centres. However, Core questions, “Where’s the value?” Citing orders of magnitude, he surmises that of the 50M current account customers 5M have substantial wealth and offer cross selling opportunities while 5M are financially disadvantaged who can benefit from time saving, noting; “it is very time consuming to be poor”. The vast remainder offer limited opportunity and have little reason to switch in a ubiquitous market where differentiation for providers is difficult, expensive and short term. Core concludes that the active 20% at the market extremes do not offer a sufficiently compelling revenue generation opportunities to warrant significant investment. Consequently, Core argues that the business case for AI is more likely to be cost saving through further productivity enhancements.

Blockchain

Core agrees with an increasing body of commentators that Blockchain is over-hyped, particularly relating to cryptocurrencies, which are fiat money and vulnerable to bubbles, as evidenced with Bitcoin. For example, the Economist points out that Bitcoin fails the three central requirements of a currency: medium of exchange, store of value and unit of account as a result of low adoption and high volatility (Economist, 2018). However, Blockchain is not synonymous with Bitcoin but rather a distributed ledger, or database, shared across a public or private computing network in which each computer node holds a copy of the ledger, so there is no single point of failure. Core advantages are decentralization, cryptographic security, transparency, and immutability. It allows information to be verified and value to be exchanged without having to rely on a third-party authority (Mckinsey, 2018a)

Core anticipates that distributive ledger technology will spread through the sector, mainly for trade finance; where proof of ownership is needed for a traded commodity. The technology is relatively heavy on computing use and therefore likely to be more effective in small, trusted user groups. Core concludes that Blockchain technology has no role to play in payments for many years, noting that generally large organisations see no compelling reason at present to invest in virtual currencies.

Addressing Financially Disadvantage and Excluded Customers

Crucial and urgent further progress is needed concerning access to all for electronic payments, which should be considered as an essential social utility in the way as water and energy. The fundamental problem of disproportionate cost burden on the least able to pay is compounded by poor relative deals for people who do not switch. This ‘Loyalty Penalty’ is the subject of a super complaint received by the CMA from Citizens Advice (GOV.UK, 2018). Core believes that future initiatives, such as Open Banking, may address these market failures by allowing financial service products to be managed optimally for customers in the background by utilising technology.

Key Industry and Regulatory Reports

A key subset of reports covering findings, conclusions and recommendations for research conducted within the industry and by regulatory bodies, together with the essential thread contained within and between these documents of most relevance to the market dynamics modelling work, is summarised in Table A2. 1

Table A2. 1: Key Industry and Regulatory Reports

Reference	Essential Thread
(Cruickshank, 2000)	Initiated the drive for greater competition in the UK Current Account Market
(ICB, 2011)	Recommended a central switching service which led to the development of CASS
(UKRN, 2014)	Barriers to customer engagement and switching across sectors
(FCA, 2015)	Concluded that CASS is operational success
(CMA, 2016a)	Three key recommendations concerning CASS adopted by Bacs: Overseen by regulator, Awareness and confidence measures and longer redirection. Exposed social exclusion and anomaly of providers rewarding affluent customers form premium accounts whilst imposing high fees on overdrafts affecting many vulnerable customers Focus on customer engagement to drive a more effective market To which end initiating Open Banking
(Defaqto, 2016)	Provider innovation are centring on 'Reward in Credit' to attract customers and confirm that the Free if in Credit (FIIC) model is here to stay Providers are not competing on overdraft charges Confirmed that CASS works for most customers but that switching rates remain low
(SMF, 2016)	Identified 4 key barriers to competition: market concentration, value transparency, low switching levels and entry barriers for new players
(TNS, 2016)	Introduced the 5 steps to switching which map against the customer Learning Journey which is core to the MDM

Original Purpose and Hypothesis for Modelling

For any model intended to explain the causal dynamics of a system, it is crucial to specify the purpose and define the fundamental hypothesis to be explored against a reference behaviour pattern (RBP) of the behaviour to be explained (Richmond, 2001, p. 175). This part of the interview specifies the original purpose, RBP and hypothesis.

Original Purpose

During early operation of CASS, the market survey forecasting tools used to predict future switching demand, needed to set the volume-based budget, proved inaccurate due to their inability to model behavioural shifts. This lead to the need to call for further funding to support the CASS communications campaign**.** In order to avoid a similar situation in future years it was deemed necessary to acquire greater understanding of underlying customer switching behaviour, against which to moderate conventional forecasting. Core proposed the application of dynamics modelling of the customer switching journey as a means of gaining more precise predictions of switching levels. To this end an initial Proof of Concept (PoC) System Dynamics model was developed.

Reference Behaviour Pattern

The primary measure used as a RBP is Moving Annual Total (MAT) for central service switching levels plotted for each month as shown in the in Figure A2. 2, the ‘presenting problem’:

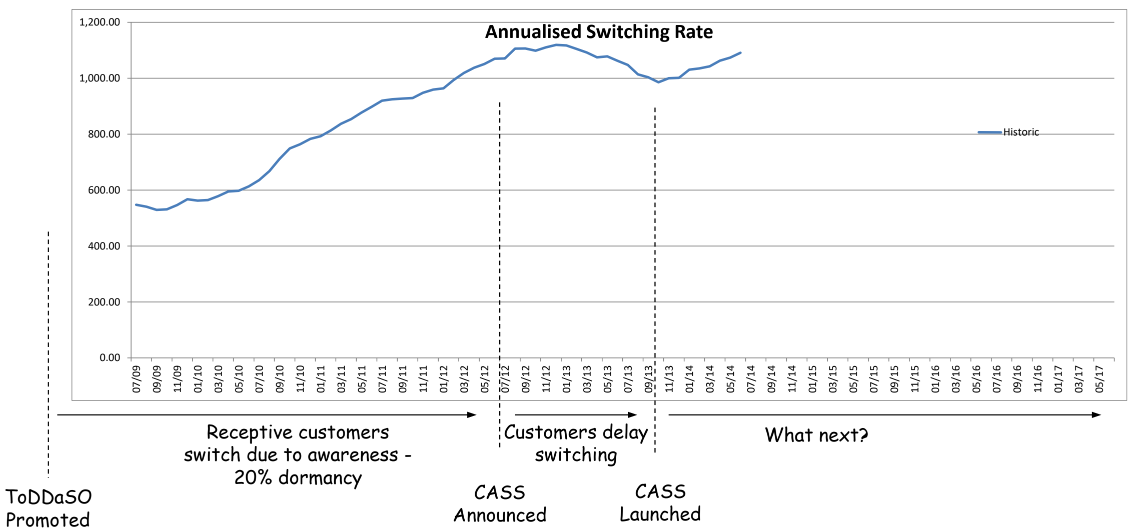

Figure A2. 2: Reference Behaviour Pattern for Central Service Switching

From 2008, the start of the calibration for the MDM, to 2012 recorded central service switching levels using ToDDaSO doubled from 600K to 1.2M customers per year. Between 2012, when CASS was announced, and 2013 when CASS was launched, switching declined, growing again after 2013.

Hypothesis

In response to a failure to increase switching rates after launch in 2004, ToDDaSO was actively promoted by member banks from 2008. This initiative resulted in a doubling of recorded central service switches over the four year period to 2012, at which point CASS was announced. Based on indicative evidence and knowledge of the market, Core hypothesised that a significant proportion of the growth in recorded switching during this period was attributable to a transition from self-switching to ToDDaSO; i.e. customers who would have self-switched anyway used ToDDaSO. Core further surmised that in anticipation of the superior CASS solution, providers ceased promoting ToDDaSO. This accounted for the decline in switching until CASS was launched in 2013, after which growth resumed at the same rate exhibited between 2008 and 2012. The resumption of growth in switching up to mid-2014 presented a dilemma; would switching levels continue to increase due to CASS or was there some other causal dynamic which may constrain growth? Core observed that the market is heavily damped in contrast comparable sectors, such as energy and telecommunications which experienced much higher rates of switching and expected a natural limit of around 1.2M switches per year, 2% of the 48m current account customers.

Core's intuition was that provider innovation of value propositions was driven by the expectation of CASS. Although no formal research is available, there are several indicators which corroborate this view. Around 150 product improvements introduced by providers between initiation of the switching programme in 2011 and launch in 2013. Core postulates that there were two categories of response, defensive and aggressive. Defensive strategies focused on brand and quality of service with the aim of retaining high value customers providing cross sell opportunities. For example, through separating TSB, there was a degree of cherry picking by Lloyds to ensure valuable customers, exploiting the strength of the Halifax brand, despite controls to ensure it was a reasonably balanced book that went to TSB. Aggressive responses are intended to win new customers, which with over 95% coverage for current accounts, means acquiring customers from other providers. For example, Santander actively exploited CASS by targeting wealthy customers through their interest paying 123 Account. The key to success lay in the capacity to spend significant sums on promotion. Santander effectively 'bought' customers with money to whom they can cross sell profitable products.

Relationship between Business and Academia

This case study demanded management and harnessing of three fundamental tensions inherent between business imperatives and academic rigour. The first concerns conflict of interest. The researcher undertook two roles: consultant contractually committed to deliver promised business value to Bacs within largely fixed funding and deadlines, whilst fulfilling the stringent rigour of doctorial research. This dual commitment exposed the risk, which manifested, of accusation that the researcher compromised and manipulated academic processes in response to commercial pressures. From the perspective of Bacs one reason for working with the University was to bring that academic rigor and experience to the work. The second tension relates to independence, which is critical for academic credibility, but rendered management of academic resources as part of an integrated team difficult. Finally, this tension was particularly apparent concerning deadlines. To be commercially viable, the MDM development was required to deliver real business value within timescales dictated by real world circumstances, always with inadequate data. Conflicts between timescale, budget and data must be managed with the appropriate level of pragmatism to address the issue under consideration. Conversely, injection of independent academic rigour is driven by time consuming research and the need for sufficient supporting data. The result was that academic validation always lagged contractual delivery. Core stressed the critical role in reconciling these tensions undertaken by Professor Colin Taylor, who attended key reviews, provided guidance and qualified assurance on the status and direction of travel.

Conclusions

There are five key conclusions from this interview in relation to the case study:

The Case Study Represented a Learning Journey

The work was a Learning Journey it its own right, transcending from an initial focus on supporting switching level forecasts for budgeting to comprehensively simulating emergent market dynamics. Each tranche was a fractal Learning Journey, undertaken with a clear purpose and performance assessed using criteria relating to the purpose. For example, purpose included the definition of scenarios, together with specific related questions, and performance measured in terms of output and insights from the MDM in simulating the scenarios.

The Work Enables Greater Mastery of Customer Behaviour

The model and, just as importantly, the modelling process, resulted in a greater understanding of switching behaviour which led directly to four key successes:

- Reducing risk through increasingly precise and reliable switching predictions
- Supporting promotion targeting and communication messages
- Demonstrating that differentiation and growth in market share is possible through a combination of value proposition which target unserved customer needs and promotion to make customers aware of both the gap and opportunity
- Informing policy decisions, evidenced by advice provided concerning ANP, saving the sector between £2 billion and £10 billion.

Commercial and Academic Tension was a Constraint

The main frustration concerned the pace of response from the academic partner, most evidenced in the lack of clarity surrounding the critical verification and validation and lack of academic papers.

The Principles, Techniques and Model are Generic

The future potential for the MDM envelops a bigger picture including directing CASS strategy against defined scenarios through capability to predict change. There are potential applications to transaction volume forecasting to mitigate risk of emerging behaviour invalidating more conventional payment volume forecasting models.

The Work Promoted Bacs as Thought Leader

Bacs published the following seven white papers directly relating to this research which drew significant interest within Payments, Finance and other sectors, as listed in Table A2. 2.

Table A2. 2: Key Bacs Papers

Reference	Essential Thread
(Bacs, 2016f)	Introduction of the Trust and Inertia loops as the dominant drivers of customer engagement dynamics
(Bacs, 2016e)	Focus on the Trust loop
(Bacs, 2016d)	Focus on the Inertia loop
(Bacs, 2016c)	Effectiveness of CASS
(Bacs, 2017b)	What constitutes an effective market
(Bacs, 2017a)	Interventions for an effective market
(Bacs, 2018)	Role and relationship of switching and the need to understand customer dynamics for Open Banking

Appendix B Cases Studies

Appendix B1 provides the full developmental case study material, key elements of which are described in Chapter 8. Appendix B2 contains further background to the validation case studies covered in Chapter 9 and includes before and after client evaluations. All materials in this appendix are as reviewed and approved by respective clients.

B1 Developmental Case Study

Introduction

This case study was conducted over a five year period between January 2014 and December 2018 involving development and application of the Market Dynamics Model (MDM) for Bacs Payment Systems Limited (Bacs), responsible for Direct Debit, Bacs Direct Credit, the Current Account Switch Service (CASS), and the Cash ISA Transfer Service (Bacs, 2016a). The case includes some early explorative modelling before the initiative was officially launched. The work doubled as consultancy assignments for the client, Bacs, and the primary developmental case study for this research. For Bacs, the purpose focused on gaining greater understanding of customer engagement in the Personal Current Account (PCA) market, particularly in relation to the role of the Current Account Switch Service (CASS), for which Bacs is responsible, in fostering effective competition in the market. The primary purpose for research concerned three key areas, Agile Learning, Causal Precision and Causal Certainty, in the context of stakeholder value. The consultancy assignments enabled both cross-sectional and longitudinal enquiry. Cross-sectional research involved comparison of behaviour between different providers and customers simultaneously and for longitudinal enquiry over time, which facilitated validation through examination and appraisal of real outcomes (Institute for Work and Health, 2015). The author was accountable for delivery of both the consultancy and research work streams requiring the management of resources drawn from Bacs, University of Bristol (UoB), providers and associates of the Author’s company, Impact Dynamics Limited (IDL).

Structure of the Appendix

This appendix introduces the background to Bacs and the market landscape in the context of customer engagement and the role of CASS. The purpose of the work is then specified from two perspectives, Bacs and academic research. The modelling architecture is outlined, followed by sections devoted to each of the four key architectural components: Real World, Conceptual Model, Physical Model, and Data Collection and Validation. Disciplines and specific work relating to verification and validation are then described. The next two sections cover real applications of, and results from, the modelling process and analysis of learning conclusions in relation to the academic purpose. Finally, future development of the MDM are proposed.

Background to Bacs and CASS

The principal activity of Bacs Payment Schemes Limited (Bacs) is provision of services relating to the Bacs Payment Schemes. In this capacity, Bacs is responsible for schemes behind the clearing and settlement of automated payments in the UK, including Direct Debit and Direct Credit (Bacs, 2016a). The company is also responsible for the Current Account Switch Service (CASS), Cash ISA Transfer Service and Bulk Payment Redirection Service, the latter ensuring that customer payments are correctly assigned to a new provider after a customer switches to a new current account provider, where that provider is a participant in CASS. Bacs is a not for profit enterprise limited by guarantee so has to ensure effective cost recovery and reserves. It is also important to note that Her Majesty's Treasury (HMT) mandated that CASS would be free to use for consumers and that the maximum switch fee to participants was restricted to £5, placing a tight restraint on funding. CASS participants provide in excess of 99% of all UK current accounts. In 2018 Bacs schemes were subsumed within Pay.UK along with other schemes covering the Fast Payment System and cheques (NPSO, 2018). The governance of Bacs and CASS are covered under the interview with Anne Pieckielon, Director of Product and Strategy with responsibility for CASS, and David Core, Head of Strategy and Regulation at Bacs who led the programme for the successful development of CASS (Core *et al.*, 2018).

Current Account Market

Current Accounts as an Essential Infrastructure

The vast majority, 96%, of adults in the UK have a personal current account (FCA, 2017b), which represents 48 million customers holding a total of 70 million accounts generating around £8.7 billion revenues in 2014 (CMA, 2016a). Current accounts serve four main functions: receive incoming payments, such as salaries, loans and refunds; enable spontaneous payments for products and services, in which respect they are linked to debit cards and mobile payment services; regular payments, such as to energy and other utility suppliers, using direct debits and standing orders; and short term borrowing using overdrafts (CMA, 2016a, p. 69). Core *et al.* (2018) emphasise that with the decline in use of cash, electronic payment services, provisioned principally through current accounts, are an essential society infrastructure, comparable to water and energy. Accordingly, current account services are researched and modelled in the context of an essential social infrastructure.

Providers and Value Propositions

The way in which a provider targets needs of different customer segments through their products and services is termed the value proposition (Kaplan *et al.*, 1996, p.73). Around 35 providers, banks and building societies, offer 135 different current account value propositions of which there are four main categories: standard, reward, packaged and basic. Standard accounts offer zero or negligible interest on balances but do not generally charge an annual fee, an arrangement referred to as the free if in credit (FIIC) model. Basic accounts are also free but exclude services, which would be included in a standard account, such as overdraft facilities. Reward accounts typically include interest on balances in exchange for a modest fee. Packaged accounts bundle a number of extras for a charge, which typically include travel and mobile phone insurance and roadside assistance (CMA, 2016a, pp. 70--72).

Responding to competitive pressures, driven through the introduction of computers in the 1960s, the UK banking market has become increasingly concentrated among a small number of large providers. By 2015, the four largest banking groups in Britain had a combined market share of around 70% for primary accounts with a similar picture in Northern Ireland (CMA, 2016a). Recent years have seen new entrants in the UK retail banking sector that offer full-service personal current accounts. These include Metro Bank, which claims to be the first new high-street bank in more than 100 years when it launched in 2010 (CMA, 2016a); non-bank brands such as Virgin Money that target the customers of their parent companies; and digital-only banks such as Starling Bank that target younger, digitally literate customers (PWC, 2017).

New Entrants

While new entrants and smaller banks have been gaining market share, this has been slow, evidenced by the fact that the four largest banking groups in Britain have collectively lost less than 5% market share since 2005 (excluding the impact of mergers and acquisitions). In efforts to reduce barriers to entry, the Bank of England simplified the process for acquiring a banking licence and lowered the capital requirements for new bank entrants in 2013 (CMA, 2016a). In 2016, the UK financial regulators (the Prudential Regulation Authority and Financial Conduct Authority) launched a New Bank Start-up Unit to support newly authorised banks and those thinking of becoming a new bank in the UK (BoE, 2016). Research by the Social Market Foundation (SMF) identified barriers to market entry by new players as one of the four principal constraints on competition, along with concentration, transparency and switching (SMF, 2016, p. 10).

Customer Engagement and Switching

Through their major investigation of retail banking in 2015-2016, the Competition and Markets Authority (CMA) estimated that customers with standard or reward accounts, around 90%, could benefit an average of £92 per year from switching. It estimated higher potential gains of around £180 per year for overdraft users and users of unarranged overdrafts (CMA, 2016a).

Crucially, whilst highlighting the concentration of the UK current account market, the CMA found insufficient evidence that market concentration was having an adverse effect on competition and detrimental effects for customers. Instead, it focused on low consumer engagement and lack of switching to explain why the market was not working well:

> The low customer engagement means that the discipline imposed by customers on banks through switching and the threat of switching is not as strong as it would be if more customers were engaged. This in turn weakens banks’ incentives to compete to gain new customers and retain existing customers.

(CMA, 2016a, p. xviii)

UK consumer surveys show that the majority, between 75% and 89%, have never considered switching their current account provider (GfK, 2015). Moreover, low levels of switching have persisted despite the introduction of the Current Account Switch Service (CASS) in September 2013. CASS is a voluntary industry scheme covering over 99% of the UK current account market that is intended to make switching current accounts simpler and quicker for individuals, as well as some small businesses and charities, by reducing barriers to switching (FCA, 2015).

This pattern of consumer behaviour concerning current accounts is not peculiar to the UK; other countries, including Sweden, Netherlands and Australia, who have made efforts to increase levels of switching, have not had much success (Hartfree *et al.*, 2016). However, it is important to recognise that the focus on switching as the primary measure of customer engagement is not universal. For example, in response to the CMA market investigation, the Financial Services Consumer Panel (FSCP), representing consumers in the regulation of financial services, challenged focus the of solutions on the demand side and urged regulators to place greater weight on the ***quality*** of consumers' switching decisions, including whether the consumer has switched to a better value product (FSCP, 2015). This reframe from quantity to quality of switching is reflected in the maturity path of the MDM development; shifting focus from volume of switching as the key measure of market effectiveness to whether those switches result in customers being more closely matched to their needs.

There is also a contradiction concerning the relationship between peoples' attitude towards banks generally and their satisfaction of their specific experience. Despite wide distrust of and resentment towards banks, particularly after the 2008 financial crash, UK current account users report high levels of satisfaction with their current account provider, with typically nine in ten survey respondents saying they are satisfied; and with no difference between large and small banks (OFT, 2013; GfK, 2015). Technically, this is explained by the ubiquitous nature and efficient operation of payments services in the UK and goes some way to explaining the low level of switching; (Core *et al.*, 2018). The networked nature of the current account, which demands that all products connect to common payments services, limits the ability to differentiate the core product.

Free if in Credit (FIIC) Model

The FIIC model refers to the provision of free basic current account services, principally payments, for customers with a credit balance. Core *et al.* (2018) explain the history of the FIIC model and consequential market distortions The Midland Bank, now part of HSBC, introduced the concept during the 1970s as a response to increasing competitive pressures. The FIIC model has since become embedded within UK banking and it would be extremely difficult, if not untenable, socially and politically to reverse. It means that now over 95% of people have a current account, including financially disadvantaged customers through the Basic Bank Account.

However, the FIIC model creates two significant distortions in the market. First, inability to attract revenue through their primary service, payments, led providers to position themselves increasingly as retail businesses with a focus on selling rather than provision of essential societal services. The pressure to cross-sell was a major factor in the Payment Protection Insurance (PPI) scandal. Secondly, a disproportionate share of the cost is loaded onto those least able to pay, principally through fees and charges to overdraft users. It is worth noting that in other markets where FIIC does not pertain, switching rates are not significantly higher because the typical charges are at a level rendering any differences in pricing insufficient to incentivise customers to switch.

Regulatory Framework

As a financial service, Bacs is subject to scrutiny by several regulatory bodies: Competition and Markets Authority (CMA), Payment Systems Regulator (PSR) and Financial Conduct Authority (FCA) and Prudential Regulatory Authority (PRA) which is part of the Bank of England (BoE), together with the Financial Markets Infrastructure Directorate (FMID) within the BoE; most significant because it oversees day-to-day operations. Each regulator focuses on specific aspects within a shared overall purpose to promote an effective market for stakeholders. The CMA concentrates on competitive effectiveness of the market to serve customers and other stakeholders equitably; for example, ensuring that no single provider enjoys unfair advantage (CMA, 2018). The PSR is concerned with ensuring correct, secure and efficient economic operation within the market (PSR, 2018). The FCA focuses on integrity of providers in adhering to regulatory rules; for example, ensuring that customers are treated fairly (FCA, 2017a). The PRA is part of the BoE and is responsible for financial integrity of players within the market; for example, ensuring that banks maintain adequate reserves (PRA, 2018). Importantly, Bacs plays a role in all these aspects of the market and, as such, provides support to and collaborates with the regulators and BoE. These relationships are profoundly significant in the development and application of the MDM because of the focus on switching and the role of CASS in the market.

Competitive Effectiveness of the Market

A detailed historical perspective of how the current account market has evolved over the previous seventy years is provided in the interview with Core *et al.* (2018), the following being a summary. After the Second World War rising affluence and associated demand increased competitive pressures on banks. The first response through the late 40s and 50s was competition through rapid expansion of the branch networks. Consolidation followed during the late 50s onward when automation started in earnest. As with manufacturing, banks then exploited the first round of computer technology in the 1960s to increase productivity, under a motivation to reduce costs in their inherently labour intensive, paper-based processes. This pattern continued with further technological advances through the subsequent three decades, which with the inclusion of building societies and other non-traditional clearing banks providing payment services, shaped the market structure and dynamics in several significant ways leading to the present situation.

On the supply side, the industry became increasingly concentrated with a few banks accounting for by far the greatest market share. Competitive pressures led to the introduction of the FIIC model which incentivised providers to frame themselves as retailers, focusing on cross sales to make up for revenue not obtainable for payments services on most accounts. Changes to traditional structures in investment markets, including deregulation and removal of traditional segregation of roles, tempted the traditional 'high street banks' into capital and investment markets; the 'casino banking' arena largely blamed for the 2008 crash (Kay, 2016). The FIIC model also injected the two key market distortions described previously: incentive for providers to 'buy' affluent customers who provide cross selling opportunities; and disproportionate costs loaded onto those least able to pay through overdraft charges and processing fees associated with less cost effective payment options. The radical improvements in productivity enabled margins to be maintained with lower levels of income, so FIIC become a major driver for automation.

On the demand side, current account coverage increased to the present level of over 95%. This increased usage rendered current accounting an essential infrastructure and, combined with reliance on increasingly electronic payments, led to concerns about the apparent uncompetitive nature of the current account market. In particular, Cruickshank (2000) highlighted the issue of low switching levels as indicative of poor competitive effectiveness in his landmark report at the start of the new millennium. The first response to encourage switching, development of the Transfer of Direct Debits and Standing Orders (ToDDaSO) service, suffered poor promotion and consequently take-up. A key limitation was perceived to be the absence of guarantees to protect customers should switches result in financial loss and a guarantee was incorporated in the design of the Current Account Switching Service (CASS). Launched in 2013, CASS shifts responsibility to the recipient provider. CASS is considered to be an operational success (CMA, 2016b, p. xl) but has not resulted in significantly increased switching levels (Defaqto, 2016).

Research conducted for this case study revealed the current account market to be highly damped from both supply and demand sides. For providers, the ubiquitous nature of payments infrastructure renders differentiation through innovation difficult and any competitive advantage short lived. Customers tend to be resistant to switching supplier through trust, often misplaced, in their current provider, combined with perceived risk and effort involved the process of switching. These patterns operate as two reinforcing loops, designated Trust and Inertia respectively, which form a core structure for the MDM. Service outcomes are not directly related to perceived satisfaction as there is a sense that 'they are all as bad as one another' when it comes to service. A consequence of the highly robust payment systems and the increasing level of self-service through internet and mobile banking is that there are very few occasions when customers experience a significantly differentiated service.

Open Banking

Core *et al.* (2018) reflect an increasing consensus that this market structure is unsustainable in the longer term, the solution to which will comprise regulation, technology and customer engagement. Concerning customer engagement, Bacs commissioned the research and model development for this case study to determine how the concept of Learning Journeys can be utilised to understand the causal dynamics of customer behaviour, with the aim of targeting, aligning and prioritising interventions, which promote an effective market. The latest initiative to inject energy into the market by encouraging greater customer engagement is open banking through the Open Banking Implementation Entity (OBIE), which allows Third Party Providers (TPP) to match customer needs with the most appropriate mix of products and services. Success will necessitate significantly greater understanding of customer needs, motivation and behaviour. The CMA describes open banking as one of a package of remedies to stimulate the market. It is worth noting that open banking allows other providers to have direct access to the current account, allowing TPPs to develop overlay services (CMA, 2016a).

Purpose of the Assignment

The work with Bacs represents a synthesis of consultancy, managed by the Author and academic input provided through the Author's doctorial research, of which this case study forms a core methodological component, and contractual partnership between Bacs and the University of Bristol (UoB). Both industry and academic perspectives are considered.

Industry Perspective: Business Imperatives

This section describes the business objectives of the engagement with Bacs, For Bacs the purpose and consequential direction of the MDM development has matured and changed during the five year duration of the case study as shown in Figure B1. 1.

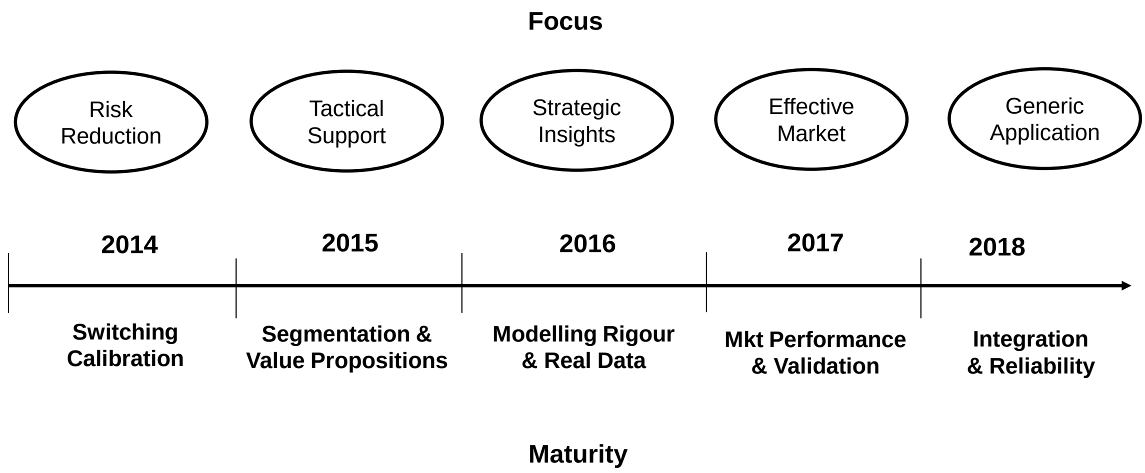

Figure B1. 1: Bacs Case Study Maturity Timeline

Each development, summarised below, enhanced all previous applications and extended functionality to meet the new requirements. For example, the MDM output increasingly precise and dependable switching level predictions, upon which Bacs has placed greater reliance for planning and budgeting purposes, in parallel with other functional capabilities, including strategic insights and market performance.

Risk Reduction

The initial purpose concentrated on reducing risk previously manifested in budgeting for CASS, by developing more precise predictions for switching levels, against which participant providers fund the service.

Tactical Support

In order to enhance budgeting for CASS, the early System Dynamics (SD) model was developed into an Agent-based Model (ABM) which segmented both customers and providers, thereby simulating changes in switching behaviour and associated causal drivers more precisely.

Strategic Insights

Focus then shifted to injecting rigour, both into real world conceptualisation and architecture and coding of the MDM, in parallel with definition, acquisition, transformation and input of real data. The result was the ability of Bacs to provide strategic insights to the policy makers with a pragmatic level of certainly. A notable example was to evaluate the predicted impact of Account Number Portability (ANP) demonstrating that it would produce only a small and transitory effect in the market set against the estimated industry implementation costs of between £2 billion and £10 billion. Therefore, the MDM demonstrated capability to provide beneficial insights at a macroeconomic level.

Effective Market

MDM development responded to increasing regulatory interest in market effectiveness through provision of a Market Performance Framework, comprising precise measures and traceability through causal drivers, based on the customer Learning Journey.

Generic Application

Through the process of model development, it transpired that the concepts and implementation are essentially generic and applicable across a broader spectrum of market settings. Consequently, the latest developments included provision for wider application within financial and across other sectors, such as energy and telecommunications. Precision was enhanced through econometric statistical causal inference and overlaying Learning Power profiles to customer segmentation.

Academic Perspective: Research Areas for the Case Study

This section explains how dynamics model development was used to investigate the core research question.

Can we define and validate a new theory and generic learning framework which aligns and optimises causal coupling of change programme deliverables with intentional equitable, sustainable and resilient stakeholder value with speed and certainty?

In this respect, the case study enabled implementation, testing and validation of the three perquisite capabilities: Agile Learning, Causal Precision and Casual Certainty, covered in Chapter 8. Rather that repeat, this Appendix structures the case study using the modelling architecture defined next: Problem Entity, Conceptual Model, Computerised Model, Data Collection and Validation.

Modelling Architecture

Verification and Validation Frame

For any form of model, whether mental or physical, to be capable of supporting value creation it must meet two essential criteria: it must reflect the real world with sufficient precision to enable achievement of intended purpose and perform operationally as intended. The first criterion is addressed through a validation process comprising two aspects, ensuring that the relevant territory is captured adequately within the model and that the model simulates the territory appropriately and correctly. The second criterion requires a verification process that for physical models, such as the MDM, includes ensuring correct coding and computation of all elements deemed to be within scope. In this respect, the development and deployment of a model is no different from any system development and must incorporate the robust Systems Engineering discipline of Verification and Validation (V&V) (INCOSE, 2010, p. 27). Although it is common practice to include verification before validation and both are essential, the Author's preference is to reverse the order to emphasise the importance of model purpose, before operational integrity of the model on the grounds that there is no point verifying code for a model that is not a valid representation of the system being modelled.

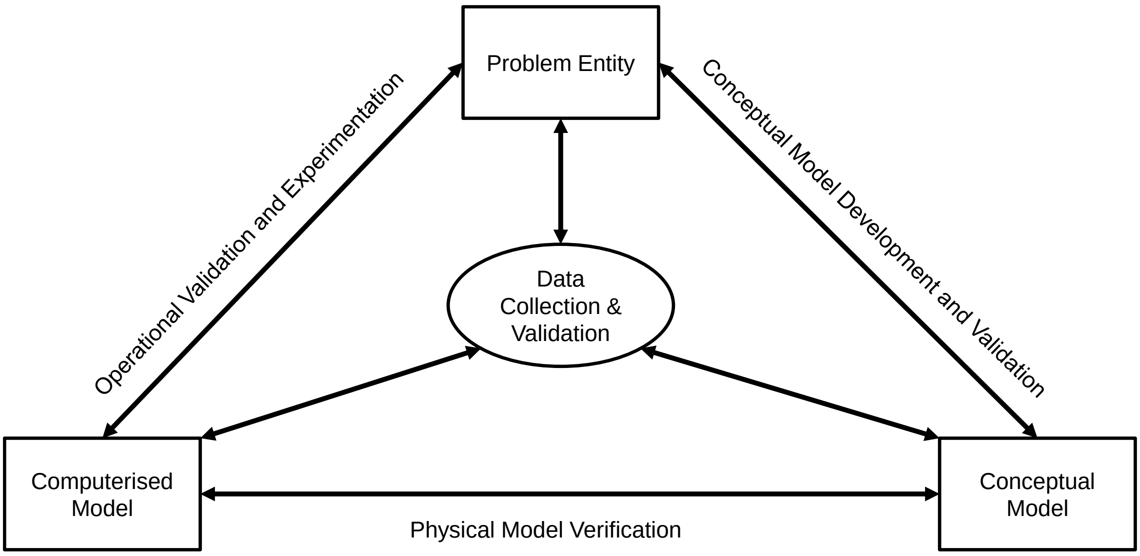

Figure B1. 2: Modelling Architecture

In the more specific context of simulation modelling, Sargent (2013, p. 12) proposes the model shown Figure B1. 2. He defines verification as ensuring that the computer program of the computerised (physical) model and its implementation are correct and validation the substantiation that a model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model. We can summarise this distinction, which is used throughout this research to characterise the mutually dependent components of value, as validation concerns doing the right things, whereas verification is about doing things right.

Value for Confidence

Sargent stresses that the focus on verification and validation is to increase the level of confidence in the model in the context of its intended use. To this end, he illustrates graphically that significant increase in confidence can be achieved for modest cost but that further confidence comes only with disproportionately high cost (Sargent, 2013, p. 13). This is consistent with Hubbard (2014, p. 160) in the context of the value of increased certainty using his definition of risk as the likelihood of negative outcomes as a result uncertainty (Hubbard, 2009, p. 80). This is shown in Figure B1. 3, which illustrates how Value Management operates within the optimum range representing the greatest 'Value for Certainty' in a given context:

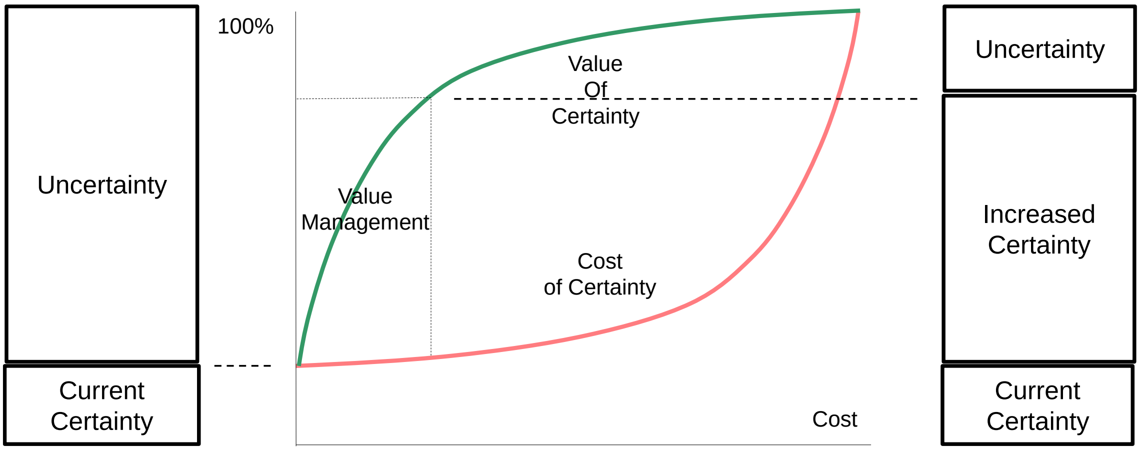

Figure B1. 3: Value of Increasing Certainty

The architectural components within Sargent's model shown in Figure B1. 2 are covered in the following four sections.

Problem Entity

This section describes the method for specifying the real world in the context of what Sargent calls the Problem Entity or System (Sargent, 2013, p. 14 Figure 2), which for this case study used two approaches:

- Experiential Research
- Literature Research

Experiential Research

Before any significant literature research was conducted key aspects relating to current account switching were elicited and modelled through direct enquiry with subject experts within Bacs and member providers. For any model intended to explain the causal dynamics of a system, it is crucial to specify the purpose and define the fundamental hypothesis to be explored against a reference behaviour pattern (RBP) of the behaviour to be explained in the context of this purpose (Richmond, 2001, p. 175). The RBP is used as the basis for historic calibration and future prediction throughout this case study.

Reference Behaviour Pattern

The primary measure used as a RBP is Moving Annual Total (MAT) for central service switching levels plotted for each month as shown in the in Figure B1. 4, the 'presenting problem':

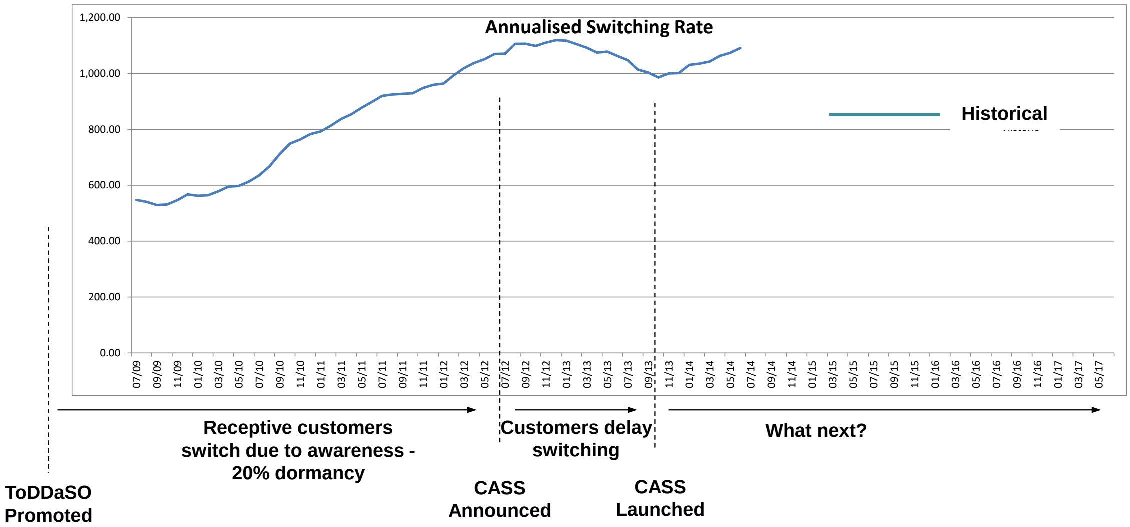

Figure B1. 4: Switching Reference Behaviour

From 2008, the start of the calibration for the MDM, to 2012 recorded central service switching levels using ToDDaSO doubled from 600K to 1.2M accounts per year. Between 2012, when CASS was announced, and 2013 when CASS was launched, switching declined, growing again after 2013.

Hypothesis

The hypothesis for historic RBP is articulated by Core *et al.* (2018). In response to there being no significant change in switching rates after launch in 2004, ToDDaSO was actively promoted by member participants from 2008. This initiative resulted in a doubling of recorded central service switches over the four year period to 2012, at which point CASS was announced. Based on indicative evidence and knowledge of the market, Core hypothesised that a significant proportion of the growth in recorded switching during this period was attributable to a transition from self-switching to ToDDaSO; i.e. customers who would have self-switched anyway used ToDDaSO. Core further surmised that in anticipation of the superior CASS solution, providers ceased promoting the personal current account (PCA). This accounted for the decline in switching until CASS was launched in 2013, after which growth resumed at the same rate exhibited between 2008 and 2012. The resumption of growth in switching up to mid-2014 presented a dilemma; would switching levels continue to increase due to CASS or was there some other causal dynamic which may constrain growth? Core observed that the market is heavily damped in contrast to comparable sectors, such as energy and telecommunications which experienced much higher rates of switching, and expected a natural limit of around 1.2M switches per year, 2% of the 48 million current account customers.

Core's intuition was that provider innovation of value propositions was driven by the expectation of CASS. Although no formal research is available, there are several indicators which corroborate this view. Around 150 product improvements introduced by providers between initiation of the CASS programme and launch were most likely implemented in anticipation of increased customer engagement. There were essentially two categories of response by market participants, defensive and aggressive. Defensive strategies focused on brand and quality of service with the aim of retaining high value customers providing cross sell opportunities. For example, it is evident from the advertising and promotion strategies Lloyds Banking Group adopted that they have targeted new customer recruitment through the Halifax product advertising and promotion while focusing on customer retention with the Lloyds brand advertising and relationship pricing offers. Aggressive responses are intended to win new customers, which with over 95% coverage for current accounts, means acquiring customers from other providers. For example, Santander actively exploited CASS by targeting more affluent customers through their 123 Account paying interest on a much larger balance than other PCAs. The key to success lay in their capacity to spend significant sums on promotion; Santander was willing to accept a lower margin on those higher balances that they attracted in return for greater cross sell opportunities to those more affluent customers.

Literature Research

A literature review of academic papers, by the Author, and industry reports by consultants working on behalf of Bacs, was conducted against the following core research question and three sub-questions:

What are the factors that influence consumer and small business engagement within the current account market?

Sub-questions:

- How do the factors cause competitive outcomes in the current account market?
- Can factors relating to engagement from other sectors be applied to the current account market?
- How can knowledge of the factors be used for effective communications strategies?

The themes that emerged through systesis from the research papers as being key influencers on engagement and switching are described below. Although considered separately, reflecting the narrow and deep focus of research papers, in reality the factors operate in combination through causal relationships. For example, research confirms a clear causal link between trust in a provider and loyalty to that provider, with the result that the customer is inclined to remain with their current provider. However, the same behaviour can also be driven from indifference towards the provider, and perceptions of the risks, costs and effort associated with the switching process, all of which relate to customer inertia. In terms of systemic causation trust and inertia behaviour represent reinforcing loops which counter the propensity for customers to switch providers. Research relating to each theme is first discussed, followed by a synthesis using a Systems Thinking approach. Findings are intentionally articulated as concise points within each theme to facilitate transition to a causal model by providing cross-reference traceability to and from key points from the literature research to a conceptual model.

Trust

Trust is a the firm belief in the reliability, truth, or ability of someone or something, which involves level of integrity, honesty and competence that one party perceives in another (Oxford Dictionary, 2018c). Another useful frame in the context of current account switching is confidence in the outcome of a situation (O'Brien *et al.*, 2001, p. 21). Trust in the current provider increases the perceived risk of switching and has more influence on loyalty than switching costs (El-Manstrly *et al.*, 2011). Research in the context of smartphones showed that trust greatly influences loyalty (de Reuver *et al.*, 2015). The relationship between trust and loyalty is important for switching because if customers trust a provider they tent to exhibit loyal behaviour by remaining with their current provider, even if this trust is unwarranted. The definition used for this case study is the degree of certainty perceived by a customer that their provider will continue to satisfy their values in the future.

Inertia

Inertia is the tendency to do nothing, remain unchanged or be resistive to change (Oxford Dictionary, 2018b). In the context of switching, inertia refers to customers' attitudinal propensity to maintain status quo with a service provider out of passiveness or inaction. It differs from attitudinal customer-loyalty in that the latter stems from a concerted decision by customers to stick with a service provider that they favour. Inertia is underpinned by lack of motivation or goal-directed behaviour and high inertia customers may stay even when dissatisfied. There are two types of high inertia customers: satisfied and indifferent. High inertia satisfied customers stay with providers even if switching costs increase because they perceive contentment with their provider. High inertia satisfied customers view switching costs synonymous with benefits and, consequently, do not engage in negative Word of Mouth (WoM) . They possibly even send positive WoM, despite the high switching costs, in which case they effectively promote switching to their provider. High inertia indifferent customers are also unlikely to transmit negative WoM. Conversely, low inertia customers are more likely to engage in negative WoM. Segmentation should include high and low inertia (Lee *et al.*, 2012). The definition of inertia used for this case study is the propensity for a customer to remain with a provider even when that provider fails to satisfy their values.

Satisfaction

Giese and Cote summarise research into consumer satisfaction as a response of varying intensity and limited time duration directed toward focal aspects of product acquisition and/or consumption (Giese *et al.*, 2000). Customer satisfaction does not positively influence switching intent but loyalty negatively influences it; therefore loyalty is more important than satisfaction, which explains the power of brands. There is a significant moderating effect of variety seeking on the relationship between loyalty and switching intent. Customer satisfaction is still the most important variable in loyalty but is moderated by variety seeking. (Jung *et al.*, 2012). Research in manufacturing suggests that companies should focus on customer satisfaction and loyalty through product-service offerings, known as Product-Service System (PSS). This effect has been graphically illustrated by developments in airline ownership and use of aircraft with the development of aftermarket support services and the move to 'power by the hour' engine provision. A PSS is a solution which adds customer value by integrating products and services across three categories: product, use and results (Pan *et al.*, 2015). Customer switching guided purely by their own experience supports limited investment in quality. Conversely, negative WoM increases attrition and induces investment in quality. (Heyes *et al.*, 2012). In pharmaceuticals, research confirms that under-fulfilment of needs decreases satisfaction, whilst over-fulfilment does not increase satisfaction, which plateaus with a certain level of fulfilment. (Oliver, 1995). The definition used for this case study is the degree to which a customer perceives that their provider has satisfied those things that are most important to them, i.e. their values, in the past and present.

Loyalty

Loyalty refers to feelings of support or duty towards someone or something (Cambridge Dictionary, 2018a). In the context of switching, there are two types of loyalty, attitudinal and behavioural. Attitudinal loyalty reflects an intention to use with a propensity to engage in WoM, Behavioural loyalty involves a tendency to stay even under less positive conditions. Attitudinal loyalty is driven by trust and relational switching cost, behavioural loyalty by trust, relational switching cost and attitudinal loyalty; behaviour is driven by attitude (El-Manstrly *et al.*, 2011). Inverting the context to loyalty, there are two types of market: Repertoire, involving discrete, separate purchases, and Subscription which applies a periodic fee for use of the product or service (Lees *et al.*, 2007). It should be noted that the PCA market is essentially a subscription model even though there are no transparent fees. Drivers of loyalty are: satisfaction, stake in relationship and value of switching. Dimensions of loyalty are: behavioural response, including repeat purchase, commitment to people providing the service and commitment to provider. Satisfaction impacts all three loyalty dimensions; stake impacts behavioural response and commitment to people, value of switching has a negative influence on behaviour and commitment to the provider (Licata *et al.*, 2009). There are four drivers of the loyalty response to dissatisfaction: hassle, longevity of relationship and lack of trust in alternatives, reflected in the belief that all providers are the same. The loyalty response to dissatisfaction is high in the financial sector due to relationship and hassle factors. The loyalty response to dissatisfaction may be temporary but provides an opportunity for providers to resolve the dissatisfaction (Panther *et al.*, 2004). The most critical factor for loyalty within telecommunications in Malaysia is perceived service quality, followed by corporate image, trust and switching cost (Amin *et al.*, 2012). The definition of loyalty used for this case study is the propensity for a customer to remain with a provider as a result of that provider satisfying their values in the context of the product and/or service in question.

Risk Perception

The most cited definition of risk is by Frank Knight who makes a distinction between uncertainty and risk; where risk is measurable certainty (Knight, 1921). Hubbard, noting the absence of possible loss, refines this perspective by arguing that risk is a state of uncertainty where some of the possible outcomes are undesirable (Hubbard, 2009, p.80), which is supported by the dictionary definition of the possibility of something bad happening (Cambridge Dictionary, 2018b). An important point with regard to switching is that risk can be real or perceived, but it is perceived risk that drives behaviour. Therefore, it follows that awareness is key. Risk perception has two dimensions: financial/functional and social/psychological. Product homogeneity relates to influence and risk; where taste matters, social risk is perceived as greater. Functional risk perception is greater for low preference heterogeneity (Wangenheim *et al.*, 2004). The definition used for this case study is impact and likelihood of occurrence of negative consequences perceived by a customer of changing their provider

Switching Costs

Switching costs refer to the perceived effort and potential financial loss associated with changing provider. There are three categories of switching cost: financial, relational and procedural. Financial and procedural switching costs do not have a strong correlation with loyalty. Relational switching cost has greater influence on loyalty than financial and procedural costs. Technology, such as online and mobile banking, is rendering relational costs of switching less important because there is less perceived investment in relationships (El-Manstrly *et al.*, 2011). In a pilot for CASS, it was found that obvious switching costs, such as time and hassle, were less important than relationship loss.). Judgment of the amount of effort in relation to the worth of investment in the switching process is a significant factor in the loyalty response to dissatisfaction (Matthews *et al.*, 2007). Perceived costs do not affect loyalty directly but do so indirectly through impact on trust in the context of smartphone owners. Evidence from the Telecommunications market suggests that providers should reconsider their tariffs given the link between perceived cost and trust, which then impacts loyalty (de Reuver *et al.*, 2015).

Switching Level

Keaveney (1995) proposes eight main causal variables of switching, which tend to work in combinations, listed below together with proportions of incidence.

- Price (which included other financial factors) 16.7%
- Inconvenience 11.6%
- Core Service Failures 24.8%
- Failed Service Encounters 19.1%
- Response to Failed Service 9.7%

- Competition 5.7%
- Ethical Problems 4.2%
- Involuntary Switching (e.g. no branch) 3.5%
- Other 4.7%

Vyas *et al.* (2014) confirmed Keaveney's switching model factors concluding also that the factors work in combination. Other research concerning motivation for switching found that the most important order is pricing, followed by service failures then denial of services. Also, size matters with random categories for switching, possibly due to absence of national network for smaller players (Lees *et al.*, 2007). Although, the proportions quoted in Keaveney's research relate to service industries more generally, it is reasonable to infer some relevance to the PCA market if applied with caution.

Word of Mouth

Word of Mouth (WoM) is defined as any positive or negative statement made by a customer about *their experience of* a product or company, which is made available to a mass of people and institutions and can also be the method of communication between two non-commercial people and without benefit in the business they are talking about (Naz *et al.*, 2013). Most importantly from a switching perspective is that WoM can influence behaviour of the recipient. 75% of respondent customers who switched engaged in WoM concerning the event that influenced the switch. 50% of switchers found their new provider through WoM, compared with 20% search and 20% publicity (Keaveney, 1995). There are two dimensions of WoM influence: informational, which concerns acceptance of reality, and normative, which relates to compliance with verbalised expectations of the referrer. Informational and normative relate to 'expertise' and 'similarity' characteristics of the WoM source. WoM influence is moderated by perceived risk which depends upon both the product and person. WoM referrals represent the most effective information source for reducing perceived risk in service purchases. Customers who perceive greater financial/functional risk will seek expertise, whilst those perceiving greater social/psychological risk will seek similarity. Both source expertise and similarity were shown to influence attitudes and subsequent decision making and perceived risk dimensions moderate both variables (Wangenheim *et al.*, 2004). WoM has two effects. First, it allows customers to learn more about their own supplier, for example confirming their own experiences. Secondly, it enables customers to learn more about alternative providers, thus having more information upon which to base a cognitive decision (Heyes *et al.*, 2012). This latter observation is consistent with our specific definition of Cognition Level: awareness of a gap between requirement and actual experience from the current provider and awareness of potential to redress the gap by switching to another provider.

Consideration Sets

In the context of switching, a consideration set refers to the specific number of providers being compared in a switching decision. For subscription markets customers have few brands in their consideration sets, which are mental lists of provider that they would consider using. There are three types of criteria for consideration sets: cost benefit trade-off (utility), goals and personal circumstances, and random. Considerations sets are useful for classifying reasons for switching, i.e. utility, expectation disconfirmation, random. When switched, customers kept their previous supplier in their consideration sets in the following percentages for each reason category: 58% random, 35% expectation disconfirmation, 45% utility (Lees *et al.*, 2007).

Age of Relationship

Age of relationship refers to the length of time a customer has been with their current provider. During the first five years of a relationship with the provider, influence tends to work only on spurious loyalty, whereas after five years it is possible to impact true, more sustainable loyalty (Licata *et al.*, 2009). Customers who stayed after dissatisfaction were with the provider for longer than those that switched, which is evidence that exit barriers increase with time (Panther *et al.*, 2004).

Multiple Accounts

In New Zealand some banks are encouraging multiple banking though the cherry picking of special offers (Lees *et al.*, 2007). The market dynamics modelling currently focuses on primary accounts, i.e. those managing most payments and salaries, which is what CASS is designed for. However, a likely consequence of open banking is customers will hold more multiple accounts, each serving specific requirements more precisely by encouraging new value proposition to enter the market, recent examples being Monzo and Starling (Reynolds, 2017).

Communications Strategies

Communication strategies need to focus on trust and to a lesser extent relational switching cost; financial and procedural switching costs are less important (El-Manstrly *et al.*, 2011). They should address different types of inertia customers (Lee *et al.*, 2012) and account for spurious and true loyalty (Licata *et al.*, 2009). Segmentation and communications should account for risk dimensions. Service expertise refers to the degree to which customers are knowledgeable and competent in utilising a product or service. This raises the question of how effective educational communications are in encouraging engagement in the market and potentially switching. Research indicates that education focused communication could be more effective for high functional risk perceivers (Wangenheim *et al.*, 2004).

Synthesis

In this section findings from the research are transformed from a ‘laundry list’ of individual themes into stories comprising the key causal relationships between the themes and drawn together to describe the dynamics of the current account market. In order to provide traceability, key structures within the causal map are derived explicitly or implied logically from the key points in the literature review findings.

Laundry List View

The array of individual themes form what Richmond (2001, p. 19) refers to as a 'laundry list', comprising a number of factors deemed to influence the main focus, in this case switching level, in some way. This is shown in Figure B1. 5, which contains some items inferred from but not explicitly described in the previous section, such as satisfaction and technology.

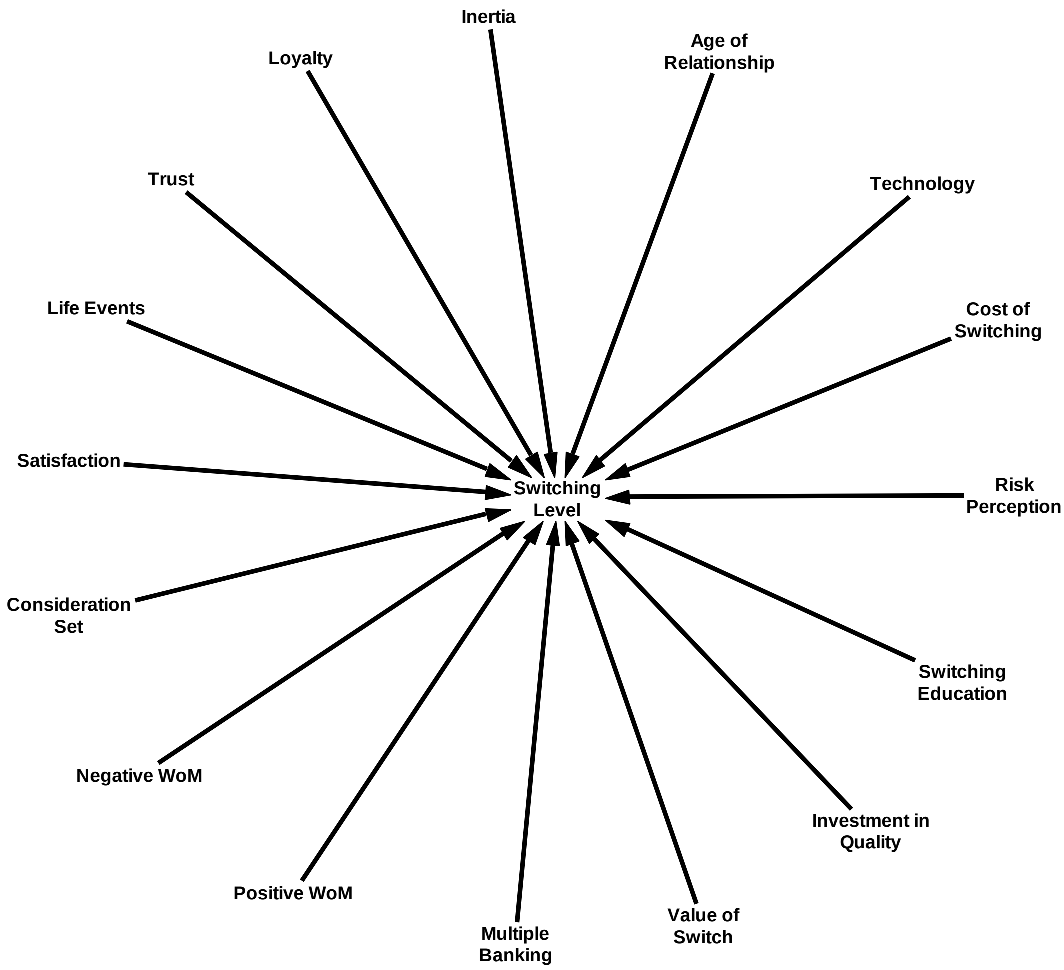

Figure B1. 5: Synthesis Laundry List View

This laundry list, which is a typical output from a brainstorming workshop, is of very limited practical value because it does not pass what the Author calls, "The so-what? test". More precisely, the so-what? test in this study is articulated as, "How does a change in one factor cause changes in one or more of the other factors and the main focus?" The 'how?' in this questions includes the nature, magnitude and direction of relationships between all factors which link the changed factor and the main focus in one or more chains of cause and effect.

Causal Story View

Richmond pursues this challenge by transforming the laundry list of independent factors into a system map of interdependent relationships (Richmond, 2001, pp. 20-22), which the Author refers to as a causal story. The causal story describing the current account market is shown in Figure B1. 6. In order to ensure objectivity, only factors and relationships explicitly derived or inferred from the academic literature are included in the story. Each element of the structure is identified by a number, referencing one of the relational themes below:

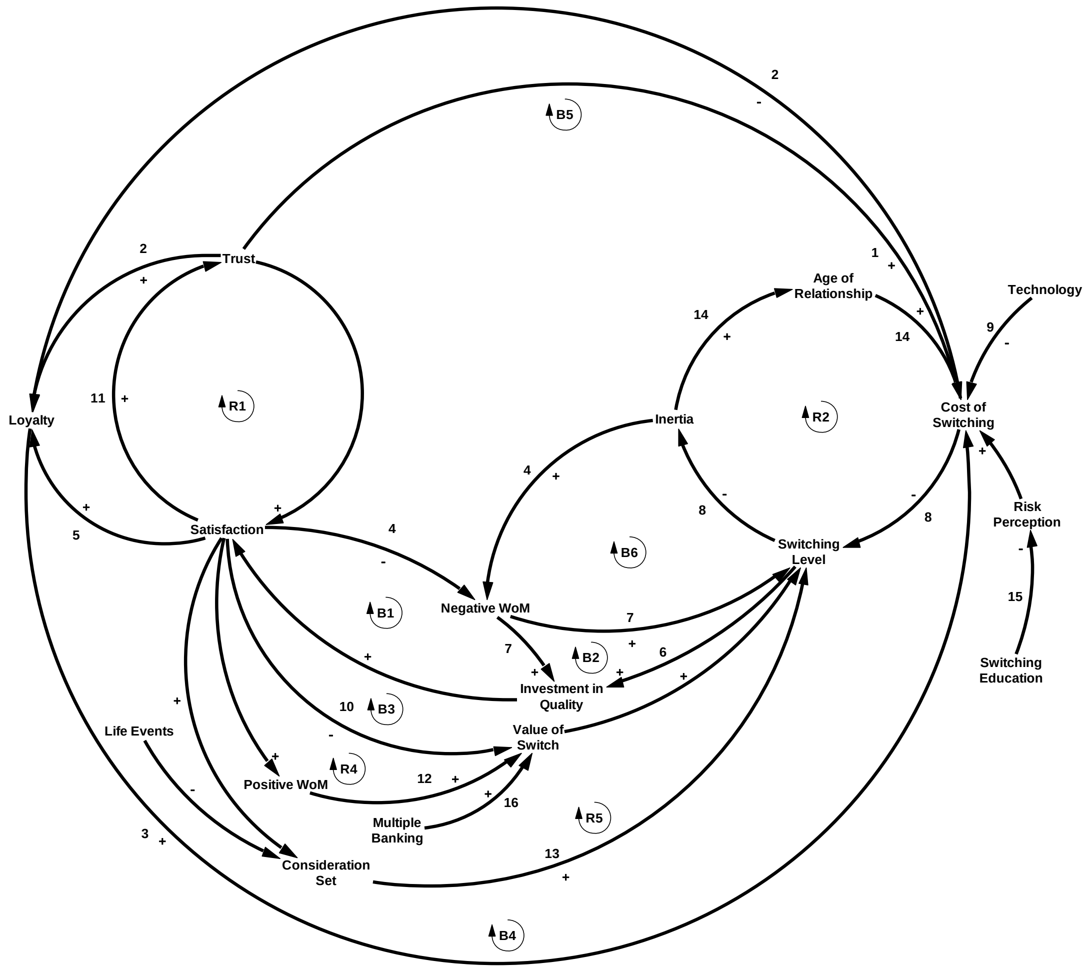

Figure B1. 6: Synthesis Causal Story View

The causal map is in the form of a Causal Loop Diagram (CLD) (Sterman, 2000, p. 13). Connection between factors define the direction, from cause to effect, and the "+" and "-" syntax denotes polarity, read as, "an increase in cause factor results in an increase "+", or reduction "-" in the effect factor. Where the chains of causality form a complete cycle the result is one of two types of feedback loop. Reinforcing feedback loops, numbered as R1, R2 etc. are either vicious or virtuous circles; which drive outcomes that have a negative or positive influence respectively. Balancing feedback loops, numbered as B1, B2 etc., act as constraints and operate towards an explicit or system imposed goal. The importance of feedback loops is that, operating as a whole, they account for the essential dynamics of a complex system, which will usually be non-linear; in this case the current account market. The following 16 points explain the relationships between factors, corresponding to the 16 connections indicated in Figure B1. 6 explain the synthesis which emerged through synthesis from the literature research. The key points are traced explicitly to annotations added to the original .pdf files of the associated academic papers and industry reports; providing precise cross-referencing for validation between the Problem Entity and Conceptual Model in Sargent's model, as shown in Figure B1. 2

1. Trust in the current provider increases the perceived cost of switching because of importance to the customer of the relationship with the provider
2. Loyalty is driven by trust which has more influence on loyalty than switching cost
3. Loyalty negatively influences switching intent by increasing the perceived loss of relationship
4. Low inertia customers are more likely to engage in negative WoM when dissatisfied
5. Customer satisfaction is still the most important variable in loyalty due to the high relationship and hassle factors
6. Customer switching guided purely by their own experience supports limited investment in quality
7. Negative WoM increases attrition and induces investment in quality directly
8. Relational switching cost has a greater influence on inertia (behavioural loyalty) than financial or procedural switching cost
9. Technology, such as online and mobile banking, reduces the relational switching cost
10. The perceived worth of investment in switching is a significant factor in the loyalty response to dissatisfaction
11. Perceived service costs do not affect loyalty directly but indirectly through impact on trust
12. WoM is a major factor in both the decision to switch and selection of a new supplier by providing information about both current and alternative providers
13. Consideration sets determine potential switch candidates and can be influenced by life events, for example a mortgage linked to a current account
14. The propensity to switch decreases significantly with the age of relationship with the current provider
15. Education-focused communication is more effective for high functional risk perceivers
16. Multiple banking increases the potential value of investment in switching:

The interrelated themes are now articulated as a causal story with explicit reference to the numbered feedback loops, again containing threads to specific insights from the research, with some inferences drawn from sector expertise where deemed essential for the logical flow:

> The current account market dynamics is driven operationally by two reinforcing loops, R1 and R2, relating to trust and inertia respectively. Trust, the degree of certainty

perceived by a customer that the current provider will continue to satisfy their values, increases loyalty, which is the propensity for a customer to stay with a provider as a result of satisfaction and trust. Inertia is the tendency for customers to remain with a supplier even if dissatisfied, due to the perceived cost of switching, which increases significantly with the age of relationship. Importantly, the perceived cost of switching is driven by the relationship that a customer has with the provider, rather than financial or procedural cost. Technology, for example online and mobile banking, is eroding this relational bond. Both loyalty and trust negatively influence switching by increasing the perceived cost of switching, denoted by balancing loops B4 and B5 respectively.

Negative WoM from customers concerning the service they are receiving, and/or their provider, is most likely generated through a combination of poor satisfaction and low inertia. Negative WoM creates a number of loops that counter the inertia cycle and improve satisfaction by encouraging providers to invest in quality. R3 is a reinforcing loop operating directly on switching level. In B1 negative WoM encourages investment in quality directly and in B2 indirectly by influencing switching.

Positive WoM from customers about the service they are receiving, and/or their provider, is principally driven by satisfaction. Positive WoM drives a virtuous reinforcing loop R4 by encouraging providers to invest in quality through increasing the perceived value of switching in recipients of the WoM messages.

Multiple banking has the effect of increasing perceived value of switching, reference 16 in Figure B1. 6.

Consideration set, the mental shortlist of providers from which a customer will select a new supplier in the event the customer considers switching, influences switching level directly through their inclusion or exclusion. Providers in a consideration set can be influenced by life events, the specific contextual circumstances of a customer at a point in time, such as starting education, getting married, retiring etc. For example, a mortgage offer may be conditional on a current account with the same provider.

Risk perception is the major driver of perceived cost of switching, which is borne largely through ignorance and lack of trust in banking and related processes.

Conceptual Model

A Conceptual Model formalises the mental interpretation of the Real World and provides the specification for the computerised Physical Model.

Causal Tracing Document

The main artefact covering the Conceptual Model is the Causal Tracing Document (CTD), which is structured into three parts using Value Principle 1, Value Alignment, Why? How? What? (Davies, 2018). Each part is discussed, together with key extracts and examples drawn from the document. The latest version of the MDM uses entirely generic naming in order to facilitate wider application within the finance sector and across other comparable sectors, such as energy and telecommunications. The CTD reflects this generic naming, for example the abbreviation CS (Central Services) is used instead of CASS.

Why? Purpose of the Model

This part of the CTD specifies the purpose of the model, which for Value Management concerns defining and realising stakeholder value within the ecosystem under consideration. Consequently, it is important to define the highest purpose in terms of precise stakeholder outcomes. The highest purpose of an effective, competitive Current Account market is to raise the customer's value outcomes through their behaviour by influencing providers to develop and deliver value products and services, value propositions, which most closely match customer needs in the context of current account banking. A core premise is that by encouraging and enabling customers to switch between products, providers will improve their value propositions, thereby improving customer outcomes whilst sustaining the market through profitability. A critical distinction, therefore, is that the highest purpose is not to maximise switching as the end game but to encourage customer engagement, manifested as the awareness of need and options, active consideration and switching where necessary, which drives providers in to meet customer and other stakeholder needs.

The primary purpose of the MDM is to provide tactical support, strategic insights and specific direction concerning factors driving customer engagement in the Current Account market in order to match their needs and interventions, such as communications strategies and product developments, intended to realise this stated purpose.

How?

This part of the modelling process builds a complete causal story of the Current Account market dynamics in three levels:

- **Essential Market Dynamics:** Focused on the Trust and Inertia loops
- **Overview:** Providing a story of the entire dynamic system as a systemic map

- **Storylines:** Key threads highlighted as causal traces through the systemic map

Many of the storylines are in the form of reinforcing and balancing feedback loops. Reinforcing feedback loops, denoted as R1, R2, R#, contain relationships that drive the resulting dynamic in the same direction, either increasing or decreasing. Reinforcing loops are manifested as virtuous or vicious circles, depending on the perspective. For example, uncontrolled debt represents a vicious circle for the debtor, whereas compound interest on capital investment is a virtuous circle for the investor.

Balancing loops, shown as B1, B2, B#, possess one or an odd number of relationships which work in the opposite direction and manifested as controls or constraints. An important distinction is that balancing loops always have an intended or system imposed goal. For example, intentional adjustment of water temperature in a shower is a balancing feedback loop in which the goal is comfortable temperature. Conversely, a hot bath will cool to the room temperature, a goal imposed by the system.

Both reinforcing and balancing loops create non-linear dynamic behaviour in the system, in this case the Current Account market, which constitutes a Complex Adaptive System (CAS) (Miller *et al.*, 2007) in which dynamic behaviour is emergent through interaction of the feedback loops.

Essential Market Dynamics

The essential dynamics of the Current Account market is shown systemically in Figure B1. 7.

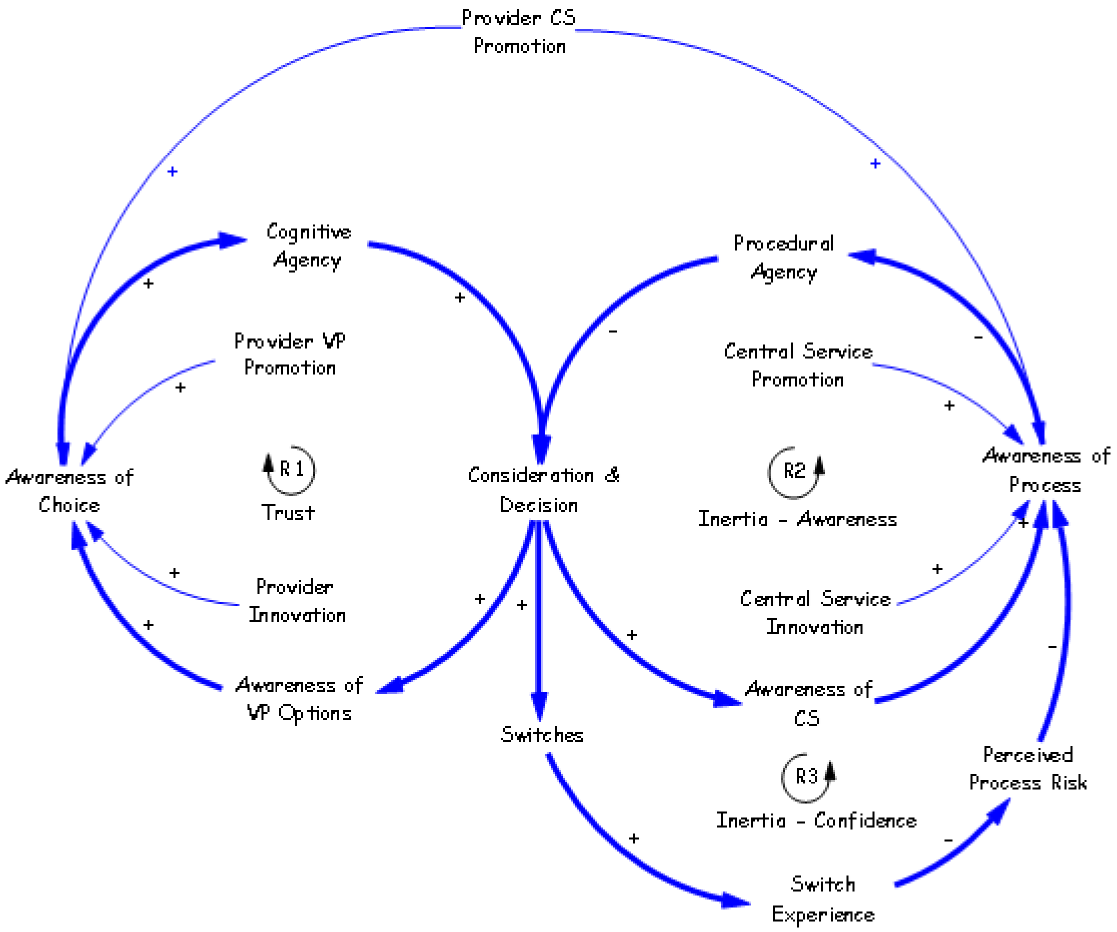

Figure B1. 7: Essential Market Dynamics

The Trust and two Inertia loops are both examples reinforcing. In the case of the Trust loop, all else remaining equal, customers are exposed to promotion and experience mainly or entirely from their current provider. Consequently, customers remain largely unaware either of any need to change or options available, thereby building trust in their current provider, whether it is actually warranted or not. This increases perceived value of the relationship, negating incentive to change, which is manifested as loyalty. The problem with the Trust Loop is that this loyalty may be misplaced or that the customer simply stays with 'the devil they know'.

For the Inertia - Awareness loop, all else remaining equal, customers remain unaware of Central Services (CS), for the Current Account market CASS, and/or do not relate to CS promotion. This means that customers do not consider options and therefore do not receive earned promotion messages, in particular through Price Comparison Websites (PCW). For the Inertia - Confidence loop, all else remaining equal, customers associate large effort and high risk with the switching process, which discourages consideration and switching. This reluctance is reinforced over time. The problem with the Inertia loops is that providers, particularly large ones, can actually gain by customers' reluctance to switch; delivering a poor service in the knowledge that it is unlikely to cause customers to switch. Consequently, there was little incentive for providers to make switching easier and only did so when forced by regulatory action.

The important point is that the influence of reinforcing loops can acted in either a positive or negative sense. In the case of the current account market, it can potentially increase active engagement in the market given the right inputs. For example, in the case of the Trust loop, increased awareness of a need and options for addressing the need results in greater agency to consider and make switching decisions, which enhances awareness. For the Inertia loops, increased awareness of the switching process reduces inertia, thereby increasing the propensity to consider and possibly switch. The former increasing awareness, the latter, anticipating a positive switching experience, reduces perceived risk, both leading to further reductions in Inertia.

A key to addressing the Trust loop R1 in Figure B1. 1 is achieving two things. First, increase customer awareness that a gap exists between what they need and what they are currently experiencing, together with awareness that alternative providers can potentially satisfy this gap. This customer awareness is called Cognition Level. Secondly, increase the propensity for a customer to act upon this awareness to consider and make a switching decision (which may be to stay with their current provider). The capacity to act responsibly and interdependently with others against a self-initiated purpose in a learning context is called agency (Van Lier, 2008). Therefore, cognition informs agency. The primary requirement for breaking the Inertia loop is to increase awareness of CS (R2) and build confidence in CS by reducing the perception of effort and risk in the switching process (R3).

However, in the absence of any mechanism to break the reinforcing loops, which are operating as vicious cycles, switching will inevitably remain low, as is evidenced in reality from statistics compiled monthly. What is needed to break the reinforcing loops, or better still transform them into virtuous cycles, is the presence of a balancing loop with sufficient influence. As discussed above, balancing loops generally migrate towards a goal, either chosen with a defined intention or imposed by the system. The key balancing loop in this case is Customer Journey, which is an instance of a Learning Journey. In systemic terms, a learning journey is a balancing loop in which the gap between a defined purpose (goal) and manifested performance in relation to that purpose is closed, i.e. performance converges to purpose. The goal for the customer journey is satisfaction of need, defined as the ideal value proposition for a customer. Performance is how a customer actually experiences the value proposition delivered by their current product, modelled as customer perception of the product value proposition. The gap is defined as the difference between what the customer perceives as their ideal value proposition and their perceived experience of service from their current provider. The customer journey is overlaid onto the essential market dynamics as the balancing loop B1 in Figure B1. 8.

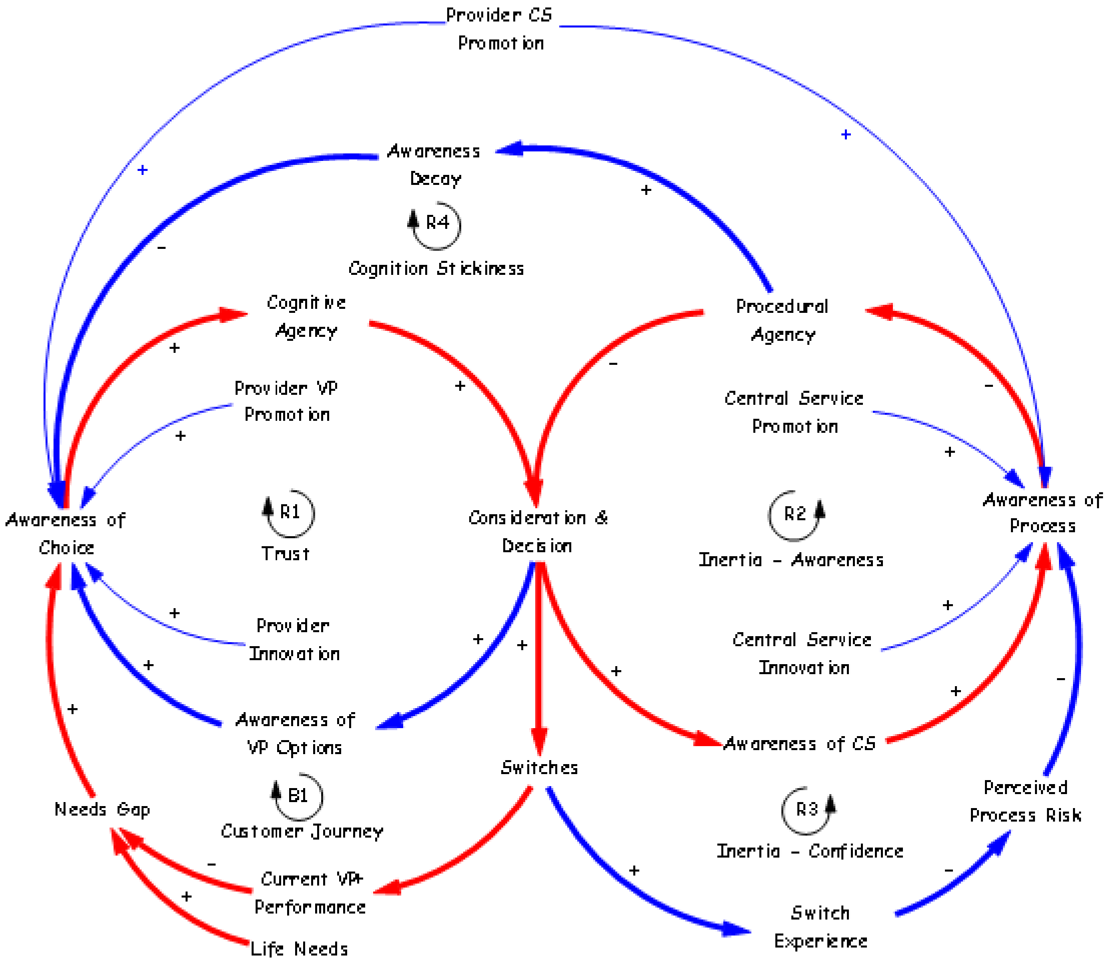

Figure B1. 8: Essential Market Dynamics with Customer Journey

Under the B1 Customer Journey balancing loop, perceived Life Needs is the goal which is targeted through customers migrating to products with a value proposition that most closely matches this need, which may be their current product. A crucial hypothesis is that perceived need is driven primarily by the contextual power of life status, such as affluence, profession, age etc., and specific events, such as entering higher education, buying a house or retiring. This balancing loop impacts the Trust and Inertia loops by driving consideration and switching decisions, both leading to reduced Inertia which also reduces resistance to Awareness of Choice in the Trust and Customer Journey feedback loops through R4 Cognition Decay. R4 reflects the tendency for customer awareness to decay over time; the 'out of sight out of mind' effect.

A powerful aspect of causal maps is that they provide direction for targeting effective interventions. For the Trust loop interventions include provision and promotion of value propositions by providers in relation to real needs of customers, in order to increase awareness of need and options for change. For the Inertia loops interventions involve provision and promotion of the central switching service, with the aim of increasing awareness of the means by which the needs can be met more precisely through switching.

In the next section a systemic map (story) of the entire market is proposed which captures the interactive nature of factors at play in driving market behaviour. Key causal threads (storylines) are then highlighted within the overall map, including loops described under the essential dynamics of the model

Overview

The Overview shown in Figure B1. 9 describes the functioning of the market from the customer learning journey perspective as a CAS in the form of a Causal Loop Diagram (CLD), from which any cause and effect storyline can be traced to both the Real World and Physical Model. The structure works equally in representing an individual customer and the customer population as a whole.

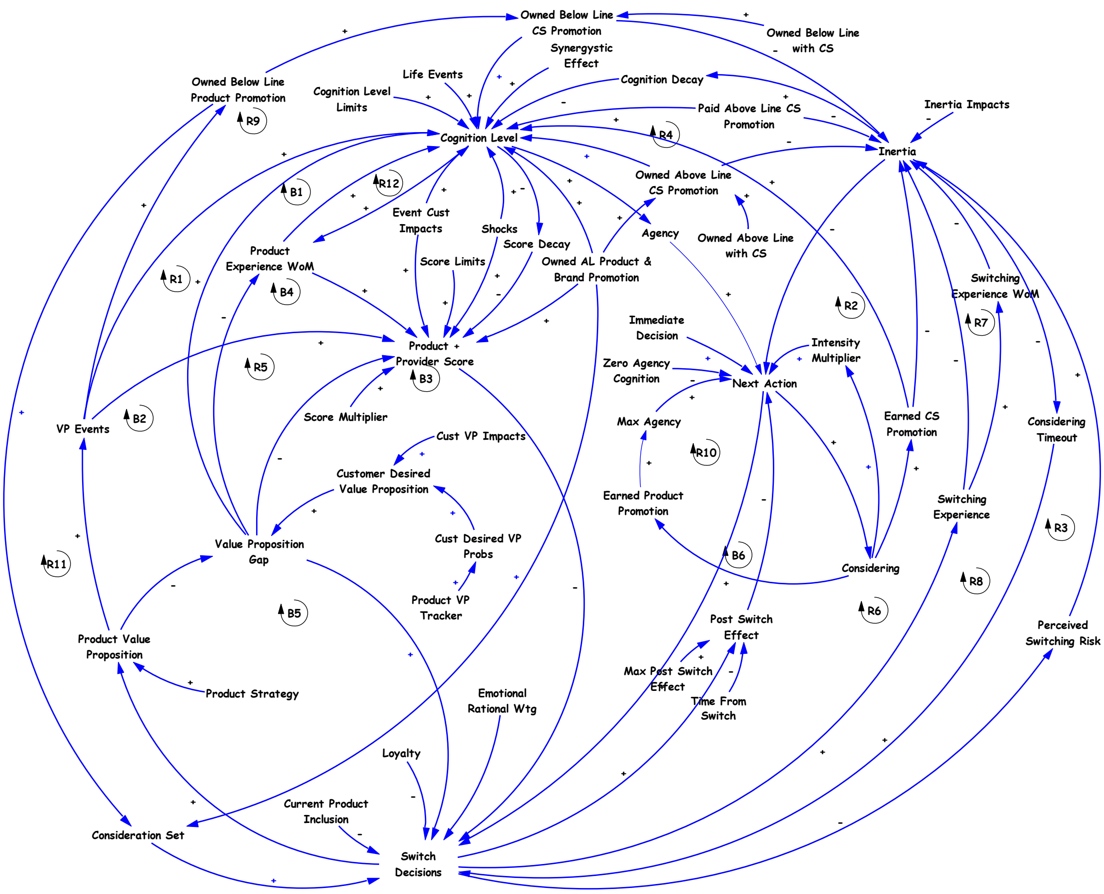

Figure B1. 9: Overview

Development of the Overview was conducted predominantly as an emergent process. The Synthesis Causal Story View, shown in Figure B1. 9, which emerged through synthesis from the literature research, was used as a starting point and refined and evolved as new structure was added to capture latest thinking and logic. Although covered first in the CTD for ease of readability and understanding, the Essential Market Dynamics was actually derived through analysis of the evolved Overview.

As discussed previously, there are essentially two mechanisms in the Model by which customers can change the current account service that they experience through switching providers; Trust and Inertia Loops respectively:

- Increase in Cognition Level (Awareness of the gap between purpose and performance and of potential options for closing the gap)
- Reduction in Inertia (Tendency of customers to remain inactive, even when aware of the need of and options for change)

Changes in Cognition Level are effected through events relating to service provision in the context of life circumstances and associated life events, thereby increasing awareness. Conversely, changes in Inertia are the result of exposure to communications and/or promotion concerning the switching processes, thereby reducing perceived effort and/or risk in switching.

Closely related to Cognition Level is the concept of Product and Provider Scores (Scores), which operates as part of the Trust Loop. Scores are, consciously or unconsciously, perpetually maintained comparisons by customers of their current and other products and providers, in terms of the positive and negative events they actually experience in relating to each provider. Changes in Scores use the same event impacts as Cognition Level, but negative experiences, such as Push events (i.e. experiencing poor customer service), are subtracted, so that the result is a net score. Scores do not directly increase the propensity of customers to switch, but are used during the switching decision as an emotionally driven criterion, to add precision to the decision process that would otherwise be assumed to be completely rational

Storylines

Storylines are causal threads of enquiry in order to answer one of two questions:

- **Causal Origin**: How is a change in a parameter of interest at the end of the thread caused?
- **Causal Use:** How does a change in a parameter at the start of the thread cause the parameter of interest at the end of the thread to change?

Both questions provide the basis for causal coherence, which relates to the Value Principle 3: Align Value Causally. For practical purposes, the first question ensures that all important causes of an intended or unintended outcome are taken into account, used for causal interrogation and explanation of outcomes evidenced from historical data and scenario modelling. The second question considers all potential outcomes of an intended or unintended change, used to direct effective interventions and points in the CAS where they can be applied most effectively. Storylines can be open with a sequential start and finish, for example when considering causal feeds into a specific node, such as Cognition Level or Inertia. However, the most insightful use of this approach concerns the explicit routing of reinforcing and balancing feedback loops, which account for the emergent, non-linear dynamics behaviour of the CAS. The CTD contains 28 threads of which 18 are feedback loops. Key loops in the Essential Market Dynamics are documented as they appear in the CTD. Each thread serves two key functions with reference to the Sargent model: validation in relation to the Real World and verification with the Physical Model. This dual role imposed some compromise. In order to facilitate verification of the Physical Model some parameters are included which represent functional solutions and not needed to define the Real World. Conversely, with the aim of rendering the map readable, it excludes detailed functionality of the model; this limitation being addressed through the formal verification process for the MDM.

R1 Trust

Reinforcing loop, driving market effectiveness through increasing customer awareness, consideration and switching

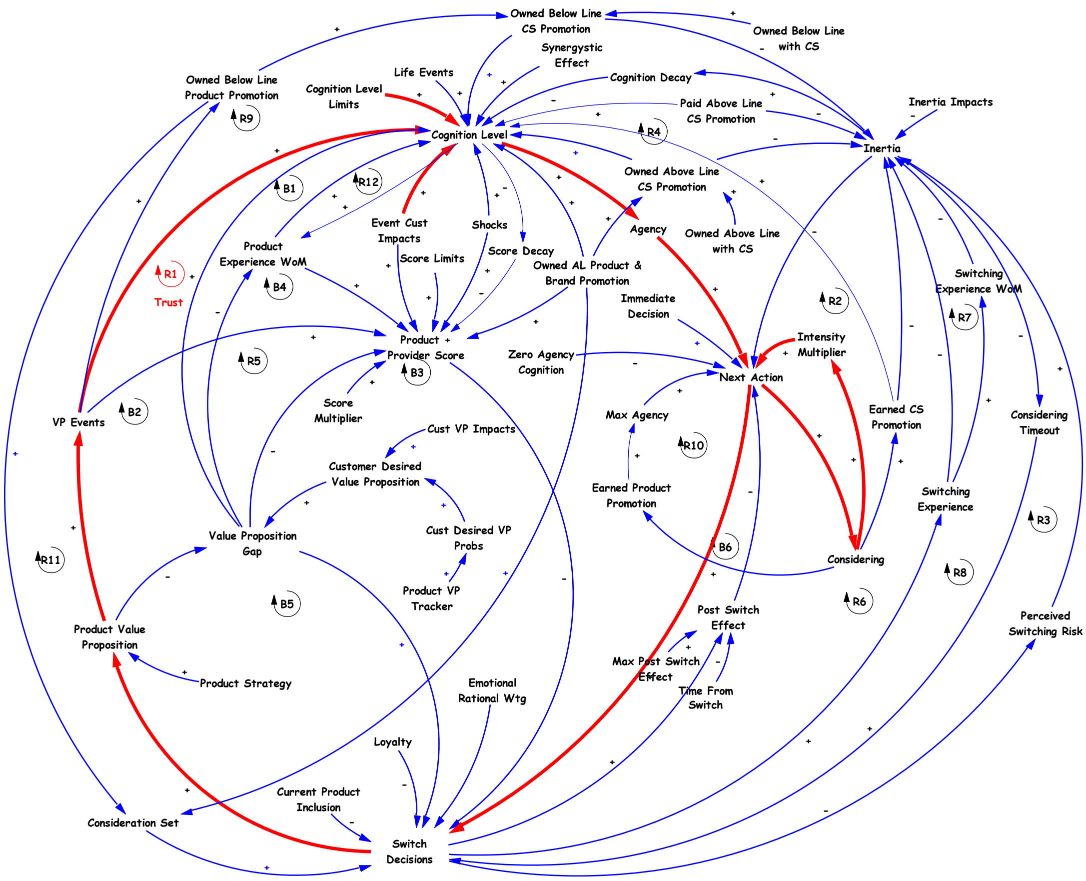

Figure B1. 10: R1 Trust

This is a reinforcing loop, in which customers build their Cognition Level, consider and may switch, then continue to increase their Cognition Level under a new provider. Service provision is expressed as a Value Proposition, comprising nine event dimensions comprising a combination of:

- Push, Pull or Publicity with
- Product, Financial or Relationship

This loop simulates the ideal situation, where providers continually improve service, driven by ever-increasing customer expectations, together with their preparedness to switch in order to satisfy those expectations. The only constraint on Cognition Level is a conceptual limit, after which it is assumed that customers will not show any additional propensity to act, i.e. Agency.

Research and experience indicate that this Trust Loop normally operates against market effectiveness because customers tend to be exposed mainly to experiences and promotion relating to their current provider. As a result, they build loyalty, whether warranted or not, and are reluctant to switch as this is perceived as losing a valuable relationship.

R2 Inertia – Awareness

Reinforcing loop driving market effectiveness through Central Service (CS) promotion from trusted bodies, such as Price Comparison Websites (PCW)

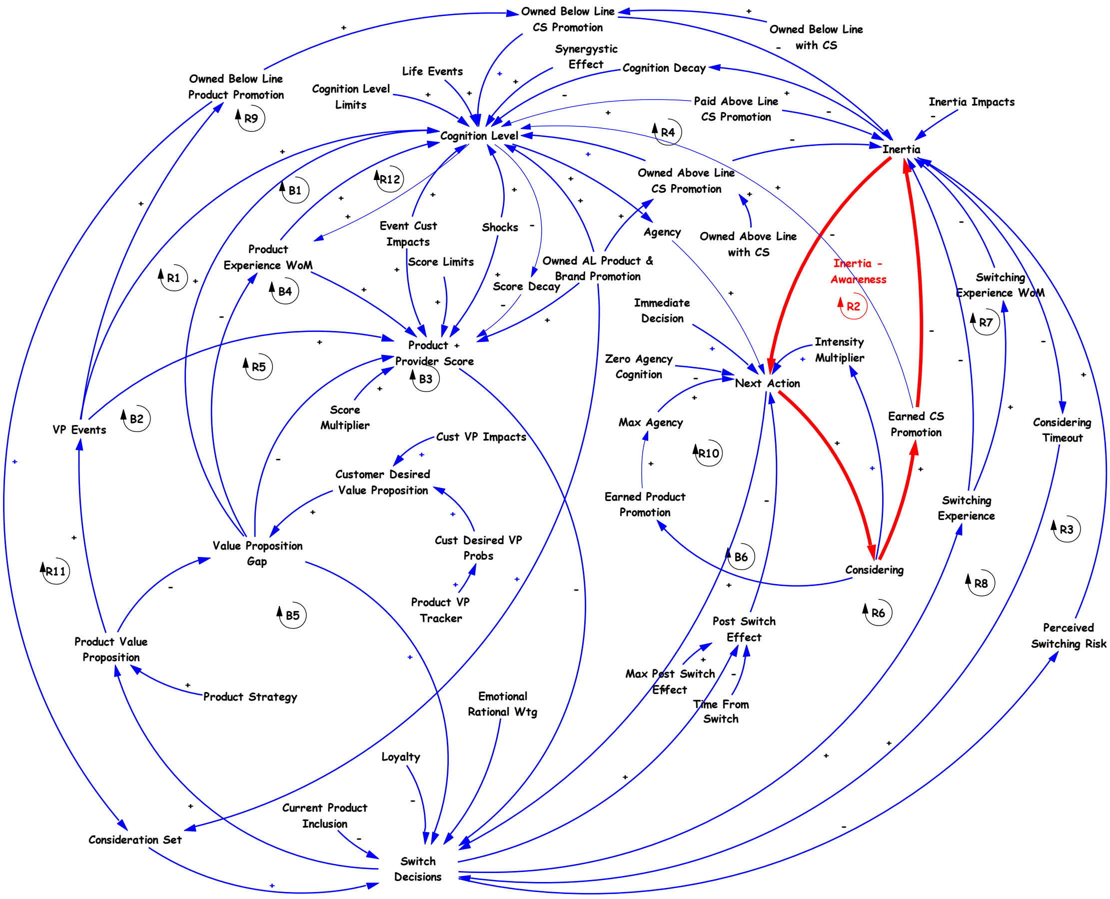

Figure B1. 11: R2 Inertia Awareness

This is a reinforcing loop in which customers in a considering state, and therefore actively seeking information, are exposed to CS promotion from trusted bodies that are independent from either providers or Bacs, the CS operator. Earned CS Promotion is delivered principally through PCWs. The effect is to reduce customer Inertia, increasing the propensity for Next Action, which triggers considering and switching, thus increasing the likelihood of a customer switching whilst they are considering. CS promotion is also provided through above and below line owned promotion from providers and central paid promotion directly from Bacs. However, as will be shown later these interventions are catalysts driving, but not structurally part of, this feedback loop.

Research and experience indicate that this Inertia Loop normally operates against market effectiveness because customers tend to perceive the switching process as involving effort and risk. As a result, customers do not consider switching and consequently remain unaware of the central switching service.

R3 Inertia – Confidence

Reinforcing loop driving market effectiveness through reduced perception of risk as a result of experiencing the switching process, with or without switching

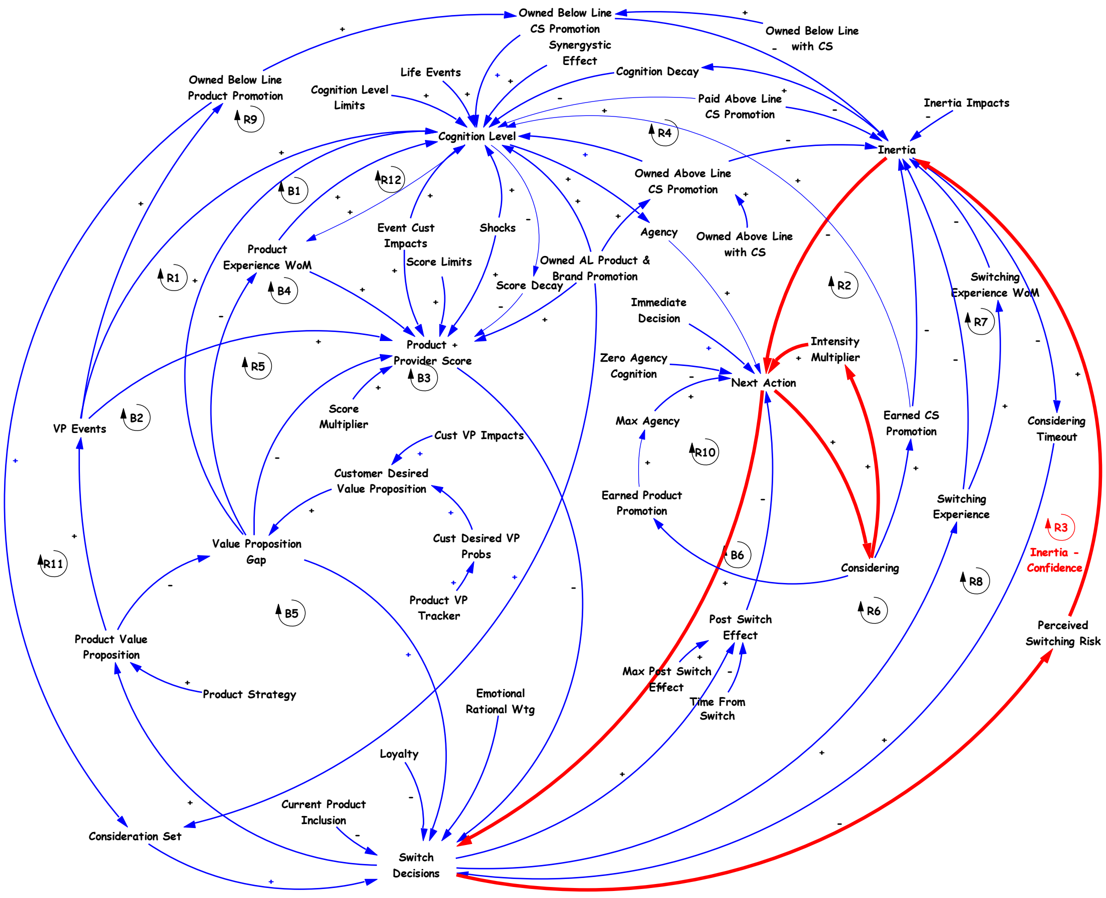

Figure B1. 12: R3 Inertia - Confidence

This is a reinforcing loop in which customers progress from a Considering state to a Switching Decision, which may or may not result in a switch. In the event of a switch, and assuming that the switching experience is positive, the perceived risk of switching is reduced. In the event of staying put and assuming knowledge concerning the switching process is positive, the act of engaging in the decision process also reduces the perceived risk of switching.

Research and experience indicate that this Inertia Loop normally operates against market effectiveness because customers tend to perceive the switching process as involving effort and risk. As a result, customers do not used the central switching service so not experiencing its effectiveness.

R4 Cognition Decay

Reinforcing loop in which Inertia influences the rate at which customer awareness naturally reduces over time

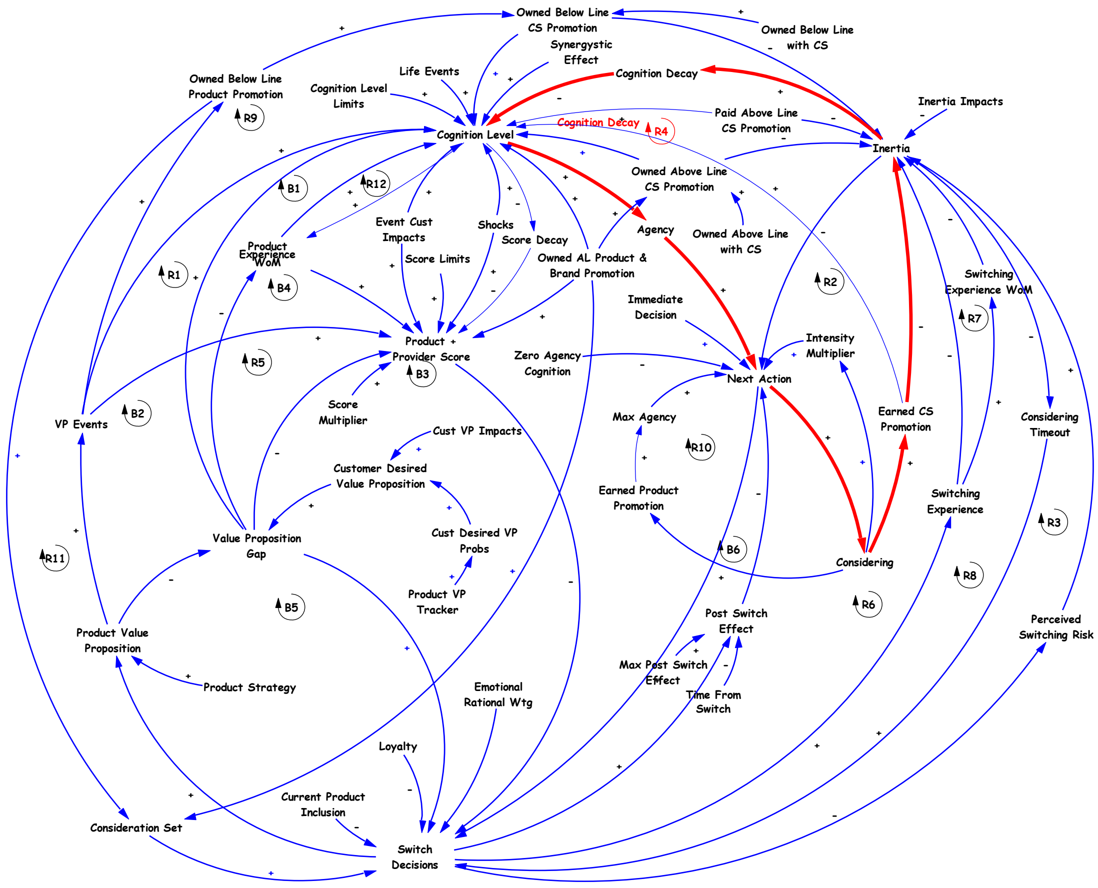

Figure B1. 13: R4 Cognition Decay

Cognition requires continuing stimulation in order for it not to reduce, because current account switching is only one of many, and in demands upon a customer's mental resources. Cognition Level is decreased by the Cognition Decay each month to simulate reduced interest over time. Changes in Cognition Level each month are generally the net difference between positive impacts and Cognition Decay. This is the 'out of sight, out of mind' effect.

Cognition Decay is influenced by Inertia; the greater the Inertia, the greater the Cognition Decay. Mathematically Cognition Decay is multiplied by Inertia which is itself a division factor that can be more or less than unity to reflect the fact that Inertia can have a negative or positive effect on the probability of Next Action.

B1 Customer Journey

Balancing loop driving market effectiveness through customer willingness to consider alternative product value propositions and switch to the best option

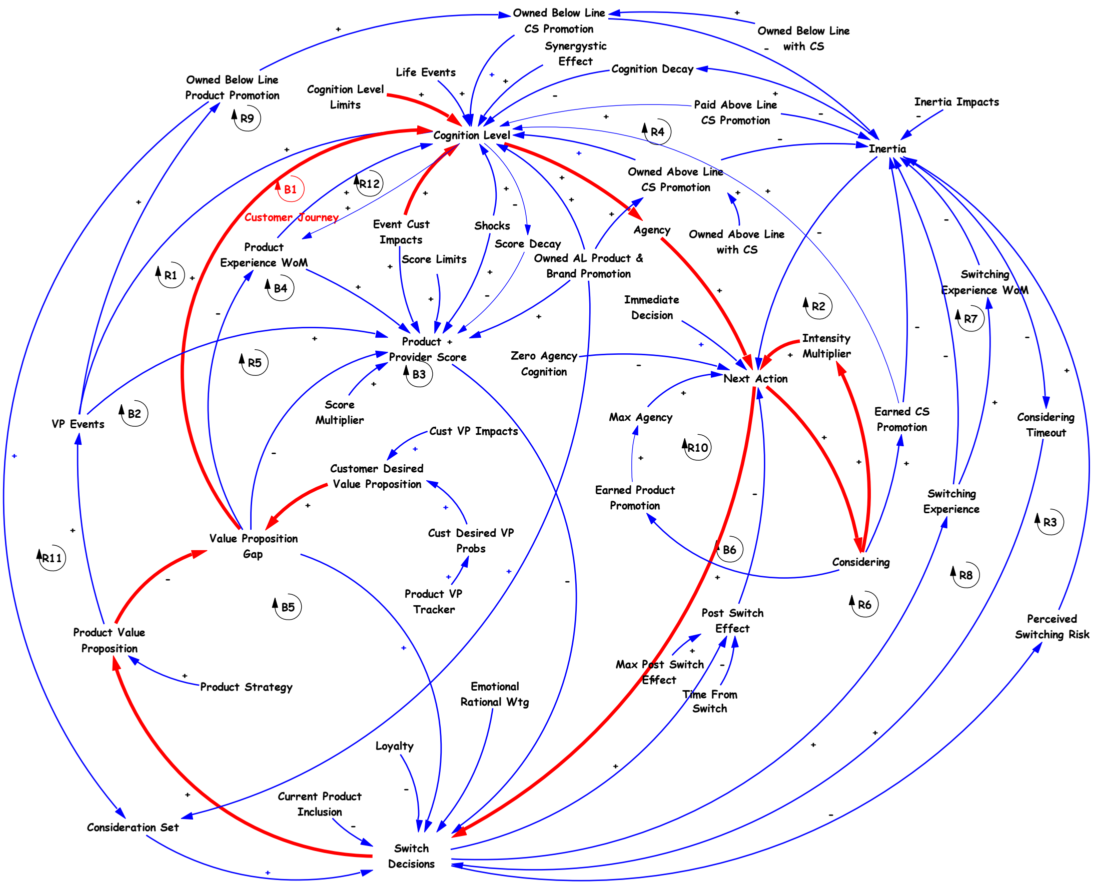

Figure B1. 14: B1 Customer Journey

This is a balancing loop in which the Value Proposition Gap, the difference between product and customer value propositions, is assessed against lower and upper expectation thresholds each month. If under the lower threshold, customer Cognition Level is increased, denoting that the customer is more likely to take action leading to a switch. If above the upper threshold, the customer Cognition Level is reduced, simulating that satisfaction is such that the customer is less likely to take action leading to a switch. Thus, this loop provides a means for customers to meet their expectations through rational checking of their current Value Proposition in relation to the customer's expectation, then taking action to consider and potentially switch.

An important point is that Scores, covered elsewhere in the map, are concerned more with customer emotion because it is what the customer actually experiences from a provider. Conversely, value proposition relates to a greater extent to rational customer behaviour based on what providers promise to deliver via their products. This distinction is used in the Switching Decision in order to take both rationality and emotion into account. In this context, rationality refers to purely logical assessment of options. Conversely, emotion accounts for decisions influenced by feelings concerning good and/or bad experiences of a product or provider, such as perceived poor service on visiting a branch.

The Trust loop concerns customers becoming aware of and being prepared to act upon the need and opportunity to change in order to meet their need, purpose, more effectively; doing the right things. The Inertia loop relates to the capacity of a customer to follow through on the process of making the necessary change; doing things right. This combination of doing the right things, Trust Loop, and doing things right, Inertia Loop, to transform purpose into performance is the basis of a Learning Journey, which is a core foundation stone of this approach.

Key Algorithms

Open threads in the CTD relate to key nodes into which a number of factors feed. Whilst the causal loops structure shows which parameters apply to a particular node, it does not define the logic of how these factors interact to produce an output. The most appropriate tool to describe this detailed logic is the simple Flow Chart, which is used in the CTD for key nodes. The Flow Chart for Next Action is presented in Figure B1. 15.

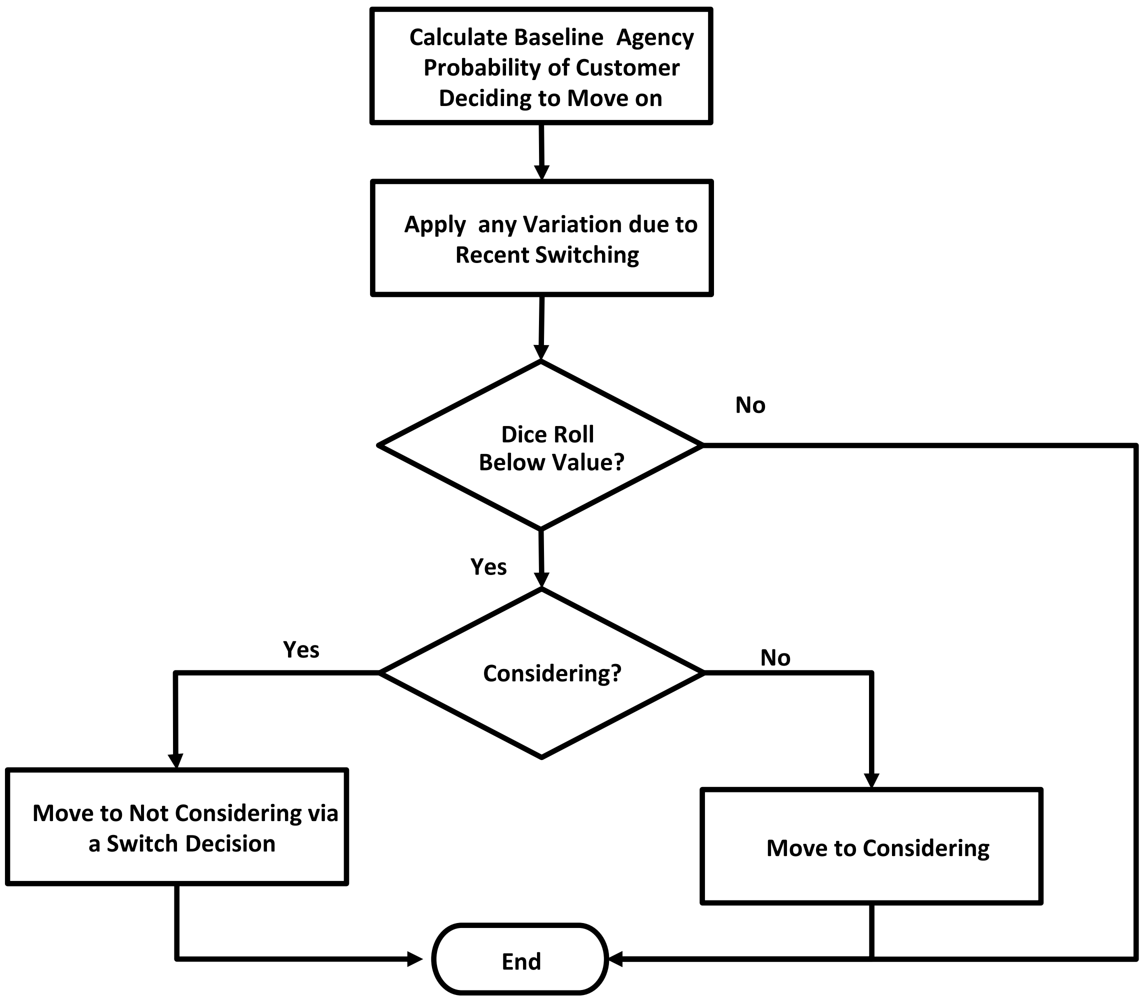

Figure B1. 15: Flow Chart for Next Action

What?

So far we have covered purpose of model development, the why?, and the causal foundation for any change needed to realise the purpose, the how? What?, defines controllable interventions, and more importantly the specific deliverables from these interventions, that influence the causal factors and relationships in order to affect intended stakeholder outcomes which manifest the purpose. The causal tracing for each intervention is shown in tree form, using the same source as the storylines, which enables direct cross-referencing with the systemic map. Sufficient levels are defined to show the linkage from the intervention to consideration and switching, via Cognition Level and Score (Trust Loop), and Inertia (Inertia Loop).

There are two mechanisms by which stakeholder outcomes can be intentionally changed through increasing the propensity of customers to switch:

- **Increase Cognition Level:** Relating to the Trust Loop
- **Reduce Inertia**: Relating to the Inertia Loop

Increase Cognition Level

Cognition Level is the customer's awareness of the service that they are experiencing in relation to their needs and expectations, of any consequent gap between purpose and performance, and of alternative provision available that potentially addresses the gap. Cognition Level is intentionally influenced in three ways, the first two from providers, the third from PCWs and other trusted third parties independent of providers:

- Provider Strategy (including Owned Below Line Promotion of Products)
- Owned Above Line Promotion (both of the Provider's Brand and of its Products)
- Earned Product Promotion

An increasingly important mechanism for driving customer engagement is WoM which includes social media interaction. Currently, there is no direct intervention to increase WoM, which is assumed to be driven by extremes in positive and negative gaps between a customer's ideal value proposition and that of their current product, along with extremes in switching experience. Future model development could include provision for representing active encouragement of WoM, for example through greater use of customer forums on PCWs, or apps.

Reduce Inertia

Reducing customer Inertia simulates a reduction in perceived effort and risk associated with the switching process. In the model providers intentionally influence Inertia in four ways:

- Owned Below Line CS Promotion
- Owned Above Line CS Promotion
- Paid Above Line CS Promotion
- Earned CS Promotion

All these interventions have the same causal linkage to switching by reducing Inertia through Cognition Delay and Consideration Timeout, thereby increasing the probability of Next Action. The causal tracing for intervention Paid Above Line CS Promotion is shown as an example in Figure B1. 16.

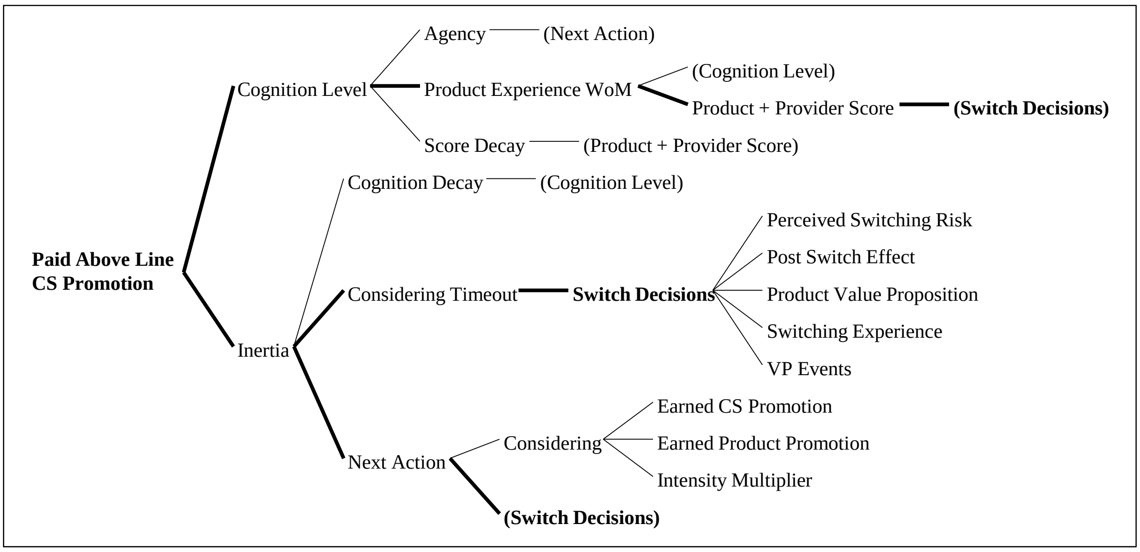

Figure B1. 16: Causal Tracing for Paid Above Line CS Promotion

Paid Above Line CS Promotion, is central promotion funded directly by Bacs, such as an advertising campaign on national television, drives market effectiveness by reducing the perceived risk of switching thereby increasing the propensity to switch and thus market effectiveness.

Computerised Model

There are two primary challenges with the validation of any model, simplifying the real world without losing essential reality, and bias. These issues are especially pertinent for Proof of Concept (PoC) models, which render the results vulnerable to challenge of credibility. First, PoC models are inherently high level with significant simplifying assumptions and indicative data. This can and did lead to the criticism that the model was simplistic and reductionist. Secondly, concerning bias there is a risk that the model simply reflects our expectations without validating the findings. This is because the model at PoC stage inevitably simplifies reality, thereby limiting the potential for unforeseen effects to be modelled and requires selection of simplified data sets. This section describes how development of the physical computer model addressed these and other challenges, including validation and verification.

Proof of Concept Models

There is wide agreement between systemic modellers that reproducing the observed problem early during the modelling process is best practice and is achieved by recreating key dynamic characteristics, Reference Behaviour Pattern (RBP), using one or a combination of simulation modelling paradigms, such as System Dynamics, Agent Based Modelling and/or Discrete Event Modelling (Sterman, 2000; Richmond, 2001; Warren, 2008; Borshchev, 2013; Brailsford *et al.*, 2014). This can be greatly assisted through the use of causal archetypes, such as 'limits to growth' and 'success to the successful' as defined by Peter Senge in his seminal book, The Fifth Discipline (Senge, 1990), which are associated with predictable characteristic behaviour patterns. Two Proof of Concept (PoC) models were developed; the first using System Dynamics, the second Agent-based Modelling, both of which utilised systemic archetypes.

System Dynamics PoC Model

The System Dynamics (SD) PoC model shown in Figure B1. 17 comprises two main chains of states and transitions; in SD parlance stocks and flows. This structure is called a "co-flow" and is used extensively in SD to simulate the interaction between two or more parameters over time. The upper chain represents customer learning states: Not Interested, Receptive and Engaged, relating to the degree of cognition, i.e. awareness, in the context of the current account product. The lower chain contains customer behavioural states: Staying Put, Considering and Switched. The essential hypothesis, based on Learning Journey theory applied to infrastructures (Deakin Crick *et al.*, 2017b), is that experience informs learning and learning pulls behaviour, creating a reinforcing loop driving switching levels which grow over time to a maximum determined by market equilibrium. The concept of market equilibrium is contentious. Brian Arthur has written extensively on the limitations of equilibrium models (Arthur, 1990; Arthur, 1999) and the application of ABM as an alternative, addressed later in this chapter. Supplementing the co-flow are other causal structures to capture related key factors, which inject energy into the market, including publicity, word of mouth, switching experience, life events and innovation (not shown).

The experiential aspects are modelled using the concept of push and pull events referring to negative and positive customer experiences respectively. The SD model was designed and developed entirely by the Author.

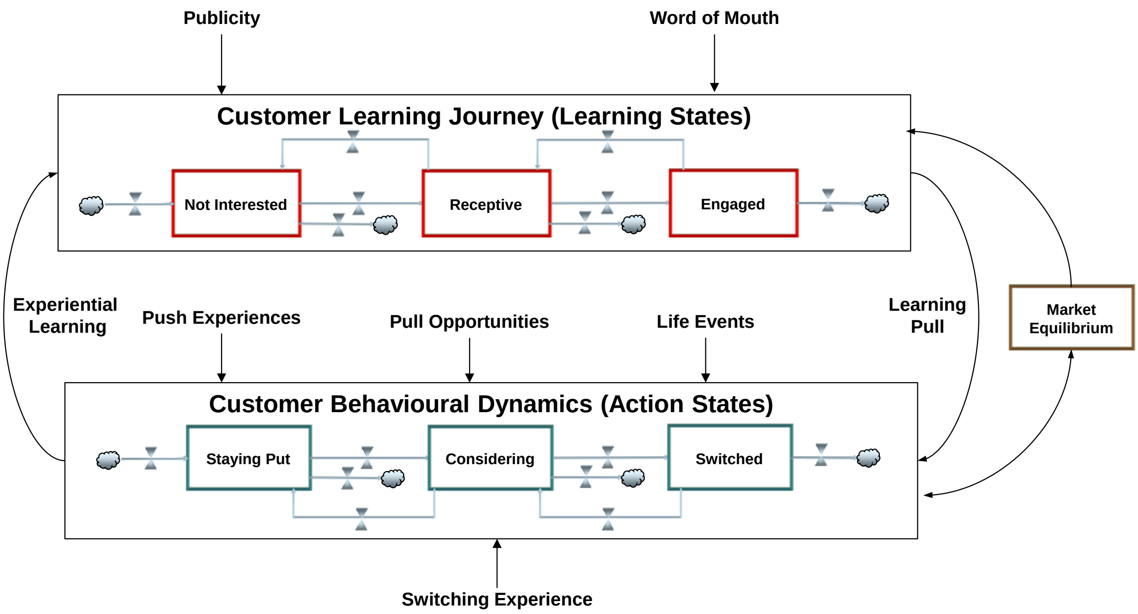

Figure B1. 17: System Dynamics PoC Model Schematic

The computerised SD model implemented from the schematic, shown in Figure B1. 18, was used to simulate potential scenarios for various interventions, for example, innovation and promotion strategies. An example of data definitions and quantity values for the SD model is shown in Figure B1.19.

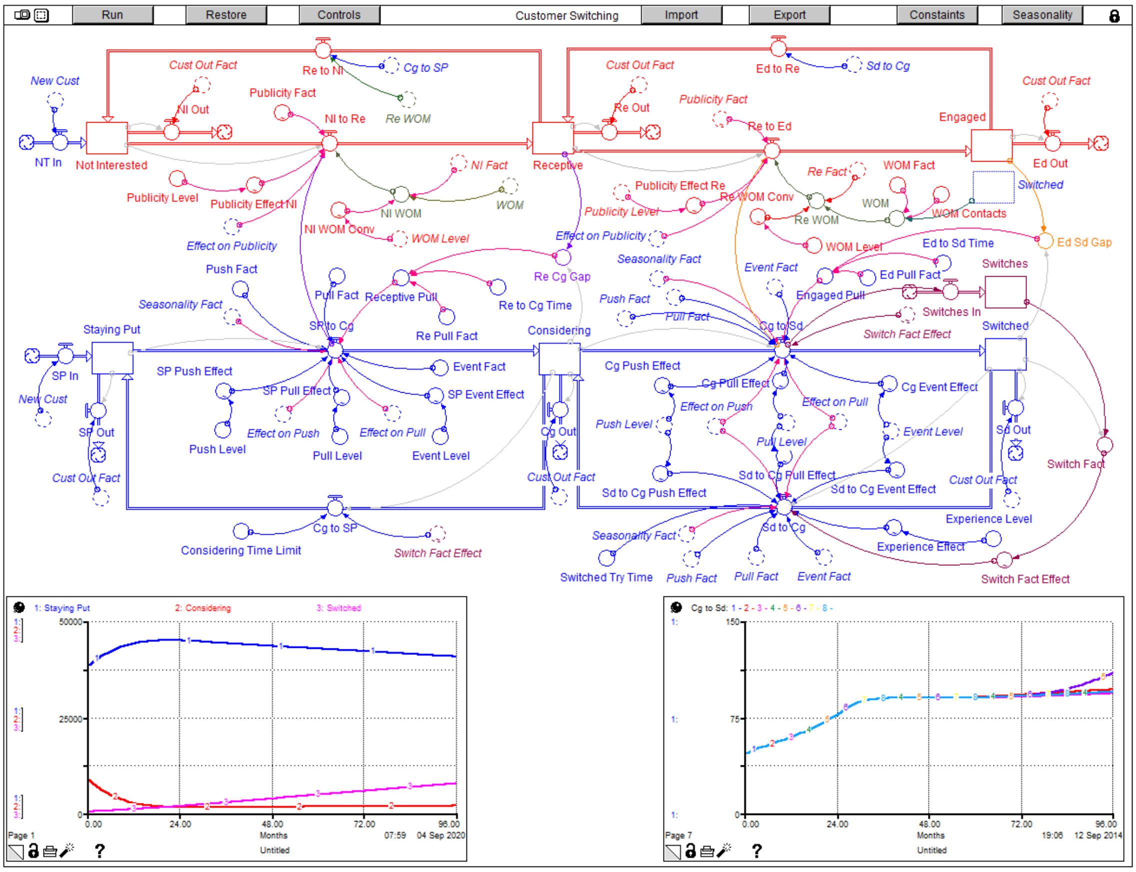

Figure B1. 18: System Dynamics PoC Model

Data Defintions and Values				
Measure	Measure Definition	Units of Measure	Value	Rationale
Initial Customer Volume and States				
Init Customers	Number of customers with a current account	K Customers	48,000	Market research and provider data
Init Staying Put Fact	Proportion of customers at start in Staying Put state	%	81	Annual Report values
Init Considering Fact	Proportion of customers at start in Considering state	%	18	Annual Report values
Init Switched Fact	Proportion of customers at start in Swiched state	%	1	Annual Report values
Init Not Interested Fact	Proportion of customers at start in Not Interested state	%	81	Annual Report values
Init Receptive Fact	Proportion of customers at start in Receptive state	%	18	Annual Report values
Init Engaged Fact	Proportion of customers at start in Engaged state	%	1	Annual Report values
Customers Entering and Exiting Market				
Cust in Fact	Proportion of new customers entering the market per month	% / Month	0.23	850K 16 yr olds, 500K Immigtation
Cust Out Fact	Proportion of new customers leaving the market per month	% / Month	0.17	300K Emigration, 700K Deaths

Figure B1. 19: SD PoC Model Data Definitions and Values

The RBP against which the hypothesis is calibrated is the switching rate, calculated as a moving annual total (MAT) of monthly switching volumes annualised, shown as the Historical plot in Figure B1. 20. The Baseline output from the PoC, demonstrated feasibility of the model to reproduce the RBP, together with full traceability of the underlying causal relationships. The two key modelling challenges, sufficient representation of reality without manipulative bias, were addressed through structured interviews, interactive workshops and rigorous reviews with a team comprising participants from Bacs, Member providers, i.e. market participants funding CASS, and UoB. Whilst there is no pretence that the PoC model provides a robust forecast, the team deemed the performance sufficient to warrant development to the next level of precision.

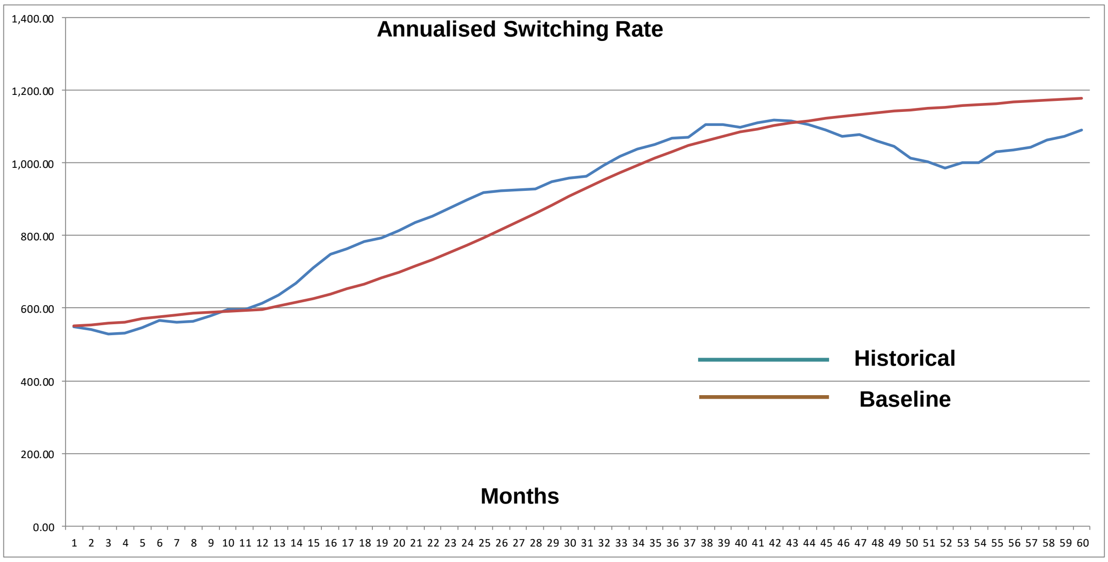

Figure B1. 20: Calibration for System Dynamics PoC Model

Agent-based PoC Model

There are two major limitations of the SD PoC model in meeting the purpose, to provide robust predictions of future switching. The first concerned an inability to replicate changes of direction in the RBP, specifically the dip in switching rates towards the end of the simulation period. Secondly, all customers are considered to be identical; there is no segmentation or differentiation in individual behaviour. Although technically possible to correct both these limitations by enhancing the SD model, the ensuing complexity renders SD models dealing with large variety clumsy and impractical. The modelling paradigm most suited to large populations of customers with different behavioural characteristics influenced by interaction between them under a network effect is Agent-based Modelling (ABM).

ABM is agent-centric, where agents are human or non-human objects with state and functional properties. For the Bacs case, there are two categories of agent, customers and providers. The architecture for a customer agent structured as a Learning Journey is shown in Figure B1. 21. Customers' awareness of a gap between need and current service provision, together with awareness of options to address the gap increases through their experience of events. This awareness is referred to in the model as Cognition Level.. Cognition drives agency, the capacity to act in accordance with cognition. Agency inherits the three learning states, Not Interested, Receptive and Engaged, from the SD PoC model. Agency determines the probability that the customer takes physical action in the form of consideration of options. This behavioural structure is rendered simpler and more elegant that that used for the SD PoC model, comprising of only two states, Not Considering and Considering. Once in a considering state, there are two ways in which a customer can transcend to not considering: switch decision or timeout. After switching, the customer continues to experience events relating to the value proposition from the new provider.

The model was enhanced over a number of releases to incorporate the most of the business rules inherited by the Operational Model and defined in the Causal Tracing Document. All business logic was developed by the Author, assisted through training by an operational research consultancy, decisionLab in the form of ABM training in the proprietary application used, AnyLogic, and model specific coding in Java.

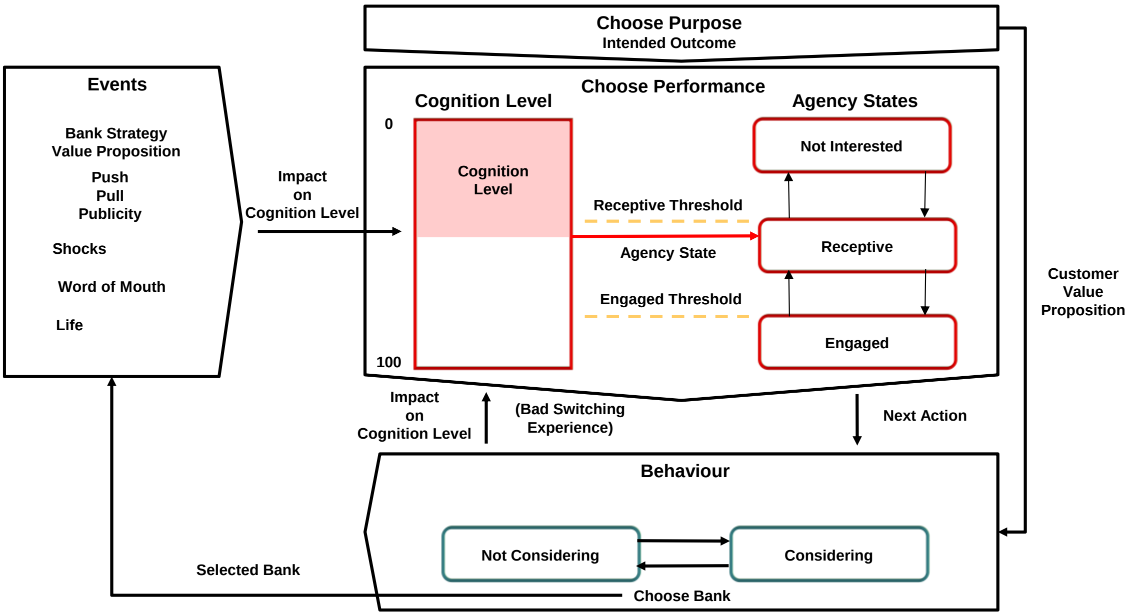

Figure B1. 21: Agent-based PoC Model

The ABM PoC model reproduced the RBP more precisely and simulated the change in direction of the annualised switch rate as shown in Figure B1. 22. The directional shift was achieved by treating the announcement of CASS as a market shock in which providers reduced promotion of PCA products until after CASS was launched in 2013. This had the effect of reducing customer cognition level and consequential propensity to consider and switch until providers increased PCA promotion after CASS launch. Subsequent development of the operational model simulated changes in switching levels more precisely using first principles based on inertia. The increase in precision of both causal relationships and calibrated output provided the justification for Bacs to sanction transition to an operational model, with the aim of tactical corroboration of future switching projections for budgeting and provision of insights to inform strategic direction.

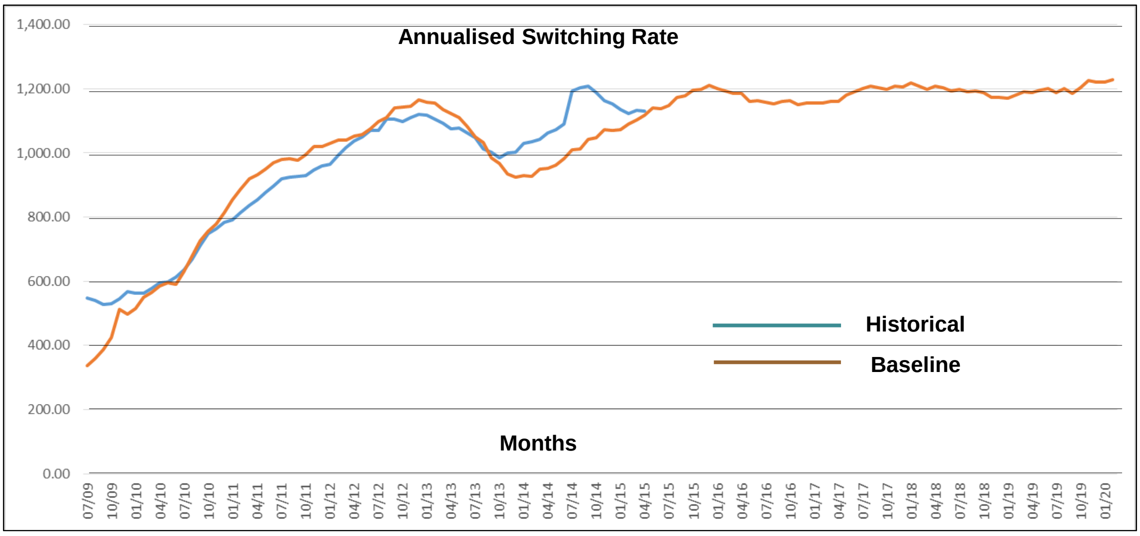

Figure B1. 22: Calibration for Agent-based PoC Model

Operational Model

From January 2016 development of the model architecture and coding was undertaken by Rich Harding, a member of the MDM development team on behalf of, and under overall direction by, the Author as design authority, in the transition from PoC to operational status. The primary control artefact for model development is the Causal Tracing Document (CTD described in Section 8.5 (Davies, 2018) produced and maintained entirely by the Author as part of the research. Navigation of the model development through the transition from PoC to operational is covered in detail through the interview (Harding, 2018) in Appendix A1. However, three key disciplines which Harding injected into development and which contributed significantly to the rigor and success of the model warrant summary: Object Orientated Programming, 3-Tier Architecture and Test Driven Development.

Object-Orientated Programming

Historically, a program has been viewed as a logical procedure that takes input data, processes it, and produces output data (Rouse, 2008). Object-oriented programming (OOP) is a programming language model organised around objects rather than actions, and data rather than logic. OOP's power lies in the precise specification of real-world objects, properties, and relationships, i.e. methods, for which reason it is particularly appropriate for dynamics modelling. It is worth noting that the first object-oriented language, Simula, was created specifically to support computer simulations of real world processes (Taylor, 1998, p. 6). Harding applies a highly disciplined form of OOP to the model code, Java.

3-Tier Architecture

3-Tier Architecture refers to clear separation and management of three levels of capability, Presentation, Application and Data. Servers are robot-like programs that exchange information with remote users, whilst clients are programs that exchange information with servers. In 3-tier architecture, clients correspond with the presentation layer and servers encompass the application and database layers (Kelley School of Business, 2014). The presentation tier is also called the client layer, business logic layer also means application tier and database and data layer are equivalent terms (SMT, 2017).

Test Driven Development

Test Driven Development (TDD) creates software in very short iterations with minimal upfront design and involves writing automated tests of a program's individual units; the smallest possible testable software components (Janzen *et al.*, 2005). TDD is the discipline of creating production and test code simultaneously and provides a highly effective and productive framework for developing software, including modelling. It is founded upon rules which focus resource on one thing at a time to ensure synchronisation between the production and test code (Reid, 2018). Beck cites two criteria for effective software development: the environment must provide rapid response to small changes and designs must consist of highly cohesive, loosely coupled components, in order to make testing easy (Beck, 2003, p. x). Very significantly in the context of TDD processes, Beck also applies Systems Thinking using Influence Diagrams, i.e. Causal Loop Diagrams (CLD,) which include feedback (Beck, 2003, p. 207), and fractals using Fibonacci series which relates to the Golden Ratio (Beck, 2003, p. 211). TDD is very closely related to Fail Fast principles, adopted throughout the research, of which there are four attributes of failure which render Fail Fast effective: early, fast, often and better (ArrkGroup, 2015).

Data Collection and Validation

There are two imperatives for data with respect to the model, obtaining the necessary level of data and ensuring that the data is valid. For context, This section outlines the four key processes involved in the data challenge: definition, sourcing, transformation and validation, more fully described in the interview with Shaofu Huang, the academic team leader for much of the data aspects of the MDM development (Huang, 2018b) covered in Appendix A1.

Data Definition

It is essential to differentiate between the structure and properties of a data item and its value. The former is referred to as Meta Data, whilst the latter generally what people take to mean by the term 'data'. Whereas data values can vary in quality and quantity, Meta Data provides a stable specification of the nature of that data. For this reason, Meta Data is increasingly used in building Business Intelligence (BI) applications (Fletcher, 2018). Whilst the quality of data was limited, particularly during the PoC stages, model parameters where specified precisely from the start. Concerning data quantity, Sargent acknowledges the common difficulty in having sufficient data upon which to conduct significant statistical analysis, in which case he advocates the use of graphics (Sargent, 2013, p. 19) , which were used extensively throughout MDM development.

Data Sourcing

During the early PoC stages of model development, input data was largely derived through estimates provided by industry experts, rigour being injected through multiple perspectives, captured through interviews, workshops and reviews. From the start of transition from PoC to operational status, significant time, cost and resource was invested to acquire real data upon which to derive values for model parameters. Data sourcing was greatly helped by precise data definitions which enabled specification of data requirements sourced from third parties. This process was led by the University of Bristol and described in the interview with (Huang, 2018b).

Data Transformation

A further challenge when dealing with real data is that it is rarely collected in the form needed and must undergo a data transformation process to render it suitable for populating model parameters The first transformation process, developed by the Author, involved decomposition of model parameters into 'data atoms' which could be mapped against real raw data and reconstructed into the parameters. Excel was used as the platform for this initial tool, which was later enhanced by Huang who introduced Bayesian inversion and later converted the transformation into R code which provided a far more scalable and robust solution (Huang, 2018b).

Data Validation

Validation proved to be the most difficult aspect of data for the MDM, which involved both quality and quantity. Concerning quality, the challenge lay in sourcing available real data with which to populate model parameters, after due transformation. In many cases it was necessary to use surrogate data. For example, Cognition Level is a core model parameter, defined as recognition of a gap between a customer's need and current service provision and options for redressing the gap, on a scale of 0 to 100. The data used to populate Cognition Level was derived from customer survey data elicited through the question, "How likely are you to remain with your current PCA provider for the next year?" The inverse provided a distribution across customers for Cognition Level. With respect to quantity, the latest model version contains only around 40% of the parameters populated entirely with real data, the remainder being a combination of estimated and hybrids of real and estimated data (Huang, 2018b). However, by focusing on the most critical data it proved possible to achieve an acceptable level of validity for the purpose (Taylor, 2018).

Verification and Validation

A critical imperative for any model is that functionality meets a defined purpose and that the model is fit to meet this purpose. The former is validation, the latter verification (V&V). More precisely, validation concerns ensuring that that an end product meets a stakeholder's true needs and expectations, doing the right things, whilst verification tests the system to prove that it meets all specified requirements at a particular stage of its development; doing things right.

(Plutora, 2018). In the context of modelling, validation relates to capability to represent the real-world sufficiently precisely to enable fulfilment of the intended purpose of the model. Verification focuses on how reliably the model operates as intended, which in practical terms means correctness of code. As Wood advises, conducting a full V&V effort only after a model is completed is extremely costly and time consuming (Wood, 1986). Consequently, significant resource was invested in both validation and verification on an ongoing basis.

It is also critical for the intended application of the MDM that V&V processes are rigorous, transparent and conducted independently by a qualified party. To this end, the University of Bristol undertook independent validation and also provided a rigorous review of verification, which was conducted by a team member, Alex Jackson, sufficiently separated from model coding to be considered independent (Jackson, 2018). A comprehensive description of the V&V is covered under the interview with Shaofu Huang, the academic researcher responsible for this work (Huang, 2018b). Summarising the final report (Huang, 2018c), Professor Taylor wrote the following concerning validation and verification of the MDM:

> Validation
>
> “Extensive numerical simulations, albeit using the limited empirical data sets that are currently available, led to an effective model calibration process. If applied correctly, the process can lead to a model that achieves an error of +/-15% on forecasts up to at least 12 months beyond the calibration data period. As expected, the error increases for longer prediction periods. As the observational market record lengthens, the data sets will become long enough to explore further the accuracy beyond 12 months.”
>
> Verification
>
> “The ABM model verification process conducted by Impact Dynamics Ltd, with support from Bacs, was shown to be done with appropriate rigour. Whilst it is impossible for a code to be error free, there is ample evidence that the code implements the MDM causal model as intended. Extensive numerical exercises using the code (in its numerous versions) did not reveal any obvious errors in the coding, although the complex, non-linear, nature of the model, which will be sensitive to initial conditions, could conceivably been consistent with expectations.”
>
> (Taylor, 2018)

Conclusions: Industry Perspective

This section outlines conclusions of the case study in the form of real applications of the MDM from an industry perspective, considering the business imperatives.

Risk Reduction

CASS Budget Support

The market dynamics modelling work was initiated in 2014 to provide corroborative support to the conventional forecasting methods used for predicting future switching levels, upon which funding for CASS was based. In this capacity, the MDM fulfilled a risk reduction role and as the model developed and was shown to provide more robust predictions, Bacs became increasingly reliant on the output for this purpose. The MDM is now an operational tool for supporting the setting of budgets for CASS and is updated on a monthly basis with key data elicited from market surveys and other reports.

Tactical Support

Communications Strategy

The model has also been used to test a number of scenarios relating to promotion of CASS. This work suggests that in the absence of continued innovation and product promotion by providers, which tend to be linked, switching would decline to around the rate seen in 2008-09, before active promotion of the predecessor to CASS commenced. Figure B1. 23 illustrates this result which is corroborated by the most recent MDM version running scenarios relating to the price sensitivity of CASS. The model was also enhanced to explore the relative importance of central promotion and provider communication of CASS with the intention of helping to optimise the effectiveness of central communications.

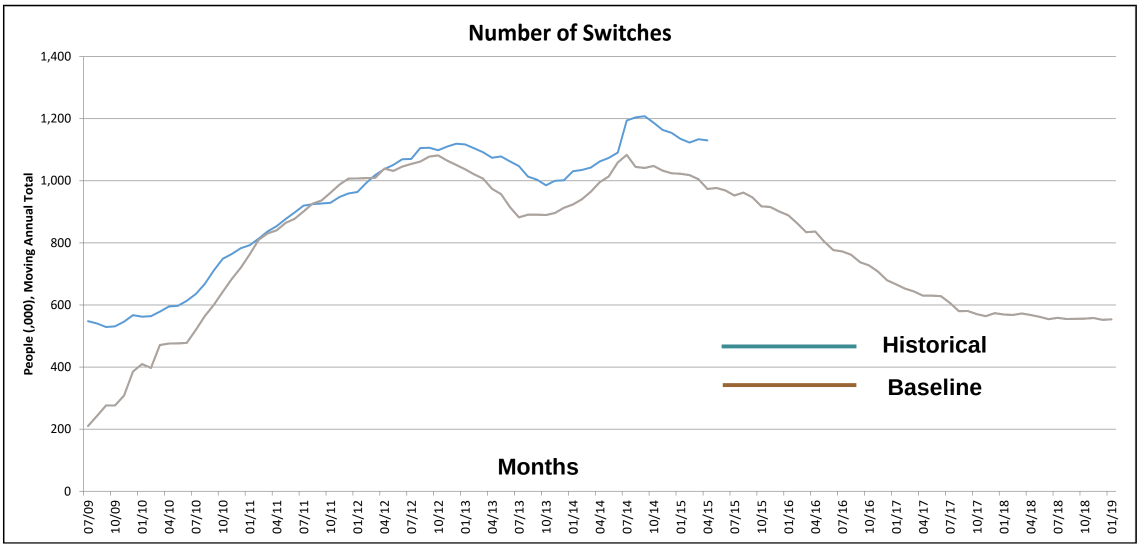

Figure B1. 23: Prediction of Switching without Promotion of CASS

CASS Price Sensitivity

Pay.UK, into which Bacs has now been subsumed, is pursuing a wide ranging redesign of the elements of the national payments infrastructure that it is responsible for under the New Payments Architecture (NPA) programme. One potential route to funding the NPA is through a levy on participants in existing Pay.UK services such as CASS. To this end, the MDM is being deployed to model potential future scenarios to inform the CASS Executive Committee of the likely sensitivity of market participants to changes in the switch price. Two basic scenarios are modelled: providers change their level of PCA product promotion and the introduction of new entrants into the market.

Strategic Insights

Account Number Portability

In view of the Competition and Markets Authority's (CMA's) comments on Account Number Portability (ANP) (CMA, 2016a), Bacs commissioned a review through the University of Bristol, using output from the MDM, to assess the likely impact of ANP on overall switching volumes and to comment on the mechanisms through which the impact would be created (Bacs, 2016b). Results from the MDM suggest that the overall impact on switching would be low and transitory, similar in size to the impact observed when CASS was launched. The model suggests that there would be minimal incremental switching over about three years after the introduction of ANP, resulting in around 360k additional switches over that time. Figure B1. 24 illustrates the model output, showing actual known switching to date, the model baseline forecast and incremental impact of ANP predicted by the model. Further modelling has also shown that a greater effect would be achieved through participant product innovation and promotion.

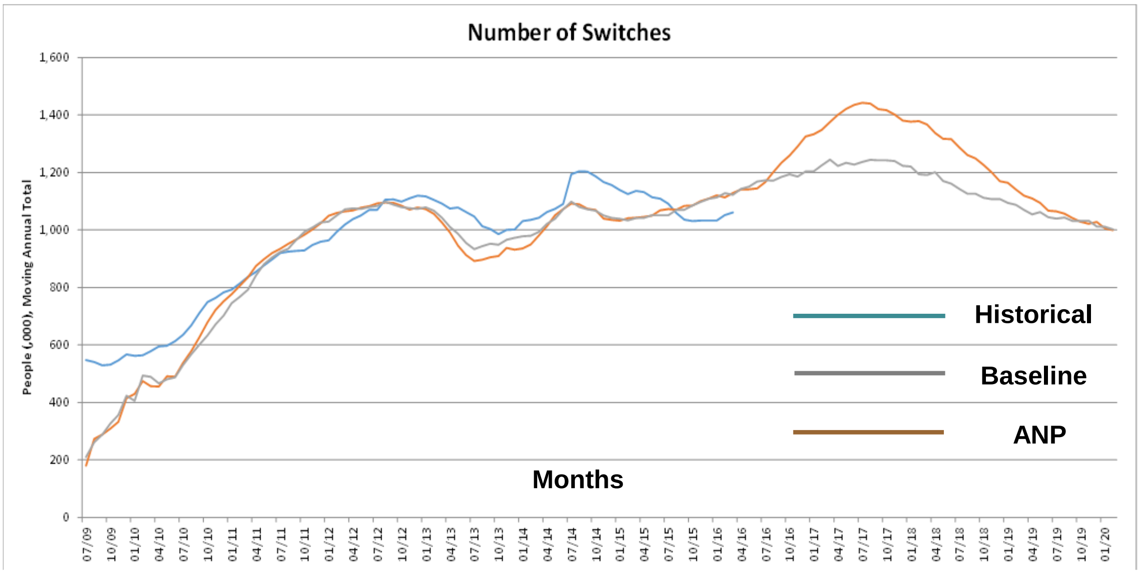

Figure B1. 24: Account Number Portability Scenario

This review identified four key reasons why ANP is likely to have the limited impact on the market forecast by the model:

- ANP does not target any of the eight reasons for switching researched across comparable sectors, namely; Price, Inconvenience, Service Failures, Failed Service Encounters, Failed Service Response, Competition, Ethical Problems, Involuntary Switching (e.g. no branch).
- A major reason for customer inaction is the perceived risk of switching which comprises three dimensions; financial, relational and procedural. Research indicated that relational risk dominates because of the perceived investment of customers in their bank which increases with the age of relationship.
- Customers consistently report general satisfaction with their current services leading to loyalty to their current supplier, despite a general lack of trust in the sector.
- That general lack of trust in banks can engender an “all banks are the same” mind-set in some customers, which in this context renders ANP an irrelevant response.

The review and results were made available to the regulator and were believed to be a significant consideration in the ANP proposal not being pursued by the CMA and FCA, saving the market an estimated £2 billion to £10 billion.

Effective Market

After publishing of the CMA report in 2016 (CMA, 2016a), interest grew across the industry, government and regulators in characteristics defining a well-functioning market to meet customer purpose in the context of current accounts, how the structure needed to change and what interventions might effect this change. Bacs’ response to the CMA report was to commission further development of the MDM in partnership with the University of Bristol, with the aim of addressing these questions. The ensuing model enhancements consolidated into a Market Performance Framework as shown in Figure B1. 25.

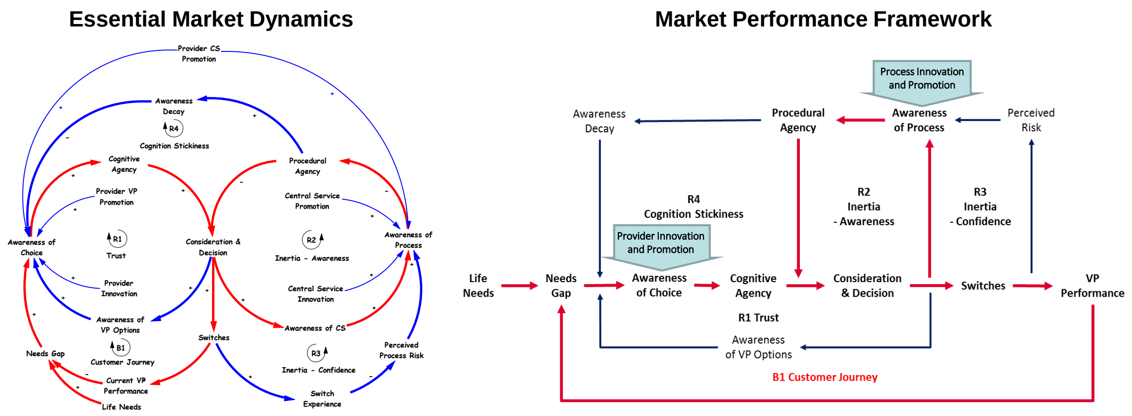

Figure B1. 25: Market Performance Framework

Two key points to note from **Error! Reference source not found.** are first, the essential dynamics incorporating the customer learning journey is used as the foundation of the market performance framework and secondly, the feedback loops are restructured into a rectilinear layout to provide a more user friendly presentation. Most recently, under work commissioned by Pay.UK, market performance capabilities of the MDM are being used to explore possible future scenarios for the PCA market under an open banking landscape. Essentially, there are five broad scenarios capturing the potential of a market comprising: more providers offering more value propositions with more useable customer journeys, more securely serving more customers, including those hitherto excluded from the market. These scenarios are also used to explore CASS price sensitivity described earlier.

Generic Application

Through the process of model development, it became evident that the concepts and implementation are essentially generic and applicable across a broader spectrum of market settings. Consequently, the latest developments included provision for wider application within the financial sector and across other sectors, such as energy and telecommunications. Precision was enhanced to support this broader application through econometric statistical causal inference and overlaying Learning Power profiles to customer segmentation.

Conclusions: Academic Perspective

This section outlines conclusions of the MDM development from an academic perspective, considering research areas for the case study.

- Generic Learning Framework
- Causing Intentional Value
- Equitable and Sustainable Stakeholder Value

Generic Learning Framework

This section covers how the two related theories of Learning Journeys and Learning Power are formulated into a generic learning framework through this developmental case study.

Framing Change as a Learning Journey

A Learning Journey is usefully framed as the process of transition from an intentionally selected purpose to manifestation of that purpose through performance. In the context of realising purposeful outcomes for users of infrastructure, financial services being an important instance, the process is structured into a Customer Journey. Four key steps within the customer journey stood out through the modelling process: awareness of need and selection of purpose, action through consideration of options and decision, evaluation of choice in relation to purpose, reassessment of need and purpose. For the MDM, these steps were incorporated explicitly as follows:

Awareness of Need and Selection of Purpose

Through experiencing events, customers grow their cognition, defined as awareness of the gap between current service provision and purposeful needs and quantified as their ideal value proposition, together with awareness of opportunities to redress the gap.

Action through Consideration and Decision

Agency, the capacity to act, grows through cognition and is enabled through provision of the capability to switch using CASS, which leads to the action of consideration of options and decision whether to switch providers or stay put.

Evaluation of Choice in Relation to Purpose

During the course of consideration, customers make a switch decision by comparing a selected subset of providers, named consideration set, with their ideal value proposition. This is moderated with their emotional attitude towards those providers built through experience over time as a score; ensuring that both rational and emotional considerations are included in the choice.

Reassessment of Need and Purpose

Post the switch decision, which may be to stay put, customers continue building cognition by experiencing the value proposition of their latest provider, with reference to life events, WoM and market events, and reassess this experience with their ideal value proposition, which also changes over time to reflect shifting expectations from the market.

These four steps map closely to the Deming Cycle: Plan-Do-Check-Act (PDCA), which not only provides a powerful learning process for individuals, or groups such as customers, but also change programmes. The framing of a Learning Journey as a Deming Cycle is corroborated through subject expert interviews (Tracy, 2018; Huang, 2018b) and is also the direction of travel for application development by the principal academic authority (Deakin Crick *et al.*, 2017a). Therefore, it follows that the Learning Journey frame provides a generic learning framework for a change programme as an entity, which is integral with the learning of individuals engaged in the programme to create greater potential capability of programme deliverables, which can then be utilised more effectively by customers to create value. In other words, the Learning Journey frame provides a means of creating value for all stakeholders of a change programme.

Learning Power

Whereas a Learning Journey is the process for transcending purpose into performance, Learning Power is the dispositional capability and energy needed to navigate the journey successfully. Potentially, Learning Power offers three insights. First, it provides a measure of learning disposition at a given time. Second, the measure, consolidated from seven dimensions shown in Figure B1. 26, can inform which specific aspects of learning need to be strengthened in order for the learning entity, which could include a human individual or group, programme or machine, to realise a defined purpose. Thirdly, combined with learning preferences (McCarthy *et al.*, 2005), the measure can direct the most effective intervention to increase Learning Power in the context of defined purpose.

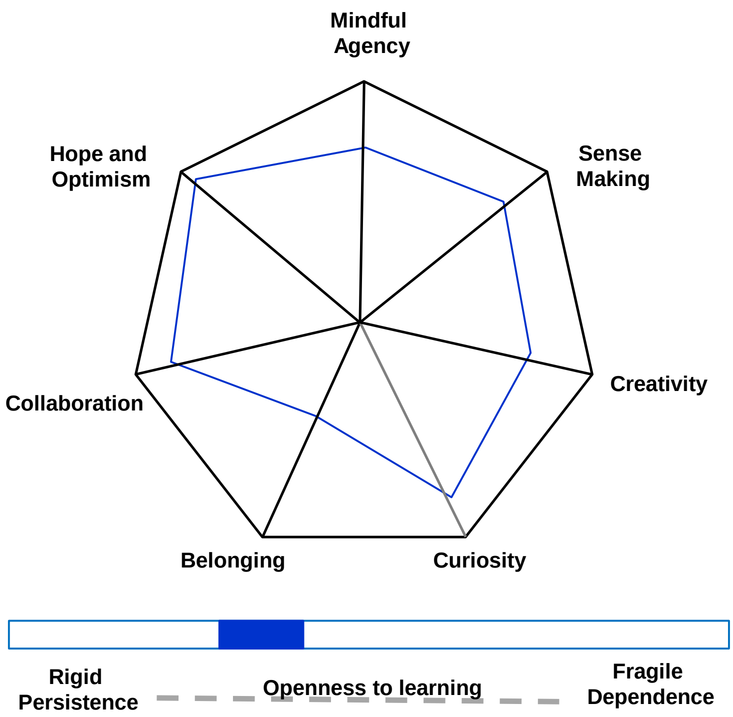

Figure B1. 26: Learning Power Profile

Learning Power was incorporated within the MDM in order to test how the concept can increase precision in future projection of switching levels and other key lead measures, such as consideration, which can inform strategies promoting a well–functioning market. Specifically, Learning Power was used as a second level of customer segmentation, the first being the Money Advice Service (MAS) financial dispositions shown in Figure B1. 27.

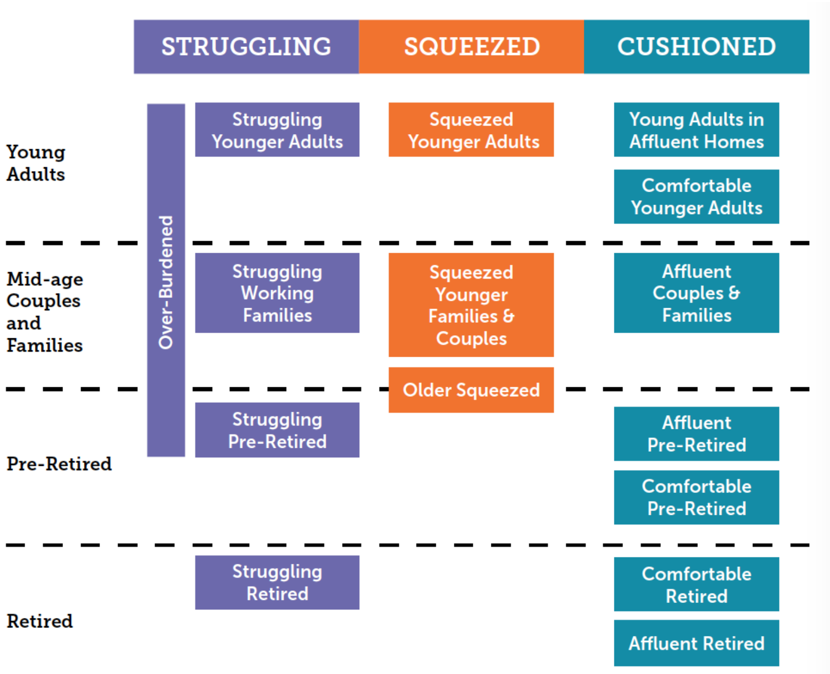

Figure B1. 27: MAS Financial Dispositions – First Level Customer Segmentation

For practical purposes the variation of Learning Power dispositions was simplified through the use of archetypal profiles which can be logically linked to the financial disposition segments. Each of the fifteen MAS segments was assigned three Learning Power archetypes, examples of which are shown in Figure B1. 28. The archetypes were defined by Helen Tracy, a team member and subject matter expert in Learning Journey and Learning Power theory and practice, interviewed for this research (Tracy, 2018). The inclusion of Learning Power proved the effectiveness of a second level of customer segmentation based on mental disposition, to supplement financial state, However, Tracy concluded that more appropriate dispositional foundations may be better suited for any further development, such as self-determination and motivational theory (Ryan *et al.*, 2000; Deci *et al.*, 2008) on the grounds that these are more closely linked to behaviour.

Struggling Younger Adults **Struggling Working Families** **Struggling Pre-retired**

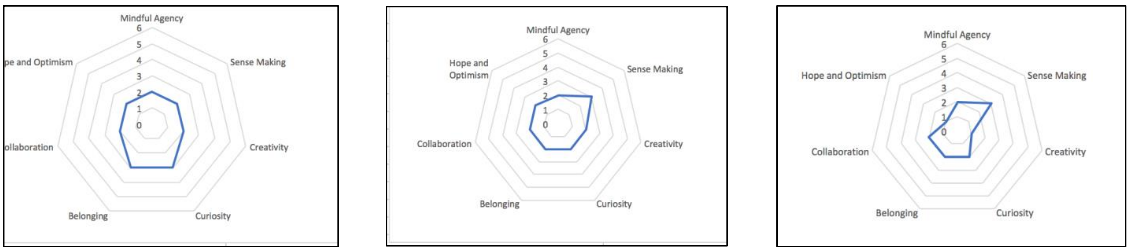

Figure B1. 28: Learning Power Profiles – Second Level Customer Segmentation

Causing Intentional Value

This section describes how the MDM development addressed three key challenges: modelling Complex Adaptive Systems, tracing causality to diagnose problems and direct effective interventions and integrating the power of systemic thinking with statistical rigor provided by econometric models.

Modelling Complex Adaptive Systems

Complex Adaptive Systems (CAS) present a particular challenge for modelling causality because of the sheer number and complexity of relationships which determine emergent behaviour, which we nevertheless wish to influence intentionally. By nature, emergent behaviour of a CAS cannot be predicted precisely, unlike many even highly complex engineering systems which follow predictable Newtonian laws. CAS typically include social systems, such as organisations and markets, the performance of which are determined by human behaviour. Therefore, in order to create value intentionally when dealing with CAS with any degree of certainty, it is essential to model underlying structures and associated causal characteristics.

In this respect, Systems Thinking offers two key tools for modelling CAS, feedback loops and systemic archetypes, which enable simplification of complexity whilst retaining causal clarity, a combination which the Author terms ‘Precise Simplicity’. Modelling reinforcing and balancing feedback loops, which account for non-linear behaviour and multi-directional causality, using Causal Loop Diagrams (CLD) formed the principal control vehicle for the MDM, documented formally in the Causal Tracing Document (Davies, 2018). The CLD defining the entire MDM, shown in Figure B1. 9 provides strong evidence of the applicability of the approach to modelling CAS. There are two keys to success. First is developing the systemic model through causal stories which can be elicited directly through interviews and workshops or synthesised from research, an example of the latter shown in **Error! Reference source not found.**. Secondly, the complexity is managed by highlighting the major storylines which comprise the overall CAS, the example for customer journey is shown in Figure B1. 14.

Systemic archetypes, afforded broad awareness through Peter Senge’s seminal book, The Fifth Discipline (Senge, 1990) and reframed for general purpose by (Wolstenholme, 2003), are repeating causal patterns which not only result in predictable outcomes but are also generic across physical and human domains. These properties render archetypes a powerful means to predict patterns of behaviour in CAS, providing a pragmatic level of certainty for directing change programmes. For example, two systemic archetypes clearly emerged during the early PoC modelling work. Frist, the dominance of large providers and their ability to dominate the PCA market through high spending on promotion, constituted an instance of ‘success to the successful’ comprising opposing reinforcing loops. Secondly, evidence of the highly damped nature of the market for switching is an example of ‘limits to growth’, structured as a reinforcing loop and constraining balancing loop.

Causal Tracing for Diagnosis and Direction

Having modelled the CAS, it is necessary to trace causality through the chains of relationships for two fundamental purposes: diagnosis of problems and analysis of exhibited behaviour, directing effective strategies and interventions to influence system behaviour and value outcomes.

Diagnosis and Analysis

For diagnosing and analysing the cause of a problem or behaviour, relationships are traced back from the focus of interest in what is termed a ‘Causes Tree’ which some software applications can create automatically. The Causes Tree for Switch Decisions is shown in Figure B1. 29.

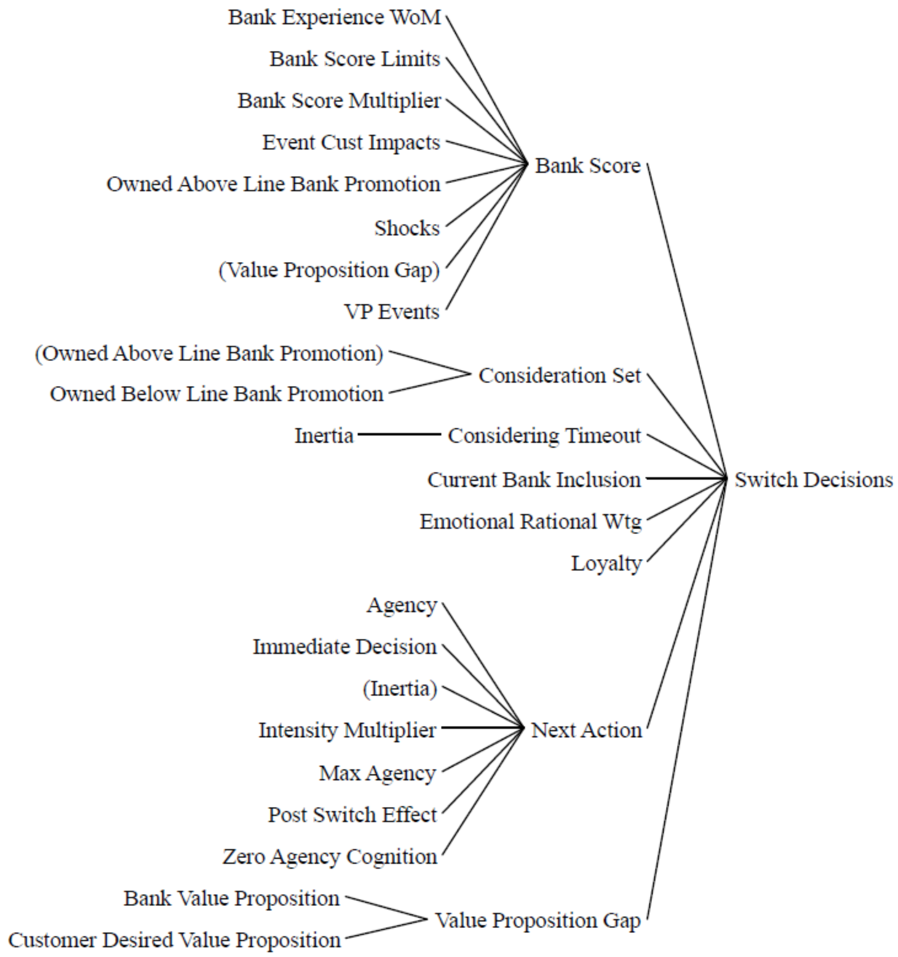

Figure B1. 29: Causal Tracing for Switching Decisions

For practical application, the diagnosis and analysis process is greatly assisted with graphic output from the model along the causal chains of interest. For the MDM this support to causal tracing was provided by graphics captured as output from the model as part of the Market Performance Framework as shown in Figure B1. 30. A significant report commission by Tesco Bank defined five steps to switching in the current account market, summarised as: openness, value, benefits, ease and choice (TNS, 2016), were readily mapped to the framework.

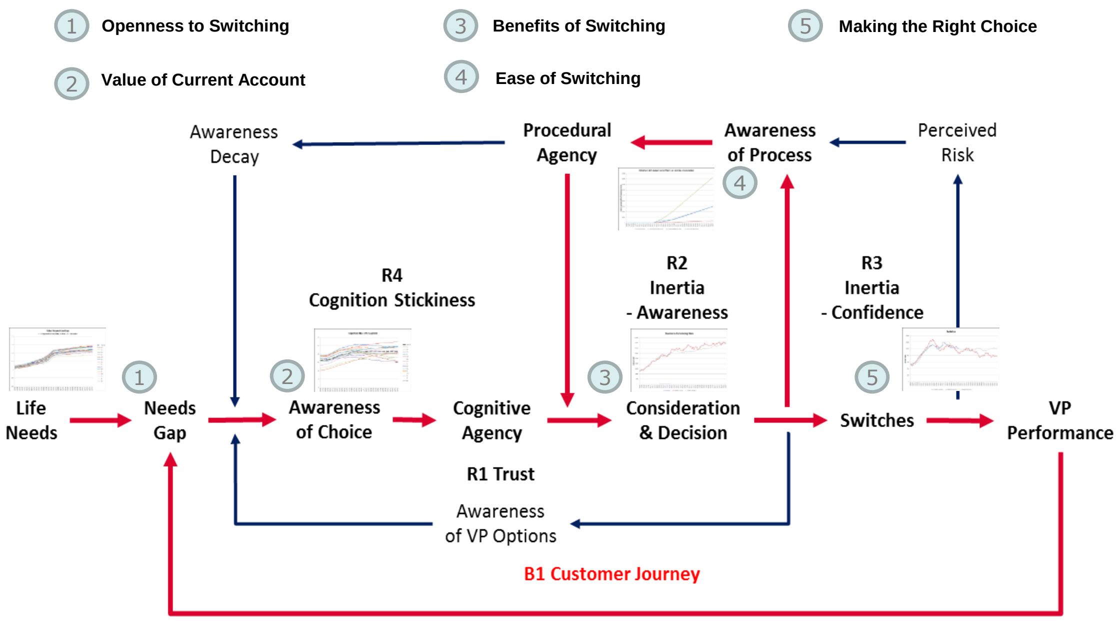

Figure B1. 30: Market Performance Analysis

Directing Policy, Strategy and Interventions

The second key application of causal tracing is directing effective policies (Business Dictionary, 2016a), strategies (Business Dictionary, 2019g) and interventions (Jeanty, 2017; Mirriam-Webster Dictionary, 2019c) to influence system behaviour and value outcomes. To examine how a proposed action causes changes to problem or behaviour, relationships are traced forward from the intervention in what is termed a ‘uses tree’, which some software applications can create automatically. By example, the uses tree for Paid Above Line Central Service Promotion.

Integrating Systemic and Econometric Modelling

Two apparently diametrically opposite approaches to modelling complex systems are systemic and econometric models. Both have the same aim, quantifying causal relationships which explain behaviour, enabling meaningful prediction of future outcomes and capability to cause desired outcomes intentionally through policies, strategies and specific interventions. Systemic techniques, such as Causal Loop Diagrams (CLD) and associated quantitative simulation using System Dynamics (SD) and Agent-based Modelling (ABM), inject causal precision by capturing many relationships, often populated with imprecise data. Conversely, econometrics uses mathematical equations to model relationships, causal precision being achieved by tackling the so-called problem of endogeneity. Endogeneity arises from the impossibility of accounting for every last influence and statistical analysis based on the regression techniques prove inaccurate, i.e. non causal, when potentially unobservable factors related to the policy or treatment of interest are omitted (Stouli, 2018).

Systemic approaches enable rapid top-down modelling of CAS through storytelling with people closest to the problem and/or research, and translation into a quantitative simulation, as demonstrated through this case study. The main weakness of this approach lies in the difficulty of populating models with real valid data, necessitating high level estimations and assumptions. This makes the approach vulnerable to challenge of credibility; again as experienced in this research. Econometrics provides mathematical and statistical rigor and enjoys a high level of credibility through wide application by economists, which affords a perception of being scientific. However, this rigour comes at a price; lack of intuitive simplicity and rapid scalability. The approach tends to be bottom up, combining small subsets into the overall system, such as the economy.

The key conclusion is that respective strengths can be combined and weaknesses neutralised by integrating systemic and econometric modelling through the common thread, causal inference. Causal inference refers to a set of techniques for modelling relationships with econometric diagrammatic archetypal structures (Pearl *et al.*, 2018). A team member and Economist from the University of Bristol, Sami Stouli, was commissioned to explore how systemic and econometric approaches related to each other and how they can be integrated to enable intentional value creation. The report (Stouli, 2018) concluded using a real example, that the precision and credibility of systemic models can be greatly enhanced by applying causal inference techniques. The specific linkage is achieved by applying causal inference to the most critical and sensitive nodes in the systemic model, as shown in Figure B1. 31. Stouli was also interviewed for this research as a subject expert in both economics and causal modelling (Stouli, 2017a; Stouli, 2017b).

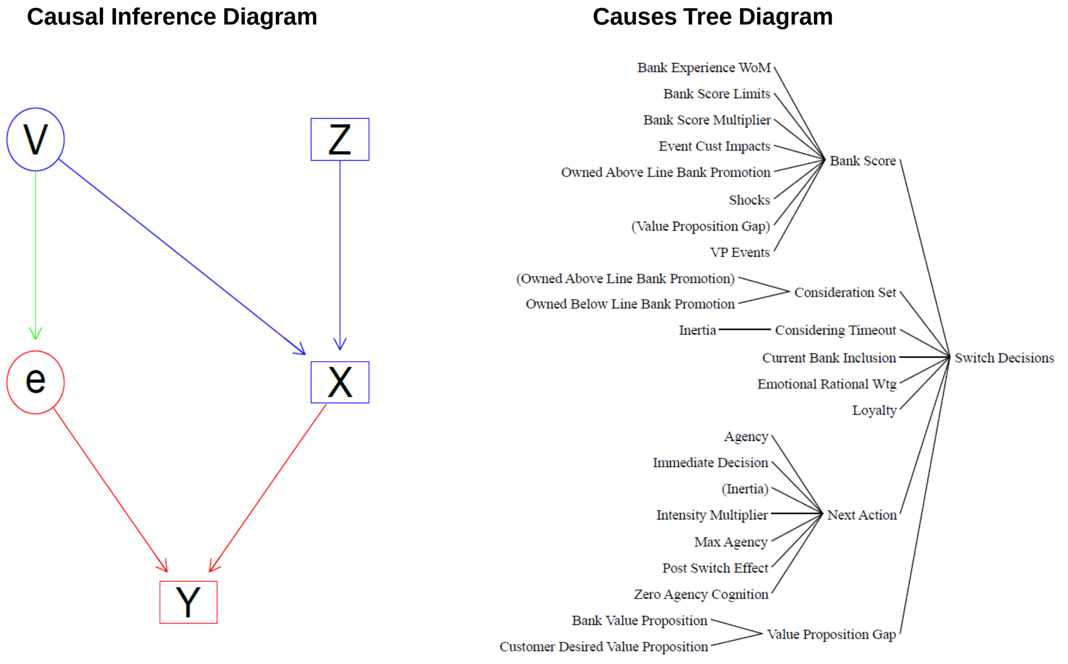

Figure B1. 31: Relationship between Econometrics and Systems Thinking

Equitable and Sustainable Stakeholder Value

A critical shift in mental model resulting from Systems Thinking is that the most profound challenges threatening our existence, such as equality and sustainability, are most significantly determined, not by the parts and events, but underlying structures of cause and effect in which surface events are a symptom of relationships between the parts operating as a system. Senge summarises this phenomenon as, “structure influences behaviour” (Senge, 1990, p. 40) and illustrates this distinction as the reason why changing leaders without the system structure rarely, if ever, results in anticipate change. Gladwell corroborates the importance of causal structure as the ‘power of context’ in his book The Tipping Point (Gladwell, 2000). Both seminal authors stress the apparent paradox of systems; small changes can result in large effects, leverage, which can be harnessed, not only by official leaders, but people with certain influencing characteristics, communicators, mavens (early adopters promoting their experience through WoM) and salespeople, who cause a system to tip through engagement. Senge’s proposed response to these and other systemic insights is the focus on learning and Gladwell’s, harnessing the power of influencers, delivering simple, clear messages within the most powerful context. These solutions are mutually inclusive and reinforcing.

Prudent application of systemic thinking and modelling elicit solutions to the related wicked problems of equality and sustainability in two powerful ways, which were developed through this case study: stakeholder value partnership and integration of hard and soft measures.

Stakeholder Value Alignment

Stakeholder value alignment is a term coined by the Author to encapsulate ability of a system, not only to create value, but also ensure that the value is mutually reinforcing between stakeholders. The concept of mutual stakeholder value is referred under various other guises and contexts (Mayo, 2001; Green *et al.*, 2004; Frow *et al.*, 2011). Alignment of value is important for two reasons. First, it focuses energy on creation of value. Secondly, alignment reduces conflict which constrains value creation.

A system perspective provides the means to identify opportunities to redesign the causal structure of a system to comprise reinforcing loops which create value and balancing loops, such as regulation, which ensure equitable distribution of value between stakeholders, together with policies, strategies and interventions needed to sustain the system. Stakeholder value alignment is supported by Value Principles 2 and 3: Specify equitable value and Align value causality respectively.

The MDM facilitates exploration of stakeholder value alignment between customers and providers:

Customers

Customers converge towards an available PCA value proposition (VP) which most precisely maps onto an ideal VP matching their needs. In this way, the customer journey, an instance of Learning Journey, is the means by which a customer purpose, expressed as their ideal VP, is transformed into performance, manifested as a customer experiencing the closet match to their ideal VP, where necessary through switching. Customers are segmented by financial disposition and the MDM quantifies the degree to which customers in each segment are able to match their ideal VP to those offered by the market. Of particular interest from an equality perspective are low income customers, designated ‘struggling’ and ‘squeezed’, who are the most vulnerable to the double whammy of being excluded from optimally cost effective payment services and high charges.

Providers

Providers are segmented into categories, such as leaders, innovators and challengers, which offer different VPs for their PCA products, targeting customer segments they most want to attract. The MDM tracks changes in overall market and customer segment share, driven by switches to and from these ‘provider archetypes’. Although market share does not necessarily reflect profitability, the measure nevertheless provides a strong indicator of provider performance. The model demonstrates that encouraged by the FIIC model, providers focus on attracting wealthy customers to whom they can cross and up sell more profitable products. Large participants achieve this through high levels of promotional spending and offers, the costs of which are disproportionately loaded onto low income customers, for example through overdraft charges. This is an instance of the ‘success to the successful’ systemic archetype operating across different stakeholders, large providers retain or increase market share and wealthy customers gain advantages at the expense of the least wealthy The MDM enables exploration of how these seemingly competitive behaviours result in unintended consequences, notably exclusion of low wealth customers and discouraging new entrants, together with potential regulatory and other interventions which counter negative outcomes.

Integrating Hard and Soft Measures

Hard data refers to facts which can be verified through objective direct measurement and/or observation. For example, the number of sales of a product, value per sale and revenue from sales are hard data by these criteria. However, customer satisfaction, perception of their provider and propensity for a particular behaviour, such as repeat purchases or expensive returns, are examples of soft factors, which usually require the capture of some kind of surrogate measure, such as historic behavioural patterns which can be used for Predictive Analysis (Siegel, 2016) or as in this case study customer survey questions which are inherently subjective. The key point is that the most critical intelligence often requires both data types. For example, future profitability requires prediction of sales volumes, which is dependent on customer behaviour driven by satisfaction. A CAS comprises many hard and soft factors with multiple relationships which increase exponentially with the number of factors.

The systemic view provides a powerful framework for modelling the factors, but more importantly, the relationships between them, in two critical ways. First, the factors and relationships operate as interconnected feedback loops resulting in non-linear emergent behaviour, which cannot be captured for practical purposes using conventional linear tools, such as spreadsheets or conventional market research with limited statistical significance of small samples. Secondly, it is often possible to identify one or more dominant systemic archetypes which not only exhibit predictable patterns of behaviour but also operate generically across hard physical and soft mental and behavioural domains. For example, the success to the successful archetype comprises opposing reinforcing loops where one loop dominates at the expense of the other. In the physical domain, examples include unequal distribution of wealth, the rich get richer, and market dominating leaders, such as Google, Facebook and Amazon; together with large providers in the PCA market. An important mental example is habitual behaviour, such as excessive spend, rather than saving. Importantly, the archetype operating at a mental level translates into a hard physical manifestation; in this example accumulation of debt, and the systemic paradigm enables integration of these domains.

The way in which the MDM integrates hard and soft measures is explained through the most fundamental data used; the two types of measure relating to events which drive the customer journey. The first concerns probability that a customer is subject to a particular event, for example, a bad experience on visiting a branch, website or contact centre through unhelpful provider staff, which is designated a ‘Relationship Push’ event. This is considered by the Author as ‘hard’ data because there are ways to capture verifiable objective information through observation, complaints and recorded conversations etc., all of which are becoming increasingly automated. Similarly, customer life events, such as education, marriage and retirement, are available through national statistics. The second type of data relates to impact upon the customer as a result of the experience, reflected as increase in cognition which drives propensity to consider and switch, and perception, i.e. score, relating to the associated provider, which influences a switch decision. This information is ‘soft’, on the grounds that it is subjective and not directly verifiable. It is captured for the model mainly through customer survey questionnaires and duly transformed. However, the MDM focuses on customer behaviour and both data types are essential. They are integrated through their incorporation within the VP structure in the customer journey.

B2 Validation Case Studies

Introduction

This appendix submits three real world case studies, each spanning the entire Value Power Framework, as evidence of validation for the new value theory. Each case is completely self-contained. This injects a degree of duplication, justified on the grounds of the necessary to include essential context and theory for clients in order to provide them with sufficient material with which to review and approve the case effectively

io oil and gas Case Study: Brown Field Gas Reservoir

Company Background

This case study was conducted between November 2015 and March 2016 with io oil and gas consulting (io) http://iooilandgas.com/, a joint venture between GE Oil & Gas and McDermott. Their mission is to transform the upstream oil & gas industry by helping to bring more projects to sanction by delivering greater certainty through disrupting traditional thinking and bringing higher decision quality into the front-end. A critical belief that it is more important than ever with oil prices potentially 'lower forever', to make more projects commercially viable at a sub $50 / Barrel oil price, at the time of the assignment, rather than waiting for a return to high commodity prices. With this in mind, at the heart of everything io do is delivering greater certainty for their clients. To this end, the company's CEO, Richard Dyson, has developed a delivery framework which he calls Value Protection, reflecting the emphasis on risk management in the oil and gas sector. He also introduced Decision Quality as a critical related capability (Spetzler *et al.*, 2016).

There are two key points to note from this background. First, the mission to deliver value with speed and certainty through disrupting current mental models, which constitutes triple-loop learning, is completely consistent with the Value Management approach. Secondly, the Value Protection approach is very similar in structure and practice to Value Management, in which programme value is specified from the earliest Concept stage, through the Value Power Framework described later, and 'protected' throughout all life cycle phases.

Contextual Background

The Need for Agile Investment

The collapse in oil prices has shifted the value dynamics within the oil and gas sector and is driving the need for agile investment, involving greater attention on the commercial viability of extending the lives of existing brown field reservoirs in relation to higher risk green field investments. In today's market every $ of investment must count. When the oil price was three digits, there was often limited incentive to invest in enhancing existing facilities, the high price obscuring the need to remove waste. With, at the time of this work, the oil price at around $30 /

Barrel and predicted to remain below $80 for the foreseeable future. The need to deliver greater value from less resource with speed and certainty is the new imperative and we refer to this philosophy and approach as Agile Investment. The term is normally used in relation to private investment portfolios. However, in the context of this case study, agile investment means targeting deliverables from investment programmes where and when they cause greatest stakeholder value, congruent with overall strategy and protected through contained risk. This dictates that we need to find new ways to extract greater value for longer from existing brown field assets, demanding a fundamentally new approach to this kind of investment.

There are four prerequisites to investment agility, which is measured consistent with best practice as Net Present Value (NPV) and Internal Rate of Return (IRR). First, we need to target investment to focus on the key drivers of value. Secondly, we need to align investments to maximise value across the full field, ensuring both technical and commercial coherence. Thirdly, we need to prioritise the deliverables from investment programmes by value. Finally, we need to protect the value by eliminating as much risk as practical as early as possible in the programme life cycle and then manage the residual risk through rigorous feedback and correction.

Limitations of Conventional Methods in Oil and Gas

The generic phases for managing investment in oil and gas facilities are:

- Concept: Concept Screening numerous options into a shortlist of viable options
- Pre-FEED: Selecting a preferred solution
- FEED (Front End Engineering Development): Detailed development of the preferred solution
- Execution: Detailed design, construction, installation and commissioning, leading to first oil or gas

The oil and gas industry is already very proficient in risk management. However, with reference to the process, there are three fundamental limitations of conventional methods in maximising full potential value, which relate to the prerequisites for investment agility. The first challenge is the difficulty in shortlisting viable solutions under the Concept phase, from which to select an optimal preferred solution in Pre-FEED. This concerns targeting. The second problem is the siloed nature of data analyses, whereby each part is considered in isolation, when a full field asset will only deliver the value potential if optimised as a total system holistically. This issue relates to alignment. The third issue concerns the time it takes conduct the analyses, which results in delays for investments and translate into lost value. This problem concerns prioritisation. These three problems render the protection of value difficult.

These limitations are fully recognised by io and provide the opportunity for the company to create value by disrupting the conventional process whilst harnessing its strengths. It was deemed that a systemic approach had the potential of significantly reducing the time and cost of the Concept and Pre-FEED phases. To this end, the Author was engaged to provide and transfer capabilities in Systems Thinking and System Dynamics on a major project for a global oil and gas company client of io. The client and project must remain anonymous for commercial confidentiality purposes and are referred to as Client and Brown Field respectively for this case study.

Assignment Background

Purpose of the Assignment

The purpose of the assignment is to deliver a safe and competitive project that will underpin Brown Field future base reliability and supply for contractual commitments by efficiently lowering system pressures to increase rate and recovery in line with Area Development Plan (ADP) requirements by 2020. To that end, it was decided to commission the development of a System Dynamics (SD) model to evaluate alternative scenarios rapidly and assist in the identification and adoption of the best value solution and facilitate the decision making process.

Brown Field Project Background

The Brown Field gas production fields are important assets to the Client and represent some 17% of Client production and 55% of production for that location. Production from Brown Field is anticipated to decline in the medium term. The incorporation of gas compression to deliver increased production and maintain production plateau rates will delay the decline in production. The Brown Field production system operated by the Client supplies domestic gas and income to the local area which is reflected in the commercial dynamics involving various royalties and taxes, in addition to provision of gas. The system is a complex of nearly 25 gas and condensate fields, producing close to 2.0 billion cubic feet per day (bcf/day) of gas and condensates; production comes from more than 35 reservoirs located at various depths. The produced fluids are a mixture of biogenic and thermogenic gas and condensates with yields which tend to increase with depth or reservoir pressure. The identified production mechanisms include fluid and rock expansion in volumetric reservoir with compartmentalisation, and water drive with weak and strong aquifers. The producing fields in the Brown Field complex are grouped in three hubs and a crucial capability of the SD model is to simulate multiple flowlines, which considerably increases the modelling complexity.

Value Learning Environment

Following Alistair Smith's Accelerated Learning principles , the first prerequisite is a conducive learning environment (Smith, 1998) which, within a Value Management context, focuses on stakeholder value creation. Three important aspects of the learning environment contributed to a successful assignment outcome. First, the work represented an imperative for io to establish their lead in the value driven approach and was fully funded by the Client with clear delivery deadlines. Consequently, it was afforded high priority and complete Board level commitment. Secondly, a highly competent and motivated inter-disciplinary team, led by a full-time Project Manager, was assigned to contribute in parallel with their other commitments drawing together experts covering the four key elements of the system: Reservoir Engineers, Pipeline Engineer, Power Engineer and Business Strategist. The latter full-time and designated for skill transfer in the and SD modelling techniques and tools. Thirdly, a dedicated room was allocated which facilitated an ideal perpetual workshop environment, supporting the agile rapid prototyping approach adopted to maintain pace whilst effecting shifts in thinking.

Value Power Framework

Connect the Learning

An important first step is to connect the learning from previous studies to the purpose of this assignment. Life extensions to the fields in the Brown Field area have been considered previously. A total of 49 compression concepts were studied and offshore compression at the one of the platforms was selected in 2010. However, this option was halted due to high capex, marginal economics and the perceived availability of other production options. Gas compression facilities have been installed for other fields.

Currently, the Client has a concept selection short list of five options where the base reference is a hub involving a bridge linked separate compression platform. The Client is also constructing a detailed reservoir and flow assurance model covering Brown Field. However, this detailed approach is not appropriate for the rapid screening of a large range of compression options. Consequently, it is intended that the SD model will provide this rapid screening capability.

Big Picture

Considerable effort was initially devoted to elicit the big picture which added precision to the contextual background. This was achieved through a combination of directed questioning and deep listening, together with real-time SD model construction with the entire team to ensure that all essential perspectives were included and apparent anomalies reconciled using the why? how? why? question structure (Sinek, 2009) as shown in Figure B2. 1:

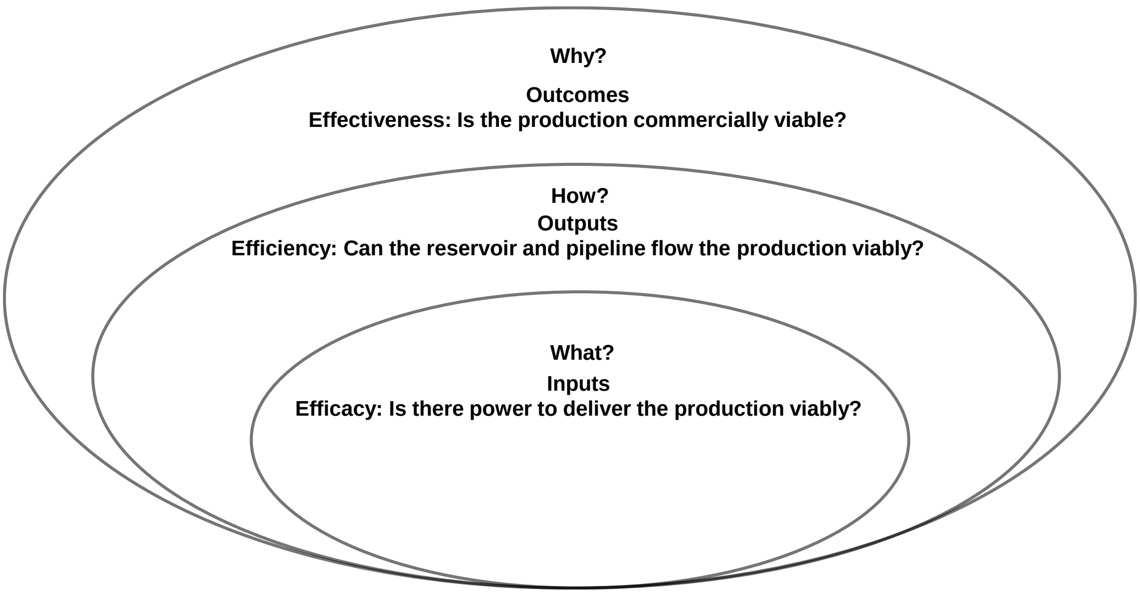

Figure B2. 1: Frame: Big Picture

Essential Learning

There are five learning distinctions of direct relevance to the Value Management research:

Value Learning Team and Environment

The first distinction accounting for success was the highly committed team, all members being willing to explore new concepts, methods and language. The work involved single, double and triple loop learning. Triple loop learning was in the form of a shift in perspective from conventional detailed analyses to systemic modelling. Engagement was significantly enhanced through the dedicated working space which facilitated a perpetual workshop environment.

Specification of Purpose

The presenting problem for the assignment was to develop a SD model to simulate options for extending brown field gas production with the aim of reducing the time and cost of the Concept and Pre-FEED stages of the study process. Considerable effort was initially devoted to define the context and specify the purpose more precisely. The result provided a big picture using the why? how? what? structure. This early clarification was further qualified with the Client during the first of five key teleconference workshops. In Decision Quality, this process is referred to as Appropriate Frame (Spetzler *et al.*, 2016, p.13).

Rapid prototyping

Rapid prototyping, adopted to model the gas extraction and delivery system, proved to be invaluable for integrating the different parts of the system from first principles, involving numerous iterations. The team rapidly became comfortable with ambiguity and associated willingness to challenge and discard iterations. This became even more important when it became clear that greater precision was needed, thus demanding a completely new computerised model structure, which developed into the final deliverable.

Action Learning

The Business Strategist, Himadri Singh, was not only tasked with supporting the complex commercial aspects of the model, but also to learn the systemic modelling technique and application of the SD tools used, Vensim from Ventana Systems, inc. and iThink from iseesystems inc. The Action Learning approach was particularly effective in the transfer of capabilities to Singh who very quickly became fluent in Systems Thinking language and proficient with the simulation tools. By applying his specific sector knowledge and financial analytical precision, his proficiency in key aspects of modelling exceeded my own, at which point synergistic creativity resulted in a significantly superior deliverable that would have otherwise have been possible through me acting in a conventional consultant role.

Decision Quality

Richard Dyson, CEO, directed me to the principle of Decision Quality and gifted the book entitled the same name (Spetzler *et al.*, 2016). The Decision Quality Framework comprises interactive requirements structured as a chain, which can be mapped closely with the Value Management phases (shown below in parenthesis).

- Appropriate Frame: Defining the problem being addressed in terms of purpose, scope and perspective (Frame and Intention)
- Creative Alternatives: Exploring a rich, exhaustive set of options (Programme)
- Relevant and Reliable Information: Connecting outcomes to alternatives (Model)
- Clear Values and Trade-offs: Specifying criteria for success in the context of values (Certainty)
- Sound Reasoning: Integrating alternatives, information and values (Alignment)
- Commitment to Action: Translating high quality decisions into action (Track)

In reality, the mapping is not exactly one-to-one but fractal; all Decision Quality requirements will be applied for each Value Management phase. However, it is useful to consider the broad overlay. Another powerful aspect of Decision Quality is strong emphasis and supporting techniques and tools to counter biases. In this respect the authors draw heavily on the work of (Kahneman, 2011).

Acknowledgements

The successful outcome of this work was the result of a highly committed team. All freely shared their expertise and fully engaged in a language and approach which were completely new to all the players. Critically for the fail-fast approach, the team embraced ambiguity and demonstrated the courage to risk being wrong. The core team comprised the following people:

Project Manager: Graham Inman
General Advisor: Roy St-Pier
Reservoir Specialists: Chris Freeman, Julio Herbas
Pipeline Specialist: Tim Highfield
Power Specialist: Tim Hawes
Business Strategy and Commercial: Specialist Himadri Singh

Also, thanks to CEO Richard Dyson for permission to use this material for the research thesis and gift of the book Decision Quality.

KWMC Case Study: Citizen-led Housing

Organisation Background

We Can Make is a citizen-led housing initiative led by Knowle West Media Centre (KWMC) and architects practice White Design. KWMC is an arts organization and charity that has been based on the estate for 21 years. White Design is an award winning chartered architect practice that has collaborated with KWMC for the past 10 years. KWMC www.kwmc.org.uk, founded in 1996 and rooted in the community of Knowle West located in South Bristol, is an arts and media centre (built of straw bales) that delivers socially engaged media arts projects contributing to a wider understanding of the role of the arts in communities and cities. KWMC promotes and leads citizen-led programmes in the local area using a radical and successful approach, founded on trust, involving an integrated value chain of stakeholders in the form of citizens, suppliers, authorities and financial investors. This creates a highly resilient, repeatable win-win model. KWMC works across different disciplines using art and technology to address issues including health, housing, and smart cities

We Can Make is a case study as part of the Research Councils and Innovate UK funded Urban ID programme of research led by the University of Bristol Urban ID. The purpose is to explore more effective ways to address critical urban challenges with the aim of creating more resilient, healthy, prosperous and sustainable cities. In this context, KWMC performs as a "living lab", fostering civic innovation by collaborating with residents, artists, cities, business and academia to support positive change and explore new, better ways of living together. As an integral part of this role, KWMC runs a community-based digital fabrication space called The Factory. This innovation space trains local people and develops new products and services targeting community needs and generates knowledge that is shared with other cities across the UK and beyond.

Temporary, or Transportable Accommodation (TAM) units, which provide the affordable housing solution are an innovation of White Design, an award winning chartered architects practice and sustainability consultancy. As part of the new carbon economy, the company combines pragmatism, affordability and beauty into solutions that allow people to live, work and learn more sustainably. White Design is based in Bristol with extensive experience in community-led architecture, including co-housing and intentional communities.

Contextual Background

A Broken System

In their two reports (KWMC, 2017b; Mean *et al.*, 2017) the We Can Make team provide brutal evidence of fundamental failures with the conventional housing market. Referring to the problem as ‘A Broken System’, their findings are based on extensive research. The UK needs to build at least 250,000 homes per year to meet increasing and changing demand. However, there are five systemic issues which constitute barriers to achieving this requirement. First, the construction market is highly concentrated with the result that the few houses built are developer-led against profit, rather than need. Secondly, as demand increasingly outstrips supply, house prices escalate beyond the means for many and growing numbers of people in need of a home. The average home is Bristol has risen from 3.6 to 8.2 times average annual earnings in just twenty years. Thirdly, housing operates in a siloed fashion, disconnected from wider social and economic needs, such as social care and growing local jobs and manufacturing. Fourthly, the planning system imposes obstructions. Planning applications for Knowle West are twice as likely to be rejected as those for affluent Clifton, a situation attributed to lack of access to expertise needed for navigating complex regulatory demands on submissions. In addition, there is perpetual pressure to resist low quality, place-less developments, manifested as the Not in My Back Yard (NIMBY) mindset. Finally, there is limited scope for replicating best practice to improve productivity without violating quality (NewStatesman, 2018).

These factors combine to lock people into a competitive vicious cycle for any hope of securing the most essential infrastructure of everyday life, a safe and secure home, in both private and social housing sectors. In the private housing market, people are forced to divert ever higher proportions of income and savings to getting on a property ladder where the bottom rungs are missing. Conversely, they have to compete on proof that they are the “most needy” in order to win eligibility for the scarce supply of social housing. From a national economic perspective, both these systemic patterns work against the imperative to increase productivity.

Citizen-led Housing

Knowle West is large public housing estate built in the 1930’s and represents one of the most economically disadvantaged and socially excluded communities in Bristol. However, very importantly, social networks are strong, for example, as a result of several generations of families living close to each other. Regeneration money has been pumped into Knowle West. However, it is often perceived by residents that very little positive change has been realised despite some significant changes, such as south Bristol hospital and new academy schools (Hassan, 2017).

We Can Make is a live Research and Development (R&D) programme which represents convergence of three key elements: a radical reframing from developer to citizen-led supply around a purposeful conviction to satisfy needs (why?), mastery of causal factors and relationships based on research (how?) and an innovative, sustainable solution (what?). This brings together local people, architects, artists, policy-makers, academics and industry professionals to develop practical and scalable ways in which the citizen sector can have a greater role in making new homes, including where and how they are built. Rather than designing homes as products, We Can Make is concerned with re-imagining the wider legal, financial and policy enabling framework so that citizens and communities can better meet their own housing needs, as opposed to relying on speculative developers or top-down schemes.

This holistic frame addresses fundamental problems with the conventional housing market and supports a flourishing community in six critical ways (KWMC, 2017b, p. 4). First, housing is delivered non-speculatively at point of need. Secondly, competition is converted into collaboration through working with the assets and know-how embedded in communities. Thirdly, a principal barrier and cost, acquisition of land, is solved by unlocking the large volume of microsites available in urban and suburban areas, largely ignored by the mainstream development industry due to lack of commercial viability. Fourthly, the solution supports local economies through regional manufacture and assembly. Fifth, developer profit is directed back into the community to support local facilities and services. Finally, the business model, comprising a design, finance, legal and enabling platform can be replicated in different neighbourhoods, offering the prospect of addressing the housing crisis at national level.

Assignment Background

Purpose of the Assignment

The purpose of the assignment is to deliver a Financial Model which quantifies the commercial viability of the We Can Make business model for Knowle West and replication across other local communities under a Community Interest Company (CIC).

Declaration of Credit

No credit is claimed by the Author concerning research, design or innovation relating to the We Can Make initiative. Involvement focused purely on developing a Financial Model with the purpose of securing funding for the roll out of We Can Make within Knowle West. However, it is also critical to honour intended outcomes for other stakeholders encapsulated within the highest purpose, supporting a flourishing community through affordable housing. To this end, it was necessary to develop the Financial Model in this broader context.

Value Learning Environment

Following Alistair Smith's Accelerated Learning principles (Smith, 1998), the first prerequisite is a conducive learning environment. The Financial Model was evolved through several informal and highly interactive workshops. The first workshop was conducted in the KWMC Factory which promotes a strong innovative aura. Further workshops were held in open areas within the university, which also facilitated the learning environment needed to meet the time and budget constraints without compromising rigour. The interaction was informal and high energy. Humour was used to role play different stakeholder perspectives, for example, developing the business case from an impersonal, objective investor viewpoint.

Value Power Framework

Connect the Learning

The We Can Make team have conducted extensive research relating to the market described previously. In addition, the research included interviews with the local community to determine precise housing requirements which elicited dominant hierarchical needs articulated as stories (Mean *et al.*, 2017, pp. 24 - 25). The result is a comprehensive picture of purpose, real world changes and intervention needed to achieve the purpose which provides a robust foundation for developing the Financial Model.

Big Picture

As a result of the previous exhaustive research, design and innovation the big picture provided by the We Can Make team is very clear and summarised using the why? how? why? question structure (Sinek, 2009) as shown in Figure B2. 2.

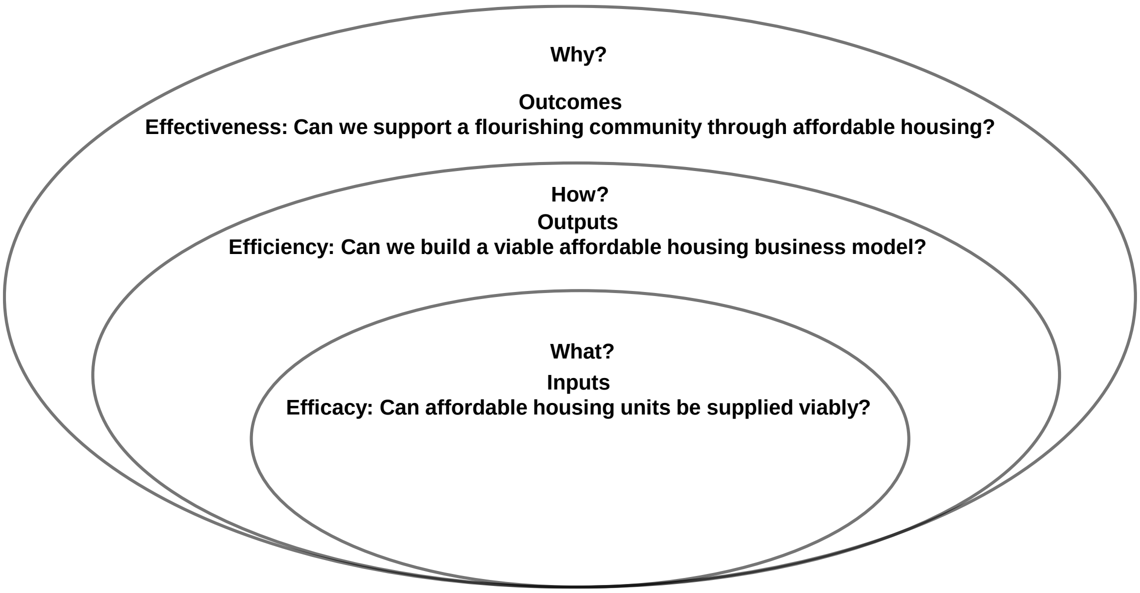

Figure B2. 2: Frame - Big Picture

Essential Learning

There are three learning distinctions of particular relevance to the Value Management research:

Value Learning Team and Environment

The first distinction accounting for success was the highly committed team, all members being willing to explore new concepts, methods and language. The work involved single, double and triple loop learning. Triple loop learning was in the form of a shift in perspective from conventional detailed analyses to systemic modelling. Engagement was significantly enhanced through the use of both dedicated workspace at KWMC and university coffee bars, which had the effect of releasing innovative energy in the team.

Specification of and Alignment with Purpose

The We Can Make team provided a precise specification of purpose, which was cascaded through real-world adaptation and change to the innovative solution comprising TAM units. This entire process constituted triple loop learning, requiring a shift in mental models, from competitive, land-driven conventional housing development to citizen-led.

Rapid prototyping

The Financial Model was developed in a very short duration and minimal budget. This was made possible through near real-time development and honing of the Financial Model during the informal workshops. For this approach to work, it is necessary for all participants to work with, and even embrace, ambiguity; achieved successfully.

Acknowledgements

The successful outcome of this work was the result of a highly committed team comprising::

Melissa Mean: Head of Arts Programme, KWMC
Craig White: Founder and Director, White Design

Also, thanks to Carolyn Hassan, Founder and Director, KWMC, for permission to use this material for the research thesis and participating in an interview (Hassan, 2017).

System Eyes Case Study: Building Information Modelling

Company Background

This case study was conducted between October 2018 and May 2019 with System Eyes Consulting in Calgary, Alberta, Canada. Seb Cox, Principal, started his career as an Engineer Officer in the UK's Royal Air Force. For 8 years he was involved in aircraft maintenance and Integrated Logistics Support (ILS) relating to O&M and operational readiness. His various leadership roles included aspects of risk management, maintenance oversight, organisational change management, continual improvement, mentoring and defence diplomacy. He also supported asset managers and program managers responsible for Through Life Capability Management (TLCM).

During his subsequent 8 years of project management and business analysis in the built environment, he has been influencing change with a vision to improve the management of integration, information and innovation towards a service-oriented delivery and sustainment approach. Cox is currently developing tools to improve the integration between projects and strategy utilizing systems thinking methods including business dynamics simulation.

Contextual Background

The contextual background to the Building Information Modelling (BIM) proposition is articulated in depth by Cox in his white paper (Cox, 2018) based on his experience and research and corroborated through case studies. The essence of this paper is provided below and in a subsequent presentation by Cox which provides an applied Systems Thinking perspective to the subject (Cox, 2019c).

Traditions evolved over centuries in the Architecture, Engineering, Construction, Owners and Operators (AECOO) industry are manifested as resistance to change. Second only to Agriculture and Hunting as the least digitised industry in the USA, productivity has been declining in recent years compared with gains in most other industries. The fundamental problem lies in fragmentation of the design and construction process, resulting in high levels of waste accounting for cost overruns and delays. There are three dimensions of fragmentation: vertical, horizontal and longitudinal. Vertical fragmentation refers to lifecycle stages where disconnects emanating from projects are migrated to asset management. System disconnects also occur in project IT and multi-disciplinary disciplines across design, construction and manufacturing. Furthermore, most procurement models involve change in responsibility for project integration and/or project information, exacerbating disconnects. The problem of horizontal fragmentation concerns trades and disciplines traditionally working with a degree of independence, together with their own IT systems, document control and risk management. Longitudinal fragmentation includes inconsistency of project teams which, together with poor knowledge and asset information transfer across projects, renders learning significantly limited; failure patterns being perpetuated rather than corrected.

The consequence of this fragmentation and waste is that buildings often fail to deliver intended stakeholder value as a result of problems with design, construction, commissioning and aftercare. Increasingly diverse stakeholders and complex relationships between them necessitate greater innovation, in particular thorough systems integration and better collaboration. Despite traditions, change is progressing rapidly, driven by many factors such as: infrastructure assets/systems and digital technology; sustainable asset acquisition and lifecycle management, enabling technologies and globalisation.

Critically, evolution of infrastructure projects and services are exhibiting similarities with industries which have already undergone transformational systems integration, notably defence/aerospace. The transition for infrastructure requires two fundamental shifts. First, the traditional functional view of assets must be supplemented by focusing on capabilities provided by infrastructure which translate into stakeholder value. Secondly, integrated support and mission interoperability must be designed with capability evolution and sustainment. Other less obvious but critical similarities between infrastructure and aerospace include supply chain integration, incorporating aftercare services, and relationships between physical assets, people and digital technology, with an increasing focus on the human and digital technology components of asset-system capability.

Assignment Background

Purpose of the Assignment

The purpose of the assignment is to deliver a Proof of Concept (PoC) System Dynamics (SD) model which demonstrates how specific aspects of BIM and integrated project delivery can be targeted precisely to 'points of power' in key feedback loops in the building process, where greatest influence can be channelled to value creation. Cox has experience applying Systems Thinking within military aerospace and construction and is interested to explore Impact Dynamics' Value Management approach to Systems Thinking and System Dynamics. It is intended that the PoC model provide some insights for development by System Eyes Consulting of a scenario and sensitivity analysis demonstration for wider industry engagement and learning

BIM Proposition Background

In the UK, BIM is defined as using advanced computer systems to build 3-D models of infrastructure which hold large amounts of information about its design, operation and current condition (HMG, 2015, p. 5). At the planning stage, it enables designers, owners and users to work together to produce the best possible designs and to test them in the computer before they are built. In construction, it enables engineers, contractors and suppliers to integrate complex components, cutting out waste and reducing the risk of errors. In operation, it provides customers with real-time information about available services and maintainers with accurate assessments of the condition of assets. In 2011 the UK Government Construction Strategy mandated the use of Level 2 BIM on all public sector projects by 2016. This decision has led to Government and the construction industry working together to develop the industry's skills and reduce the cost of infrastructure. BIM has been identified as a significant contributor to the savings of £804m in construction costs in 2013/14 announced by the Cabinet Office. The Ministry of Justice has identified BIM as having enabled £800,000 of savings in the development of the Cookham Wood Young Offenders Institution. And this innovative technology is central to the development of new rail projects, like Crossrail and HS2, where it is confirming the UK's leading role in the development of digital technologies for infrastructure and construction.

Value Learning Environment

From a learning perspective, the assignment comprised two requirements. First, it is necessary to train Cox in the basics of the Value Management approach to SD modelling. Secondly, it is essential to validate the core proposition. Collaborative development of the SD model for this case study was conducted entirely through remote communication using Skype. In particular, the model was constructed in real time, made possible through screen sharing functionality.

Value Power Framework

Connect the Learning

Cox and the Author combines their significant experience within defence/aerospace/manufacturing industries, in addition to infrastructure, and share a conviction that human and systems integration, leading to the reduction in waste, are critical elements in delivering greater stakeholder value from building programmes. They contend that advances in BIM offer a potential enabler for this integration if deployed using a systemic approach focusing on stakeholder value.

Frame

The big picture is framed as three interlocking questions why? how? and what? as shown in Figure B2. 3:

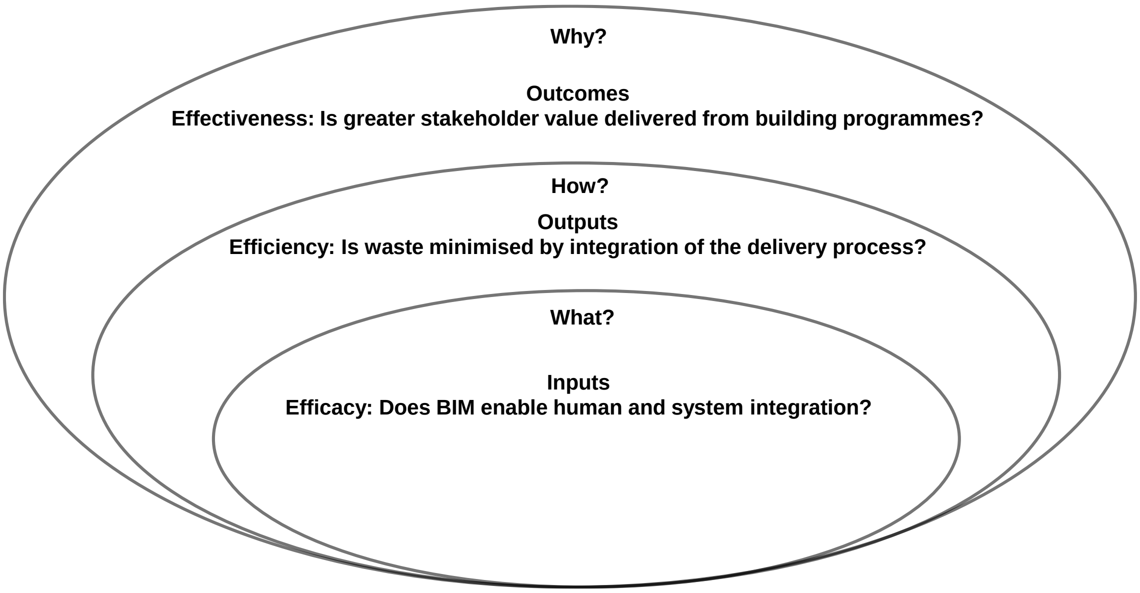

Figure B2. 3: Frame – Big Picture

Essential Learning

There are three learning distinctions of direct relevance to the Value Management research:

Real Time Remote Collaboration

This case study is the second instance where the Author conducted simultaneous training and SD model development in real time and completely remotely, in both cases utilising Skype screen sharing functionality. The approach proved both efficient and effective, despite the 7 hour time difference between London and Calgary. Efficiency is attributable to the use of focused one hour time slots synchronised with the collaborators other work commitments, including during travel. Effectiveness is evidenced through the speed of learning and ability to translate client knowledge into a SD model through structured questioning and interactive feedback. The first use of this approach with a Qatari client in 2012 was also successful for the same reasons.

Action Learning

The study provides further validation of the Action Learning approach in which structured training, in this case System Dynamics, is incorporated within direct application of the learning to a specific purpose, development of a commercial value proposition and support tool for information integration for building and infrastructure programmes. However, feedback from Cox indicates the need for greater flexibility in transitioning between high level modelling and specific detail.

Quantifying Intangible Factors and Relationships

The most significant and contentious challenge in this case was the quantification of intangible, soft, factors which in this case represented the core structure of the model. These included: System Trust, Human Trust, Collaboration, Integration and Information Quality. The challenge is intensified by the non-linear and interactive nature of relationships between the factors.
The approach adopted is to define the intangible factors on a scale, 0 to 100, and relationships between them input as non-linear graphical functions, most of which were exponential to reflect the disproportionate impact of higher scores.

Acknowledgements

The Author wishes to thank Seb Cox for his high commitment to this collaboration, the contribution to which resulted in the successful outcome of this work.

Appendix C Glossary of Terms

This glossary provides definitions of terms used for the purposes of the research.

Affordance

A use or purpose that a thing can have, that people notice as part of the way they see or experience it (Cambridge Dictionary, 2019i)

Agency

Action or intervention producing a particular effect (Oxford Dictionary, 2019a)

Causality

Relationship between cause and effect (Collins Dictionary, 2020)

Cause

Something that brings about an effect or a result (Mirriam-Webster Dictionary, 2020a)

Cognition

Mental action or process of acquiring knowledge and understanding through thought, experience, and the senses (Oxford Dictionary, 2019b)

Convergence

Two or more things, ideas, etc. become similar or come together (Cambridge Dictionary, 2019a)
Act of joining together as one (Vocabulary.com Dictionary, 2019)

Disposition

Attitudes and modes of conduct made up of values, actions, attitudes, and beliefs (Purdue University, 2019)

Economics

Social science concerned chiefly with description and analysis of the production, distribution, and consumption of goods and services (Mirriam-Webster Dictionary, 2019a)

Economy

The state of a country or region in terms of the production and consumption of goods and services and the supply of money; careful management of available resources (Oxford Dictionary, 2018a)
As used for Value for Money, minimising the cost of resources used while having regard to quality (NAO, 2017)

Effectiveness

Degree to which objectives are met and targeted problems solved; doing the right things (Business Dictionary, 2019a)

Efficacy

Ability of something to produce the intended result (Cambridge Dictionary, 2019b)
Doing the right things right (Author) See also Effectiveness and Efficiency

Efficiency

Comparison of what is actually produced or performed with what can be achieved with the same consumption of resources (Business Dictionary, 2019b)
Doing things right (Author) See also Management

gig Economy

A free market system in which temporary positions are common and organisations contract with independent workers for short-term engagements (TechTarget, 2016)

Governance

Set of policies, regulations, functions, processes, procedures and responsibilities that define the establishment, management and control of projects, programmes and portfolios (APM, 2019)

How (Used as an Adverb)

Manner, way or means by which something works; way, manner or means by which something happens (Mirriam-Webster Dictionary, 2019b)

Important

Necessary or of great value (Cambridge Dictionary, 2019c)

Income

Money that is earned from doing work or received from investments (Cambridge Dictionary, 2020a) Therefore, income is a flow, amount over a period of time, whereas wealth is a stock, accumulation

Inertia

The tendency to do nothing, remain unchanged or be resistive to change (Oxford Dictionary, 2018b)

Inputs

Resources, such as people, raw materials, energy, information, or finance, which are put into a system to obtain a desired output; Inputs are classified under costs in accounting (Business Dictionary, 2019c)

Integrity

Quality of being honest and having strong moral principles that you refuse to change and being whole or complete (Cambridge Dictionary, 2019d)

Intention

Something intended; an aim or plan (Lexico Oxford, 2019a)

Intervention

The act of interfering with the outcome or course especially of a condition or process so as to prevent harm or improve functioning (Mirriam-Webster Dictionary, 2019c)
An approach a business can use to effect change within its organisational structure or processes (Jeanty, 2017)

Leadership

Doing the right things (Drucker, 2006) See also Effectiveness

Loyalty

Feelings of support or duty towards someone or something (Cambridge Dictionary, 2018a)

Management

Doing things right (Drucker, 2006) See also Efficiency

Mental Model

Beliefs, ideas, images, and verbal descriptions from which we consciously or unconsciously form representations of perceived reality explain cause and effect, leading us to expect certain results, give meaning to events, and predispose us to behave in certain ways (Business Dictionary, 2019d)

Mission Statement

Defines what a company wants to do now in terms of purpose and values, why they do what they do (Diffen, 2014; Iowa State University, 2016)

Objective (Business Context)

Specific result that a person or system aims to achieve within a time frame and with available resources, expressed as a verb-noun structure, for example, minimizing expenses, expand internationally, maximise profit (Business Dictionary, 2015a)

Outcome

The outcome of an activity, process, or situation is the situation that exists at the end of it (Collins Dictionary, 2015)

Outputs

The amount of energy, work, goods, or services produced by a machine, factory, company, or an individual in a period (Business Dictionary, 2019e)

Point of Power

The level and specific point within a complex system where a capability delivered by a programme can influence causal factors which lead to realisation of intended stakeholder outcomes (Author)

Policy

A set of basic principles and associated guidelines, formulated and enforced by the governing body of an organization, to direct and limit its actions in pursuit of long-term goals (Business Dictionary, 2016a)

Process

Any activity or group of activities that takes input, adds value to it, and provides an output to an internal or external customer using resources to deliver definitive results (Harrington, 1991, p. 9)

Productivity

The ratio of what is produced to what is required to produce it; measures the relationship between output such as goods and services produced, and inputs that include labour, capital, material and other resources (Tangen, 2005, p. 36) See also Value Productivity

Prosperity

Stage in an economic cycle in which conditions of relatively low-unemployment and high total income prevail, leading to high purchasing power (Business Dictionary, 2017b)

The condition of being successful or thriving (Mirriam-Webster Dictionary, 2020b). This definition includes non-financial aspects of flourishing, such as health and happiness, as opposed to wealth which is confined to material state.

Purpose

Why you do something or why something exists (Cambridge Dictionary, 2019j)

Redundancy

A situation in which something is unnecessary because it is more than is needed (Cambridge Dictionary, 2019e)

Redundancy (Essential)

Spare capacity necessary for a system at a given status to deliver intended stakeholder outcomes to a defined level of performance (This research)

Resilience

Capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop and how humans and nature can use shocks and disturbances like a financial crisis or climate change to spur renewal and innovative thinking (Stockholm Resilience Centre, 2019)

Satisfaction (In the context of customer)

A response of varying intensity and limited time duration directed toward focal aspects of product acquisition and/or consumption (Giese *et al.*, 2000)

Spillovers

Secondary effect that follows from a primary effect, and may be far removed in time or place from the event that caused the primary effect (Business Dictionary, 2019f)

Spin

Describe a situation or information in a way that is intended to influence the way people think about it (Longman, 2020)

Strategy

A method or plan chosen to bring about a desired future, such as achievement of a goal or solution to a problem (Business Dictionary, 2019g)
A set of hypotheses about cause and effect (Kaplan *et al.*, 1996, p. 149)

Supply Chain

Entire network of entities, directly or indirectly interlinked and interdependent in serving the same consumer or customer (Business Dictionary, 2019h)

Theory

A good theory is about connection between phenomena, emphasises the nature of causal relationships and explains, predicts and delights (Sutton *et al.*, 1995, p. 378)
A formulation regarding the cause and effect relationships between two or more variables, which may or may not have been tested (Gill *et al.*, 2002, p. 229)

Trust

Firm belief in the reliability, truth, or ability of someone or something, which involves level of integrity, honesty and competence that one party perceives in another (Oxford Dictionary, 2018c)

Usefulness

Quality or state of having utility (Cambridge Dictionary, 2019f)

Validation

An activity that ensures that an end product stakeholder's true needs and expectations are met (Plutora, 2018); doing the right things

Value

Amount of money that can be received for something, importance or worth of something for someone, how useful or important something is (Cambridge Dictionary, 2019g)

Regard that something is held to deserve; the importance, worth, or usefulness of something, material or monetary worth of something, worth of something compared to the price paid or asked for it (Lexico Oxford, 2019b)
The relationship between satisfying needs and expectations and the resources required to achieve them (Institute of Value Management, 2017)

Relationship between benefit and cost of realising those benefits (Hippo Engineering, 2012)

Value for Money

Optimal use of resources to achieve the intended outcomes, comprising economy, efficiency and effectiveness (NAO, 2017)

Value Management

Value Management (VM) is concerned with improving and sustaining a desirable balance between the wants and needs of stakeholders and the resources needed to satisfy them. Stakeholder value judgements vary, and VM reconciles differing priorities to deliver best value for all stakeholders (Institute of Value Management, 2017)

Value Productivity

The ratio between stakeholder outcomes and inputs needed to realise them (This research)

Value Power

Rate at which stakeholder value is created over time (This research)

Value Acceleration

Rate at which Value Productivity increases (This research)

Values

Important and lasting beliefs or ideals shared by the members of a culture about what is good or bad and desirable or undesirable which have a major influence on a person's behaviour and attitude and serve as broad guidelines in all situations, for example, fairness, innovation and community involvement (Business Dictionary, 2015b)

Those things which are most meaningful and important to us and consequently motivate our behaviour and determine how we spend our time (Shephard, 2005b)

Values Levels

Means of defining human maturity in terms of the manner in which people relate to each other; containers holding values, the content (Shephard, 2005c)

Verification

A test of a system to prove that it meets all its specified requirements at a particular stage of its development (Plutora, 2018); doing things right

Vision Statement

Defines what a company wants to be in the future in terms of objectives and outcomes, where they intend to be at some point in time (Diffen, 2014; Iowa State University, 2016)

Waste

An unnecessary or wrong use of money, substances, time, energy, abilities, and other resources (Cambridge Dictionary, 2019h)

Wealth

A large amount of money or valuable possessions that someone has (Cambridge Dictionary, 2020b) Therefore, wealth is an stock, accumulation, whereas income is a flow, amount over a period of time

What (Used as a noun)

Information specifying something, or the sum of its characteristics (Lexico Oxford, 2019c)

Why (Used as an Adverb)

For what purpose, reason, or cause; with what intention, justification, or motive (Mirriam-Webster Dictionary, 2019d)

Appendix D Heuristics and Biases

Appendix D defines key heuristics and biases, together with examples, drawn from Prospect Theory and other neurological research concerning cognition, decision making, learning and change (Tversky *et al.*, 1974; Kahneman *et al.*, 1979; Tversky *et al.*, 1992; Kahneman, 2011; Baars *et al.*, 2013; Kahneman *et al.*, 2013).

Heuristics

Heuristics are simple procedures that helps find adequate, though often imperfect, answers to difficult questions. Some of the most relevant heuristics are defined in Table D. 1, together with examples with the aim of providing clarification.

Table D. 1: Heuristics

Heuristics	Definition	Example
Affect Heuristic	We intuitively base decisions on emotion rather than rational calculation of risk and benefits	Incorrect decisions made on gut feel without analytical scrutiny
Anchoring Heuristic	We intuitively consider a value for an unknown quantity before estimating what we think the quantity out to be	Asking price for house becomes the anchor for assumed value, thus limiting negotiation
Availability Heuristic	We intuitively estimate the frequency of something based on the number of instances retrieved from memory and how easily these come to mind	Dramatic events, emotional personal experiences and media reinforcement distort out perception of reality
Representativeness Heuristic	We intuitively focus exclusively on stereotypes, ignoring factual base rates and validity of the evidence	Generalisations concerning trades, professions, race, gender etc.; we tend to tar people with the same brush

Biases

Biases are largely unconscious simplifications which reflect our values and beliefs, built into our mental models and manifested through profoundly influencing our behaviour. The most relevant biases from a value creation perspective, which overlap with heuristics, are defined with examples in Table D. 2. Of special relevance is Confirmation Bias because it provides a credible explanation and practical application of the linkage between focus of attention and physical manifestation, more often referred to as the Law of Attraction, through agile learning, causal precision.

Table D. 2: Biases

Bias	Definition	Example
Confirmation Bias	**We tend to observe and make conclusions from these observations which reinforce prior beliefs and values**	**'Law of Attraction' which states that we realise what we focus on, which has a strong bearing on goals, and we see what we want to see**
Belief Bias	We intuitively base decisions on belief rather than rational calculation of risk and benefits	We act upon what we believe in in favour of evidence, related to confirmation bias
Optimism Bias	View of the world as unrealistically benign, situations more favourable that they are and goals more achievable than is the case	Odds of risk are underestimated
Hindsight Bias	Inability to reconstruct past beliefs leading people to underestimate the extent to which they are surprised by past events	Actions that seem wise in foresight can look negligent in hindsight
Framing Effect	Our thinking is biased by how information is presented	Dangers of spin in politics and marketing: 90% fat-free appears more attractive than 10% fat
Loss Aversion	Prospect Theory: Our thinking is biased by an aversion to loss where eliminating the risk of losing is preferable to increasing the probability of winning, we are more driven by pain than pleasure	Fourfold Pattern: People are averse to risk even when they stand to make a large gain, are indifferent to small probability of winning when prize is large, pay more for peace of mind and gamble desperately when faced with bad options

Bias	Definition	Example
Conjunction Fallacy	We judge a conjunction of two events to be more probable than events in direct comparison; linked with Representativeness Heuristic	Linda Problem: Frequency of feminist bank tellers ranked higher than bank tellers who are not feminists even though bank tellers are a bigger set than feminists
Narrative Fallacy	People exaggerate their skill and underestimate the role chance plays in outcomes	The role of luck plays in outcomes is underestimated
Regression Fallacy	When the mind detects regression around a mean, correlation, it wrongly evokes a causal explanation	Confusion between what we experience with what we remember
Planning Fallacy	Plans and forecasts are made unrealistically close to best case scenarios	Plans do not take adequate account of risk or the interaction of dependence and statistical fluctuation
Halo Effect	Our thinking is biased by existing judgements about people	Good or bad impressions of and trust level in people stick despite new evidence to the contrary
WYSIATI	Our thinking is biased on the assumption that What You See Is All There Is (WYSIATI) so we discount or ignore what we do not know	Jumping to and excessive confidence in conclusions on the basis of limited evidence
Illusion of Familiarity	Our thinking is biased towards things which are familiar to us, thereby reducing effort in cognition	Words that have been seen before are easier to see again
Illusion of Validity	Feeling that predictions are valid even after being aware of the fact they are marginally better than random guesses	Simple algorithms, such as the Apgar assessment for new born babies are generally more accurate than expert diagnosis
Endowment Effect	An item appears to increase in value for someone if they own it	Goods for exchange are valued differently from goods to be consumed