# Exploring the Theory and Practice of Knowledge Exchange: intention, context and characteristics

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# ABSTRACT

The concept of Knowledge Exchange (KE), increasingly adopted by policy makers and practitioners,[1] is used to describe policy, investment and related forms of collaboration between universities and public, private and third sector partners. The concept is inclusive of formal and informal collaborations that extend beyond universities' traditional roles as centres of research and teaching excellence with a recognised potential to generate significant social and economic benefits. This enquiry sets out to clarify the concept of KE as a distinct mode of university collaboration and identify important factors that act to shape the effectiveness of KE projects as the basis for exploring how future projects can be supported to maximise effectiveness.

The overall aim is addressed is through a review of relevant literature and a case study analysis incorporating six knowledge exchange projects undertaken within the context of The Creative Exchange, one of four AHRC funded Knowledge Exchange Hubs. Each project focused on addressing opportunities and challenges associated with digital innovation across a variety of social contexts. The study reflects the premise that to *design* and *enable* knowledge exchange initiatives effectively, it is necessary to understand the intention, context and characteristics of this mode of collaboration and the factors that shape the delivery of the related projects. Distilled from the case study analysis and elements of the literature review, a typology of three distinct forms of University collaboration is developed (Technology Transfer, Knowledge Transfer and Knowledge Exchange) and an *Exploratory Mode of KE* identified.

The exploratory mode is situated in the context of a innovation funnel, illustrating how the concept can be integrated in to a wider process of KE project development. Research insights provide a basis for identifying enabling factors that influenced the design and delivery of the selected projects, these insights in turn are used to inform the design of an enabling framework to support future KE projects.

[1] Academics, professional KE managers, project partners (public, private and third sector).

# DECLARATION OF AUTHORSHIP

I declare that the work included within this thesis is my own work and has not been submitted in the same form for the award of a higher degree elsewhere. To the best of my knowledge it does not contain materials previously published or written by another person except where due reference is made in the text.

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# DEDICATION

My thesis is dedicated to my mother who has been unfaltering
in her support, encouragement and patience, my North Star,
helping me to navigate on my journey.

# ACKNOWLEDGEMENTS

I would like to thank and express my appreciation to Professor Rachel Cooper for her support, guidance and wisdom and for always finding time during her hectic schedule to discuss and give much valued feedback. Also, to Professor Leon Cruickshank whose coffee and cake catch-ups are always appreciated.

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I would also take this opportunity to voice a special note of gratitude to my anonymous organ donor and their family, and for all donors and those who plan to donate, for this most precious of gifts.

# PROLOGUE

The language of exploration provides a useful metaphor in capturing the essence of the researcher's journey in exploring the meaning and practice of knowledge exchange (KE). This emphasis reflecting a convergence between the researcher's orientation towards the process of enquiry and the Creative Exchange, which provided the context within which this study took place.

The Creative Exchange (CX) was one of four UK-based Knowledge Exchange Hubs, implemented between 2013 and 2017, funded by the Arts and Humanities Research Council (AHRC). Their overall aim to explore, identify and design approaches to KE and related methods for connecting academic research and practice to the creative economy to catalyse innovation and generate wider economic and social benefits.

The CX was implemented by a consortium of three universities (Lancaster University, Newcastle University and the Royal College of Art). It integrated both research and practice-based activity focused on the meaning, challenges and opportunities (social and economic) provided by emergent digital technologies and applications associated with the concept of the Digital Public Space (DPS).

Central to CX programme was an innovative and novel approach to PhD research, with PhD students playing a central role in the delivery of over 90 projects undertaken in collaboration with public and private sector partners. Their active involvement in projects being a central element of their PhD research which was informed by and carried out in parallel to their project based work. A key characteristic of CX was the emergent nature of both enquiry and practice, reflected in an iterative process of discovery, design and delivery for both the CX projects and the research undertaken.

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# Abbreviations and Acronyms

| | |
|---|---|
| AA | Affinity Analysis |
| AHRC | Arts and Humanities Research Council |
| AI | Appreciative Inquiry |
| AR | Action Research |
| AS | Activity Statements |
| ASK | Appreciative Sharing of Knowledge |
| AUTM | Association of University Technology Managers |
| CKD | Chronic Kidney Disease |
| COP | Communities of Practice |
| CPD | Continuing Professional Development. |
| CSF | Critical Success Factor |
| CX | Creative Exchange |
| DCLG | Department for Communities and Local Government |
| DIKW | Data, Information, Knowledge, Wisdom (pyramid) |
| DPS | Digital Public Space |
| DUI | Doing-Using-Interacting |
| EF | Enabling Framework |
| FACT | Foundation for Art and Creative Technology |
| GIS | Geographic Information System |
| HEBCI | Higher Education Business and Community Interaction |
| HEFCE | Higher Education Funding Council for England |
| HEI | Higher Education Institution |
| I-M-O-I | Input-Mediator-Output-Input |
| IP | Intellectual Property |
| IT | Information Technology |
| KE | Knowledge Exchange |
| KM | Knowledge Management |
| KT | Knowledge Transfer |
| KTP | Knowledge Transfer Partnership |
| LTHT | Lancashire Teaching Hospitals Trust |

| | |
|---|---|
| MIT | Massachusetts Institute of Technology |
| MVP | Minimum Viable Product |
| NESTA | National Endowment for Science, Technology and the Arts |
| NHS | National Health Service |
| NICE | National Institute for Health and Care Excellence |
| NIS | National Innovation System |
| OECD | The Organisation for Economic Co-operation and Development |
| OI | Open Innovation |
| PPT | Participatory Production Technologies |
| PREST | Policy Research in Engineering, Science and Technology |
| PSO | Public Service Organisation |
| R&D | Research and Development |
| RAE | Research Assessment Exercise |
| REF | Research Excellence Framework |
| RRT | Renal Replacement Therapy |
| RSA | Royal Society for the Encouragement of Arts, Manufacturing and Commerce |
| SECI | Socialisation, Externalisation, Internalisation and Combination model |
| SME | Small and Medium-sized Enterprise |
| SMWT | Self-Managed Work Teams |
| SPRU | Science Policy Research Unit |
| STI | Science Technology and Innovation |
| TOR | Terms of Reference |
| TQM | Total Quality Management |
| TT | Technology Transfer |
| UCLAN | University of Central Lancashire |
| UGC | User Generated Content |

## Introduction to Thesis

"*If you want to manage something you should at least have an idea on the nature of what it is you are managing*" (Essers & Schreinemakers, 1997, p.25).

This quote from Essers and Schreinemakers with reference to the discipline of Knowledge Management (KM), when adapted to Knowledge Exchange (KE), reflects the overall purpose of this enquiry. Namely, **that to *design* and *enable* knowledge exchange initiatives effectively, it is necessary to understand the intention, context and characteristics of this mode of collaboration and the factors that shape the delivery of the related projects**.

The wider aim of this study is to provide a catalyst for further reflection, discussion and research among KE practitioners (academics, managers, policymakers and wider stakeholders) into the concept, policy and practice of knowledge exchange and how it can be designed and managed to maximise it's potential social and economic benefits.

The term '*knowledge exchange*' can be associated with multiple meanings and is often used interchangeably with related concepts such as technology and knowledge transfer. It can be used to describe a discrete mode of collaboration, encompassing a wide range of disciplines, methods and outcomes or, alternatively, a continuum of engagement. This continuum spans transfer-based models that are focused on connecting potential users with university-centred knowledge to projects which place emphasis on the co-creation of knowledge through the act of collaboration beyond the boundaries of the university.

Although the word '*exchange*' brings with it an emphasis on the transactional and reciprocal dimensions of relationships, the concept is increasingly used to describe a dynamic process of team working where different forms of knowledge (tacit and explicit) are transferred, exchanged, shared, created and applied to achieve mutually agreed goals.

While the author was principally interested in the design of knowledge exchange, it was considered important at the outset to investigate different modes of KE collaboration and their underlying assumptions. This reflecting the assumption that clarity in understanding will help to facilitate the design of enabling interventions strongly aligned with the characteristics, needs and social context of specific programmes and projects.

In the context of this enquiry, these issues are explored by addressing the research question:

***Can we improve the design and delivery of knowledge exchange through insights from existing theory identified from the literature review and case study analysis based on selected projects implemented through the Creative Exchange?***

The research process (Figure 1) was emergent and iterative in exploring and refining the research question and strategy in parallel to the literature review. The project design and delivery phase of the work was followed by data collection and analysis in the context of the CX projects selected for the case study.

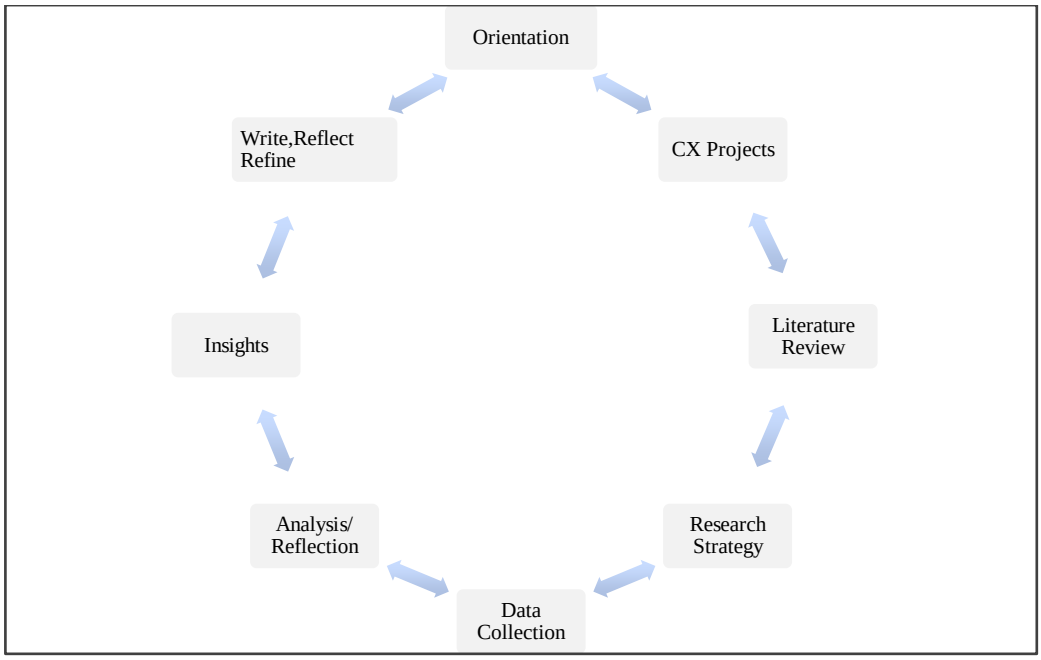



Figure 1 Overview of the research journey

The research strategy presented in *Section 1*, provides the scaffolding within which the approach to the enquiry was explored, identified and refined. The case study methodology and related methods are aligned with constructionism and the interpretivist theories which have informed the development of the approach adopted. The strategy is designed to reflect the enquiry's emphasis on the value of generating insights from the perspective of individual team members actively involved in the selected projects. The approach echoes the assumption that knowledge emerges through the process of team working (and with stakeholders) within the formal project and social context within which they are situated.

Working out from a team-centred perspective, the literature review presented in *Section 2*, addresses dimensions of theory identified as important in shaping the concept and practice of knowledge exchange more broadly. This review focuses on the historical development of *innovation theory* and related models including research and practice related to the concepts of the *National Innovation System* and *Knowledge Management* (Chapters 4, 5 and 6). The review identifies relevant theory, models and their underlying assumptions, exploring how they have shaped public and private sector policy and investment aimed at catalysing innovation, including knowledge exchange.

A further dimension of the literature review was to consider theories and approaches to understanding project-based team dynamics and effectiveness and is presented in *Section 3*. These insights are used to support the case and cross-case analysis (Section 3) and provide a scaffolding to structure insights from the six CX cases. The case study methodology, combined with the adapted Critical Success Factor (CSF) method (presented in Chapter 3), provided the framework for data collection and analysis and facilitated different dimensions of meaning associated with project design and delivery being identified and explored with insights generated from interview transcriptions and key project documents.

Distilled from the analysis and elements of the literature review, *Section 4* (Chapters 10,11 and 12) provides the opportunity to reflect on research insights and findings in relation to the research question and overall aims.

Based on the insights from the case study analysis and literature review, an *Exploratory Mode of Knowledge Exchange*[2] is identified (Ch.12) in relation to the CX where:

*Complex interdisciplinary, interorganisational and transient teams act with a high degree of autonomy and flexibility in exploring and defining opportunities and challenges associated with emergent technology, applications, market places and wider social contexts. Where PhDs play an active role in project design and delivery as an integral part of their own research journeys and where knowledge is shared, generated and applied through the act of collaboration itself. Creative and design practice are critical elements of methodology and play a central role in catalysing knowledge sharing and creation, both within the team and between the team and wider stakeholders. Where the co-creation of mock-ups and working prototypes are central in project delivery and outcomes.*

[2] Collaborative research is defined as *"..research projects with public funding from at least one public body, and a material contribution from at least one external non-academic collaborator*" (Higher Education Statistics Agency n.d.).

Research insights also provided a basis for identifying important factors that influenced the design and delivery of the selected projects. These insights have been drawn on to inform the design of an *Enabling Framework*, including measures to support future KE project design and implementation (Chapter 12). This is presented with the aim to catalyse reflection and a wider discussion among practitioners on how collaborations can be designed and supported to maximise their positive impact, both in terms of commercial and research outcomes.

# Section 1

## *Research Strategy*

# Section 1 Introduction

The purpose of *Section 1* is to introduce the reader to the research question, aims, context and strategy of this enquiry. It provides the overall framework to orientate the reader in relation to the author's research interests and the approach adopted for the enquiries implementation.

In *Chapter 1* the research question and aims of the study are presented along with its wider context. The chapter begins to explore the meaning of knowledge exchange and related concepts. It introduces key elements of existing research theory and practice explored through the literature review and considered relevant to the concept and practice of Knowledge Exchange (KE). The Creative Exchange and the concept of the Digital Public Space (DPS) are introduced as the operational context within which the enquiry has taken place and which has framed the selection of projects for the case study analysis. The scope and boundaries of the study are outlined and justification for the selection of the topic and the author's aspirations in terms of impact provided.

| **Epistemology** | **Theoretical Perspective** | **Methodology** | **Methods** |
|---|---|---|---|

Table 1 Research framework template (Crotty, 2012, p.5)

The research strategy is set out in Chapters 2 and 3. Categories derived from Crotty's (2012) ideal research framework (Table 1) are adapted to structure the narrative. It provides the scaffolding to reflect, explore and make explicit the researcher's own assumptions. Through these two chapters, the reader moves from left to right in the framework. Chapter 2 focuses on the underlying epistemological assumptions and the related theoretical orientation which have guided the development of the strategy. Chapter 3 presents the research methodology and methods adopted for data collection and analysis, exploring the degree of alignment between the different elements of the strategy (epistemology to method) and identifies issues related to demonstrating research quality.

# Chapter 1 Research Question, Aims and Context

"*We typically start with a real-life issue that needs to be addressed. We plan our research in terms of that issue or problem or question*" (Crotty, 2012, p.13).

The aim of Chapter 1 is to introduce the reader to the aims, objectives and context of this research enquiry.[3] The chapter concludes with the overall structure of the thesis.

The overarching research question identified:

***Can we improve the design and delivery of knowledge exchange through insights from existing theory identified from the literature review and case study analysis based on selected projects implemented through the creative exchange?***

Two propositions provide focus for the enquiry:

*Proposition 1*: That key characteristics of selected creative exchange project-based collaborations can be identified and used to support the development of a typology of knowledge exchange.

*Proposition 2:* Factors that enable and support the delivery of knowledge exchange collaborations can be identified from the case study analysis with insights then used to inform the design of an enabling framework to support the delivery of future knowledge exchange projects.

The overall *aims* of the enquiry are:

1. To explore the concept and characteristics of knowledge exchange teams[4] in the context of the creative exchange and how these project-based collaborations differ from other modes of university cooperation in support of innovation.

[3] In the context of this thesis, the terms enquiry and study are used interchangeably to describe this research investigation.

2. To improve understanding of the factors that impact on the design and delivery of project-based knowledge exchange collaborations.

3. To explore and identify how insights from the research can be used to design an enabling environment for future knowledge exchange collaborations.

4. To identify themes and priorities for future research into the policy and practice of knowledge exchange.

**The wider research context**

Knowledge Exchange (n): "*A set of policies and practices which enable the efficient and effective exchange and co-creation of knowledge between producers and users….so that the boundaries between the producers and users (of knowledge) ultimately become merged*" (Hagen, 2008, p.113).

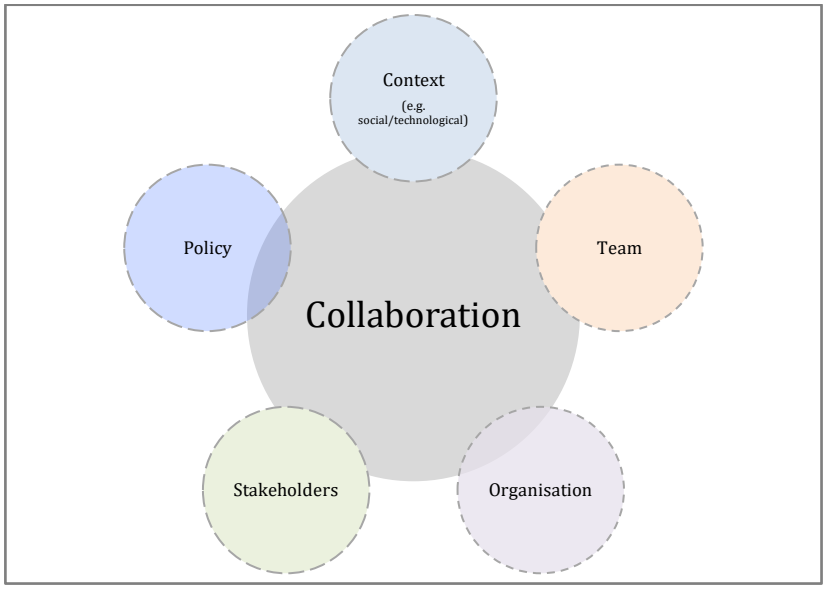



Figure 2 Dimensions of analysis within the enquiry

[4] Teams (n): *"…a psychological group whose members share a common goal which they pursue collaboratively. Members can only succeed or fail as a whole, and all share the benefits and costs of collective success or failure*" (Buchanan & Huczynksi, 2004, p.338).

Knowledge exchange is a concept increasingly adopted by government, universities and sponsors to describe policy and practices in support of collaborative projects undertaken between universities and non-university partners (public, private and third sector). Projects that are focused on catalysing innovation through leveraging expertise and knowledge through team working, where innovation can be defined as:

"*... the human effort in teams to develop, support and implement the renewal and improvement of a product, a service or a process*" (Oeij, 2017, p.1).

Figure 2 identifies key dimensions of knowledge exchange explored throughout the thesis, from concept and policy to the character of KE collaborations themselves. These lenses provide different perspectives on the meaning and practice of knowledge exchange, particularly in its role as a catalyst for knowledge sharing, creation and application with the aim of generating benefits for partners and society more widely arising from the development of new products, services and methods.

In the historical context of the European Enlightenment[5] and subsequently, with its emphasis on the primacy of reason and the power of the scientific method in driving progress, Harari (2014) identifies a growing recognition by governments of the emergent synergies between investment in research, scientific and technological discoveries and national economic wealth and power. A perceived virtuous cycle where investment and sponsorship had the potential to stimulate a positive impact in securing corporate and national wealth acting to generate increased tax revenue which provides further opportunities for investment and further social and economic development. Benneworth, drawing on the work of Bender (Bender 1989 cited in Benneworth 2009, p.15), explores the wider civic role played by European universities from the fourteenth century onwards.

[5] The Enlightenment refers to both a specific chronological period in European history during the second half of the 18th century, and to the emergence of shared values and beliefs reflected in the following quote: "*The Enlightenment consisted, in essence, of the belief that the expansion of knowledge, the application of reason, and dedication to scientific method would result in the greater progress and happiness of humankind*" (Open University, 2016, p.7)

While initially perceived as exogenous and beyond study, innovation[6] emerged as a central theme of interest for researchers, policy makers and managers throughout the 20th century and remains so today. As models were developed to explore and explain the concept and process of innovation, universities were increasingly identified as playing a central role in generating wider social and economic value beyond teaching and research. This role was manifested in their involvement in different modes of collaboration and engagement with wider society. This engagement took place as part of global, national and regional innovation systems, supported through government and private-sector investment. The investment[7] included the creation of enabling infrastructure to facilitate the design and delivery of project-based university collaborations with external partners (Godin 2009; Freeman 1995; Abreu et al. 2008; Lambert 2003; Sainsbury 2007; Wilson 2012).

Initial emphasis was placed on the role of universities in transferring technologies and knowledge generated from science-based research. Over the last twenty years, a wider range of expertise and non-science-based disciplines have been recognised as having potential to generate significant social and economic value. This was accompanied by an increasing emphasis on the co-creation of new knowledge through the act of collaboration itself (Crossick 2006; Kitagawa & Lightowler 2013; Hagen 2008). The concept of knowledge exchange (as in Hagen's definition), reflects this broader concept including a wider range of methods, disciplines (not least the Arts and Humanities) and forms of knowledge (explicit and tacit). As such, it more accurately reflects a process of innovation which is collaborative, interdisciplinary, non-linear and iterative (Hagen 2008; Crossick 2006; Abreu et al. 2008). A description reflecting this social dimension of knowledge exchange is provided by Cruickshank et al.:

*"Every productive workshop you have attended, every good meeting, creative conversation or even an interesting Twitter exchange is an example of good knowledge exchange"* (Cruickshank et al., 2012, p.1)

[6] Innovation: *"An important distinction is made between invention and innovation. Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out in practice*" (Fagerberg et al., 2005, p.5).

[7] An example in the UK being the Higher Education Innovation Fund.

The various meanings attributed to knowledge exchange reflect underlying assumptions about the nature of knowledge, innovation and collaboration and will provide a point for reflection throughout the thesis. A central cross-cutting theme for them all is the central role that collaboration and teamwork play in project design and implementation.

**The operational context for the enquiry**

The operational context for this enquiry is outlined in two dimensions. The Creative Exchange (CX), as the overarching AHRC funded programme within which the study is situated and the Digital Public Space (DPS) as the wider social, economic and technology contexts. This landscape provided a unique opportunity to study the theory and practice of knowledge exchange, exploring and demonstrating an innovative and novel approach to PhD research and multiple micro-projects with a range of partners, stakeholders and operational environments. The CX collaborations also reflected a strong emphasis on the role and value of design-led methodologies and roles for creative practitioners. This context was also strongly aligned with exploring the meaning and practice of KE with reference to emergent and uncertain opportunities and challenges associated with digital technologies.

*The Creative Exchange (CX)*

The Creative Exchange was a time-bound, knowledge exchange programme funded by the Arts and Humanities Research Council (AHRC). Implemented between 2012 and 2016, it was delivered by a consortium of three universities (Lancaster University, The Royal College of Art and Newcastle University) and was one of four national knowledge exchange hubs funded by the AHRC at that time. The CX reflected a number of important characteristics which made it a unique context within which to explore the theory and practice of knowledge exchange.

- The primary purpose of the CX was to facilitate and explore knowledge exchange between Arts and Humanities researchers and the UK creative economy in the wider context of the Digital Public Space.

- A strong emphasis on design-led methodologies, creative practice and co-creation of knowledge between partners and user groups.

- Spanning the public and private sectors, CX was designed to catalyse innovative collaborations between universities, businesses, third sector organisations, communities and government.

- Collaboration in the form of PhD-supported, time-bound small projects exploring social opportunities and challenges associated with emergent digital technologies and applications.

- Emphasis on exploring and understanding new approaches to KE and research.

The CX projects were embedded into different digital/social contexts addressing a wide range of individual and community needs. At the time of completion, the CX had invested in over ninety projects involving 100 organisations, 150 arts and humanities academics and twenty-one PhD students (Creative Exchange 2017). The author was one of the twenty-one PhDs working as part of the CX programme and the cases selected for inclusion in the Case Study were identified from within the overall portfolio of CX mini-projects implemented (See Section 3 and Appendix 4 for details of case selection).

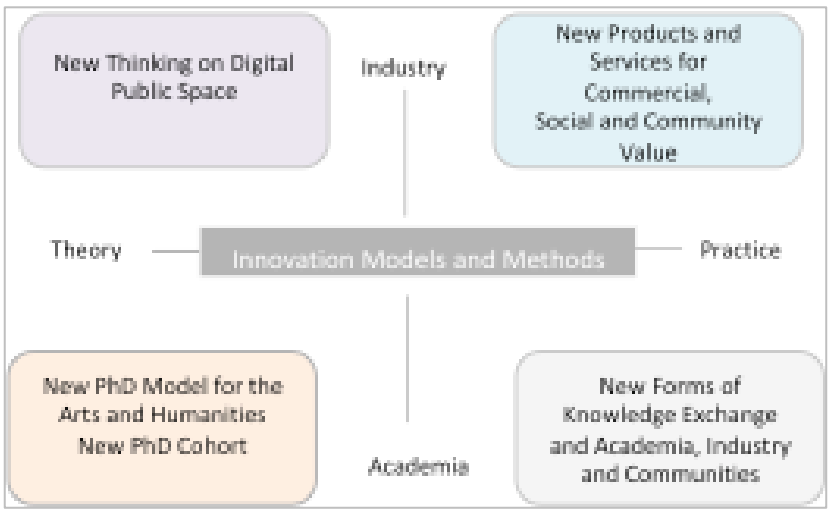



Figure 3 Dimensions of CX impact (adapted from Creative Exchange 2017)

Figure 3 highlights areas of impact from the CX's programme of work (Creative Exchange 2017, pp.5-7):

*Digital Public Space (DPS):* The concept of the Digital Public Space was initially explored and interrogated with reference to the BBC and its mission to explore public access to archives. It was then expanded to include a variety of contexts, needs and digital applications

*New products/services:* New products, services and technologies (apps, games, software, alongside company formation and job creation) in four main areas:

- Heritage
- Citizen participation
- Public service redesign
- Entrepreneurship

*Model for PhD*: Recruitment and supervision of twenty-one PhD students across three institutions, who engaged in a series of mini-projects as collaborators and facilitators. A new mixed-mode PhD model between theoretical enquiry and real-world application resulting in a new 'hybrid' group of researchers in KE who will help to recalibrate approaches to knowledge exchange across the HEI sector.

*New forms of Knowledge Exchange*: A recognition that the creative economy requires swift, agile and networked '*creative exchange*' and not simply a linear '*tech-transfer*' model of knowledge exchange.

*The Digital Public Space (DPS)*

*"Cyberspace,*[8] *not so long ago, was a specific elsewhere, one we visited periodically, peering into it from the familiar physical world. Now cyberspace has everted. Turned itself inside out. Colonised the physical"* (Gibson 2010, n.p.)

[8] Cyberspace (n): "*The hypothetical environment in which communication over computer networks occurs*" (Oxford English Dictionary 2012d).

The Digital Public Space was the wider context within which the Creative Exchange and its portfolio of projects were implemented. While initially defined in terms of public access and engagement with the BBC's digital archives, the concept was broadened to include a wide range of contexts, partners, social and individual needs, digital technologies and emergent applications. Rather than arriving at a single and simple definition, the concept of the DPS expanded:

" *..and exposed the plurality concepts that are associated with these new technologies in our public space"* (Jacobs and Cooper, 2018, p.8).

From the portfolio of CX projects, four content themes are identified (Creative Exchange, 2017, p.6) :

- *Heritage, place and tourism*: Novel applications of digital technology were used to re-envision heritage/tourism offers.
- *Citizen participation:* Creative digital technologies were adopted to encourage more open democratic processes in local communities.
- *Public service redesign:* Open data and other technology resources were co-opted to improve local services, from transport to health.
- *Entrepreneurship:* Emphasis on working with hard-to-reach micro businesses.

From this wider perspective, the DPS concept can be framed in terms of the following (Jacobs and Cooper, 2018, pp.23-24):

- Includes digitally stored and shared information.
- Is accessible to the public.
- Is space within which information flows.
- Includes both archives of content and venues for interaction.
- Has temporal aspects: not everything may be persistent, some is time specific.
- Is potentially accessible to all, but might not be evenly distributed.

Complexities in defining the DPS reflects the dynamic and transient process by which people create and share digital content as they move through public and private spheres in both physical and virtual spaces. An overarching characteristic is its dynamic, emergent and hybrid nature. Table 2 identifies key characteristics of the DPS in relation to the development of products and services in an emergent context in terms of needs and market demand (adapted from Rigby et al. 2016).

| Dimension | Characteristics |
|---|---|
| Technology | Emergent digitally focused technologies and/or applications in relation to potential products and services. |
| Market/ context | Dynamic and fast changing with emergent demand or no effective demand for untested product/services. Many unknowns with strong emphasis on exploring needs, context, opportunities and challenges (both technical, commercial and social). |
| Regulatory frameworks | Emergent and potentially contentious e.g. ownership of data, IP etc. |
| Customers/ users | High priority attached to exploring innovative design-led approaches to engaging users and potential customers as partners in exploring and understanding context, needs and in the design process itself. |
| Type of Innovation | Early stage products/services development with emphasis on development and proof of concept through use of mock-ups and prototypes. |
| Modularity of work (method) | Iterative and emergent with lessons learnt and applied en route. Cyclical process of user engagement in design and prototyping, getting feedback from potential users/modifying and redeploying. |
| Mistakes | Lessons can be integrated into the design process. |

Table 2 Characteristics of the Digital Public Space (adapted from Rigby et al. 2016)[9]

It is the wider concept of the Digital Public Space that has provided the context within which the Creative Exchange was implemented and this enquiry has taken place.

[9] Adapted from Embracing Agile (Rigby et al. 2016).

## Justification and potential impact

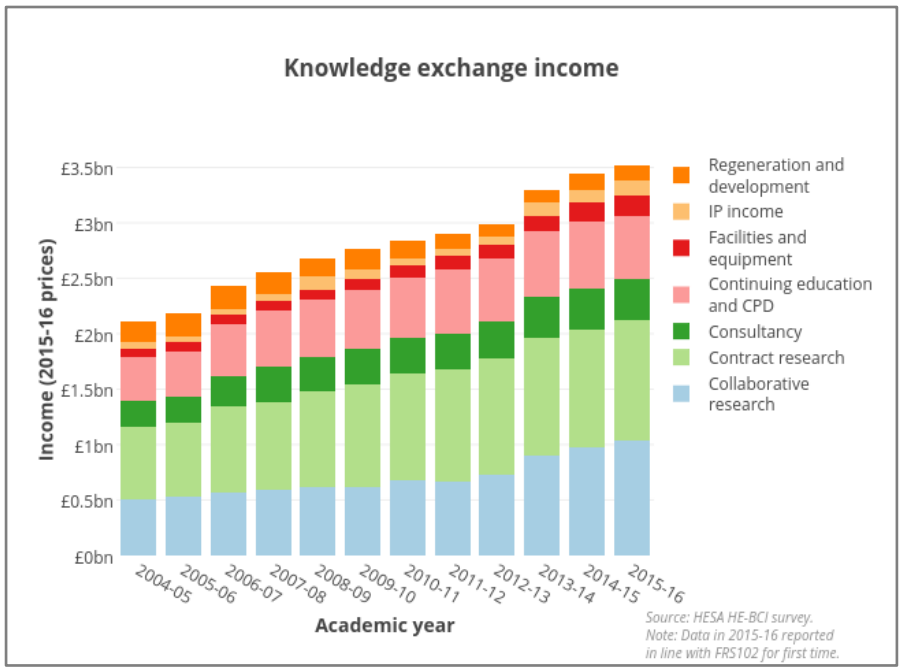



Figure 4 Knowledge exchange income: England 2004-2016 (HEFCE 2017a)

The scale of investment in and income from knowledge exchange activities reflects its role in catalysing economic and social development. In the UK, direct government investment supporting KE amounts to £200 million for 2017-2018. In terms of income, English universities generated £3.5 billion from KE activities in 2015-2016 (Figure 4) and £4,207 billion for the UK as a whole (HEFCE 2017a). Benefits over and above income are identified in relation to academic research and teaching: a range of networking opportunities; insights for further research; new projects; opportunities to evaluate and exploit research outcomes and access to cutting-edge knowledge that can be fed back into curriculum; student-based projects; and follow-up research (HEFCE 2017b).

Effective knowledge exchange requires effective collaboration. In order to develop enabling frameworks to maximise the probability of successful project outcomes, a clear understanding of knowledge exchange as a mode of university collaboration is required. This clarity providing a point of reference for the design of an enabling support ensuring that related measures are aligned with the needs of their target programmes and projects.

In essence, this statement frames the problem addressed through this research study with explicit reference to the mode of knowledge exchange manifested through the Creative Exchange and the wider uncertain and emergent technology and social contexts the CX explored. In this context, greater knowledge and insights into i) the modes of collaborations and ii) forces that shape effective team working, particularly in the context of emergent technology, applications and markets where risks and rewards are highly uncertain. Insights generated from the research are aimed to be of value for knowledge exchange practitioners, teams, sponsors and government in catalysing discussion and supporting the design of future KE programmes and projects.

While it has not been possible to identify research evaluating the effectiveness of individual knowledge exchange projects, Castellion and Markham (2013) report a 40% failure rate[10] for product innovation teams across both public and private sectors and across a range of industries. In relation to start-up software companies, Bajwa and Wang (2017) reference a failure rate of between 75% to 90% reflecting an uncertain context and a one-project approach, which characterises many small companies associated with this sector (Marmer et al. 2011 cited in Bajwa & Wang 2017, p.2376). Differences in failure rates may also be contingent on industry and market contexts, in part reflecting the agile contexts within which these projects operate. In the Netherlands, Oeij notes that failure can be found in *'well-managed projects run by experienced managers and supported by highly regarded organizations*' (Oeij, 2017, p.1). Thus, stressing interaction between a range of factors including hard (structures/processes e.g. administration) and soft (team norms and behaviours) in complex projects operating in uncertain environments.

**Existing theory as a point of reference**

Explored through the literature review (Chapters 4,5,6 & 7), existing theory and research have shaped elements of the research strategy and process:

- Defining scope and questions.
- The development of a framework for data collection and analysis.

- Exploring the relationships between relevant theory, policy and the practice of Knowledge Exchange.

*Management and Organisation Theory*: Existing research and theory provided a starting point in identifying a method and framework for data collection and analysis to support the identification of factors (the Critical Success Factor Method) shaping the effectiveness of knowledge exchange teams.

*Innovation Theory*: The concepts and models of innovation and their underlying assumptions provide a framework to investigate different modes of university collaboration and their underlying assumptions.

*Knowledge Management*: The nature of tacit and explicit knowledge and related concepts and theories associated with the management of knowledge sharing, creation and application. Emphasis was on exploring models, their assumptions and relevance to knowledge exchange.

**The researcher's perspective**

*"Collaboration is a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals"* (Mattessich et al., 1992, p.11).

My interest in the design and implementation of KE reflects my professional experience[11] in supporting external collaborations between universities and public, private and third sector organisations: collaborations aimed at creating economic and social value through knowledge sharing, generation and application focused on catalysing innovation in products, services and solutions. A central insight from this experience was an appreciation of the challenges and opportunities provided through inter-disciplinary teams working to achieve shared goals with limited resources.

[11] A career spanning public and private sector roles. Working with UK government, the European Commission with different national governments and third sector agencies in the design and delivery of policy and related programmes and projects. Most recently working in the area of knowledge exchange within the HEI sector and with public and private organisations across the UK's creative industries. Experience has also included private sector roles related to business development and consultancy.

Particularly challenging was the alignment of expectations between partners and team members, formal structures and processes and effective team working in support of positive outcomes, specifically in the context of complex, formal time- and resource-bound projects, and latterly, projects which included partners from the arts and humanities and the creative economy. A further observation was how little attention is given to understanding the factors that act to support or undermine successful collaborations as the basis for improving their design and delivery.

A starting point on my research journey was an appreciation that teamworking and collaboration are at the centre of our human journey and key to the success of our species in adapting, overcoming challenges and identifying and taking advantage of opportunities.

*"It is human to connect with others, by sharing stories, education, mentoring and other mechanisms that we have discovered throughout time"*
(Thatchenkery & Chowdhry, 2007, p.31).

Archaeological records demonstrate that modern humans (*Homo sapiens*) emerged in Africa approximately 200,000 years ago.[12] Patterns of behaviour associated with the modern human mind became increasingly manifest in the archaeological records between 100,000 and 60,000 years ago (Cook 2013). These demonstrated emergent and increasingly sophisticated material and social culture, reflecting in turn complex cognitive capabilities (Amati & Shallice 2007) not least imagination and creativity. As humans migrated across Europe 40,000 years ago, a social and material revolution took place which has maintained its worldwide momentum to the present (Mithren 1999). The emergence of art, religion and of increasingly sophisticated technologies have been traced to this period, with subsequent centuries marked by an increasing velocity in the generation, accumulation and application of knowledge in all aspects of human life. In this context, our species' ability to generate, share and apply knowledge through reflection, problem-solving and collaboration is a defining feature

[12] Recent archaeological discoveries in Israel identify human remains from approximately 180,000 B.C. which indicates an earlier movement out of Africa and challenges the accepted dates for the emergence of *Homo sapiens* in Africa (Marshal 2018).

of economic and social change. Amati and Shallice (Amati & Shallice 2007, pp. 359-361) identify the unique human capabilities (h-Capacities) that facilitate the generation and sharing of knowledge in a wider social context:

- *Language* and communication.
- *Tools and instruments:* The development and application of tools and instruments with the purpose to *'…amplify, optimise and extend natural capacities*'.
- Signs, signals and other homomorphic representations: enabling humans to visually represent *'aspects of reality'*.
- *Dynamic concepts*. The ability of humans to recognise and understand dynamic forces in terms of cause and effect.
- *Aesthetic sense. " Poetry and literature are generated from language, painting, sculpture, and plastic arts from schematic representations, music from vocalisation, dance from action and so on*".
- *Meta representation.* The ability to conceptualise and represent entities beyond the world that is immediately perceived, *' a second or higher-level interpretation of 'mental, public or abstract' entities'.*
- *Algorithmic capacity*. Humans have the capacity to think and act in terms of logic, '*an efficient algorithmic capacity…*' which in time '*… provides the basis of logical operations, and eventually of arithmetic, geometry, and mathematic*s'.
- *Categorisation and organisation*: Ability to organise knowledge e.g. typologies.
- *Theory of Mind: "the ability to read the attitudes and intentions of others and make inferences based upon these perceptions".*
- *Anticipatory Planning:* Planning and acting to achieve a desired future scenario.

It is a recognition of the essentially human, social and dynamic nature of knowledge exchange that has informed my own research. In the context of this thesis, knowledge exchange is explored from the primary perspective of the collaborative process itself and of those directly involved. A process by which individuals and organisations, reflecting different epistemologies, professional disciplines, working cultures and world views, choose to work together to achieve mutually agreed goals; and to achieve this while operating in an uncertain environment with limited resources and within agreed deadlines.

**Scope and boundaries of the enquiry**

The enquiry has taken place within the context of the Creative Exchange's mission to explore new models for PhD research where a balance was sought between '*..theoretical enquiry and real world application..'* (Creative Exchange 2017, p.6). This was manifested by the PhD researcher playing a role in the design and delivery of CX mini-projects, which provided the context for the PhD's own research enquiries. At the centre of this research project is the study of six CX projects (cases) included as part of the Case Study Analysis. In this context, the meaning of the project is aligned with the European Commission's definition where:

"*A project is a temporary organisational structure which is set up to create a unique product or service (output) within certain constraints such as time, cost, and quality.*

- *Temporary means that the project has a well-defined start and end.*
- *Unique output means that the project's product or service has not been created before. It may be similar to another product but there will always be a certain level of uniqueness.*
- *A project's output may be a product (e.g. new application) or a service (e.g. a consulting service, a conference or a training programme).*
- *The project is defined, planned and executed under certain external (or self-imposed) constraints of time, cost, quality, as well as other constraints related to the project's organisational environment, capabilities, available capacity, etc.*" (European Commission, 2016, p.5)

These cases provided the opportunity to explore the characteristics, dynamic processes and factors shaping project design and delivery. Through an iterative process, the enquiry was exploratory and emergent in strategy and delivery – a hybrid PhD which required the student to navigate and reconcile the requirements of research and the demands of practice in complex real-world projects. This was reflected in a process of reflection and iteration prior to clarifying the question and arriving at a research strategy. This was a strategy that enabled project-level insights to be used in both project and research contexts. Key issues related to scope included:

- *Time:* Limited time split between the demands of project and thesis.
- *Scope of literature review*: A need to define the boundaries of the literature review as KE spans several different academic disciplines and areas of policy and practice.
- *Number and selection of cases:* The importance of identifying appropriate cases from the CX portfolio (and related selection criteria).
- *Research Strategy:* Priority in aligning theoretical assumptions with methodology and method in relation to question, context and researcher's orientation. The focus was to explore team members' perceptions of KE in the context of their own experiences. These insights provided a basis for developing an understanding of characteristics and enabling factors.
- *Data collection and analysis*: To explore and adapt the Critical Success Factor method for data collection and analysis (Chapter 3), to the context, time available, and with reference to gaining the necessary insights to address the research question.

Reflecting the epistemology (constructionism) and theory (interpretivism) within the framework of the case study methodology and CSF method, the enquiry focused on generating a deep insight into the nature of knowledge exchange in the context of the CX cases. While insights are not generalisable, they are focused on exploring the social context within which the meaning and practice of knowledge exchange collaborations take place. They provide a '*thick description*'[13] of the characteristics and enabling factors reflected within the collaborations studied (Geertz 1973; Lincoln & Guba 1985; Ponterotto 2006).

[13] Thick description*: "Intensive, small-scale, dense descriptions of social life from observation, through which broader cultural interpretations and generalizations can be made. The term was introduced in the philosophical writings of Gilbert Ryle and developed by Clifford Geertz* " (Scott & Marshall, 2009, p.761, Geertz 1973). Ponterotto (Ponterotto, 2006, p.540) cites Denzin (Denzin 2001) as playing a critical role in exploring its application beyond anthropology to social sciences more generally. This is described by Lincoln and Guba as a way of securing external validity by providing sufficient detail and context to enable readers to evaluate whether insights are transferable to other contexts (Lincoln & Guba 1985).

**Structure of the thesis**

The structure of the thesis reflects a research journey undertaken by the author, explicitly exploring what is meant by knowledge exchange as an area of policy and practice and as a dynamic process of collaboration. *Section 1 Research context and strategy:* Chapter 1 Introduces the research aims, question, context and strategy for the thesis. This is followed in Chapters 2 and 3 by a detailed presentation of the research strategy. Chapter 2 outlines the underlying epistemological assumptions and related theories that have informed the design of the strategy. This is followed in Chapter 3 by a comprehensive presentation of the related research methodology and methods adopted for data collection and analysis.

*Section 2 Framing knowledge exchange with reference to existing theory and practice:* Chapters 4, 5 and 6 explore relevant areas of research theory and practice through the literature review. They study theories, concepts and insights relevant to the different modes of university collaboration and assist in identifying their underlying assumptions and approaches.

*Section 3 Presentation of the case study and cross-case analysis:* Chapter 7 presents the Kendal project (Improving the presentation of blood test results for renal patients). The level of detail in the Kendal case reflects the author's direct role in the project design and delivery and the opportunity the project provided to closely explore themes related to the thesis. Chapter 8 presents the five remaining CX cases where data were generated from interviews with team members and relevant documents. Chapter 9 provides a cross-case analysis of identifying enabling themes and factors and begins consolidating insights and identifying patterns.

*Section 4 Research Insights and Conclusions:* Chapter 10 outlines an emergent typology of knowledge exchange in relation to other modes of university engagement informed by insights from the literature review and case study analysis. Chapter 11 reflects on the research journey and conclusions reached in relation to the research question and propositions. Chapter 12 completes the thesis by providing a reflection on research quality, lessons learned and possible areas of follow up in terms of research and the management of knowledge exchange.

# Chapter 2 Research Strategy: Epistemology and Theory

In Chapter 2, the author's underlying epistemological and theoretical assumptions are explored (the first two columns of Crotty's framework in Table 3), both in relation to their alignment with the author's own perspective on knowledge and its acquisition in the context of the study, and across the strategy in relation to theory, methodology and method. This analysis is not exhaustive but attempts to capture important guiding principles that have informed the researcher's own approach to understanding the nature of knowledge exchange in a social context.

| Epistemology | Theoretical Perspective | Methodology | Methods |
|---|---|---|---|
| Constructionism | Interpretivism | Case Study | Semi-structured Interviews |
| | Pragmatism | Critical | Project Documents |
| | Phenomenology | Success Factors | Participant |
| | Appreciative Inquiry | | Observation |

Table 3 Framework for research strategy (Adapted from Crotty, 2012)

**A working definition of knowledge**

*" Knowledge (n): Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject"*
(Oxford University Press 2016).

This simple and broad definition of knowledge provides a starting point in the exploration of epistemology and development of the research strategy for this enquiry. Polanyi (Polanyi 1958, 1965) notes a clear distinction between two types of knowledge; explicit and tacit. He identifies explicit knowledge as being codified and expressed in formal and systematic language reflected in the form of data, words/numbers algorithms, formulae, specifications, manuals and reports; and in this form it can be processed, stored and transmitted.

In contrast, tacit knowledge is not formalised and is centred in personal experience (Polanyi 1958; Nonaka & von Krogh 2009; Nonaka et al. 2000):

"*Tacit knowledge is deeply rooted in action, procedures, routines, commitment, ideals, values and emotions. It `indwells' in a comprehensive cognizance of the human mind and body*" (Nonaka et al., 2000, p.15).

Sveiby (1997) defined knowledge as either i) object or ii) a subjective social construct which is generated in relation to both the individual and context (Paulin & Suneson 2012). In large part, this reflects the distinction between explicit and tacit knowledge (Polanyi 1958; Spencer 1997; Nonaka et al. 2000; Nonaka & von Krogh 2009).

A further perspective on types of knowledge is captured in a distinction between individual and group knowledge (Hislop 2013):

- *Individual knowledge*: is generated and resides in the individual. From an objectivist perspective, individual cognition is the basis for knowledge and understanding.

- *Group knowledge*: knowledge that exists within the social group and manifests in shared work practices, understanding and perspectives. It can be both explicit, such as written guidelines, or tacit, group knowledge (e.g. ways of working based on shared memories and experience).

Hecker (2012) identified three dimensions of collective knowledge (Table 4). While different epistemologies and theories of knowledge acknowledge the explicit/tacit distinction, from an objectivist point of view they are mutually independent with a tendency to attach a higher value to explicit knowledge. From a constructionist perspective, all knowledge possesses both an objective and tacit dimension and can be located along a knowledge continuum.

| Types | Definition | Locus | Relationship to individual knowledge | Origins | Exploitation |
|---|---|---|---|---|---|
| Shared | Held by individuals - collective | Individuals | Intersection between individuals | Shared | Implicit co-ordination |
| Complementary | The division of expertise within a group | Relationship between knowledge sets | Interdependencies between sets (individuals) | Specialisation. Division of knowledge within groups | Combination Integration Co-ordination |
| Embedded | Collective artefacts | Artefacts | Combination of individual knowledge in an articulated form | Codificaiton and explication. | Re-constitution Re-appropriation |

Table 4 Three types of collective knowledge (adapted from Hecker 2012, p. 430).

## An epistemological context

"*The Enlightenment consisted, in essence, of the belief that the expansion of knowledge, the application of reason, and dedication to scientific method would result in the greater progress and happiness of humankind"* (Open University, 2016, p.9).

While always central to human endeavour, approaches to the concept of a knowledge and its acquisition have changed through time. A two-level framework to these theories provides a structure for understanding many of these models (Bonevac 2013). A first, higher tier illustrates how different aspects of reality are manifest to human perception, with a second underlying level used to explore and explain the forces shaping the manifest world. It is at the underlying level that different paradigms reflect different assumptions and explanations as to the forces and the causal mechanisms at work in shaping the world we experience and how we understand it.

Lincoln and Guba (1985) outline the emergence of different paradigms[14] in exploring and explaining the underlying forces shaping the world humans experience and give meaning to. While not being mutually exclusive (in that different approaches co-exist), they prove useful in identifying different theories of knowledge that became dominant at different times.

[14] Paradigm (n): *"... a world view, a general perspective a way of breaking down the complexity of the real world…Paradigms tell them (adherents) what is important, legitimate and reasonable*" (Patton cited in Guba & Lincoln, p.43, 1989).

In this historical context, the pre-enlightenment mode of thinking (up to the 17th century) was strongly influenced by theology, mysticism, tradition and the claims of religious and secular authority (in the form of the Church and structures of governance and power). While philosophy provided access to reflection and reason in attempting to understand the world and human affairs, it was largely integrated into an ecclesiastical world view (Russell 1946, p. xiii). In the absence of empirically-based knowledge and reasoned explanations as to the workings of the world, communities invariably turned to personal experience, tradition and the supernatural to aid their understanding of the forces that shaped the world and their own lives.

During the European Enlightenment, this view was increasingly challenged as empiricism emerged as the dominant perspective on the nature of knowledge and knowing (Russell 1946). Empiricism emphasised the ability of humans to acquire a true knowledge of the world and the laws which governed it through the application of reason to their own experience.

" *They suggested that the natural world could be explored and understood, and that nature and everything in it was governed by underlying 'laws'; that there were rational, universally valid answers to the questions asked by an enquiring mind; that for every effect there was an identifiable cause, for every natural phenomenon an explanation, a category and a definition, if only we try hard enough to find it"* (Open University 2016, p.11).

The impact of the Enlightenment scientists and thinkers was profound, generating a lasting shift towards science and empiricism as the primary source of verifiable knowledge. This perspective provided the basis for the development of the scientific mode of enquiry (positivism); an approach predicated on the belief that it was possible to generate reliable and verifiable knowledge of an independent reality (Hislop 2013). Related knowledge claims could be differentiated and validated from those based on opinion and belief, within a social context where, within a paradigm of empirical practice, the processes, criteria and mechanisms required to demonstrate validity were developed (Shapin 1984).

Positivism's guiding principles include:

- A reality that exists independently of individual human consciousness as a separate entity but one that can be observed and understood.
- Knowledge can be objective and mirror the external reality and can be separated from individual subjectivity (Guba & Lincoln 1989).
- The objective character of knowledge reflects the underlying principles of a positivist and empirical approach to enquiry. This scientific method can be applied to understanding the social reality and not merely the physical world. Social behaviour (characteristics and patterns) can be identified, observed, quantified and measured as the basis for identifying the objective laws and principles that govern social behaviour;
- Within the positivist framework, priority is attached to objective/explicit knowledge over tacit knowledge and understanding which is characterised as being difficult to articulate and reflects cultural and personal perspectives (subjective).

An alternative framing of the guiding Enlightenment principles is provided by Bonavec (2013):

- *Truth:* There are truths that are absolute, independent of any individual mind and thus universal.
- *Knowledge*: It is possible to have objective knowledge of some of them.
- *Reason:* Reason is the best way to achieve and justify such knowledge.
- *Progress:* Acting rationally in response to objective knowledge improves our chances of achieving our aims.

*"Just as with other natural phenomena, Enlightenment thinkers came to the conclusion as a result of observation that human nature itself was a basic constant. In other words, it possessed common characteristics and was subject to universal, verifiable laws of cause and effect"* (Open University, 2016, p.22).

Applied to the practice of social research, positivism assumes that social phenomena can be treated and understood by the same methods as the physical world; that explanatory hypotheses are developed, evaluated and tested. In this context, the observer is independent, objective and emotionally detached from the subject of analysis. Patterns and theories can be generated which enable generalisable conclusions to be drawn about the underlying laws at work in shaping a fixed and predictable social reality (Johnson & Onwuegbuzie 2004).

Post-Enlightenment philosophical movements emerged throughout the 20th century (post-positivism, critical theory and social constructionism, and the catch-all post-modernism etc.) and continue to the present. These alternative perspectives challenge the underlying assumption of objectivism and the empirical approach; explicitly, that an independent and objective reality can be observed, understood, validated and generalised as the basis for true knowledge. The critiques reflect new assumptions ranging from a belief that absolute knowledge can be acquired, to the assumption that knowledge is constructed as humans interact with the world and each other, and to a purely subjective perspective on how to make sense of the world and their place in it.

**Exploring my own assumptions**

*"What then is constructionism? It is the view that all knowledge and therefore all meaningful reality as such is contingent upon human practices, being constructed in and out of interaction between human beings and their world, and developed and transmitted within an essentially social context"* (Crotty, 2012, p.42)

The underlying epistemology informing this research strategy is constructionism. This perspective reflects the premise that meaning is created/co-created as humans interact with an independent reality (the world) and with each other. This provides a perspective that is consistent with the social nature of collaboration and knowledge exchange, whether at the level of the teams working within a wider social and organisational context or individuals who approach team work from their own epistemological and professional modes of practice. A central tenet of constructionism is the principle of intentionality.

This principle places emphasis on the dynamic interaction between subject and object, between consciousness and that of which an individual is conscious (Crotty 2012, pp. 44- 45 citing Brentano 1973, Lyotard 1991). The dynamic interplay between subject and object is the basis upon which meaning is created. This is contrasted with the independent reality of objectivism, where object and subject are separate, and a purely subjective, individual perspective on the creation of meaning.

A distinction between the two related concepts of constructivism and constructionism is defined in the context of the theory and practice of psychology. The distinction is based on the focus on the individual and the internal cognitive processes that shape sense making as they (the individuals) act and react to the world around them (constructivism). This is contrasted with a process of generating meaning through social interaction and involves replacing emphasis on an individual's constructs, frames of reference and cognition with an interest in the ways in which people interact with each other in terms of communication, discourse and dialogue as they construct a shared meaning (McNamee, 2004). The implication arising from McNamee's perspective is that is not possible to define an absolute or objective truth independent of individual human consciousness as it interacts with other humans in a wider culture.[15] This is strongly aligned with the context of this enquiry where the focus of research is to gain insights into the meaning that individuals generate on their collaborative journey, which in turn is embedded and shaped by a wider professional, organisational and social culture (Geertz, 1973, p.44).

The related practice-based perspective of knowledge provides a complementary perspective on knowledge and meaning. Within this context, knowledge is characterised as *'an epistemology of practice'* (Cook & Brown 1999) reflecting the nature of knowledge and knowing as being embedded in the interplay between thinking and doing. Reflecting the principles of interpretivism and pragmatism, knowledge is:

[15] Culture*: "Culture is the invisible force behind the tangibles and observables in any organization, a social energy that moves people to act. Culture is to the organization what personality is to the individual - a hidden, yet unifying theme that provides meaning, direction, and mobilization*" (Killman 1985 cited in Carayannis & Campbell, 2012, p.4).

- *Embedded in practice*: Knowledge does not exist externally to people and society but rather is embedded in human activity. Knowledge is not merely a product of cognition but also a function of action. The act of knowing arises from the act of doing (directly relevant to a process of co-creation of knowledge/artefact within the KE collaborations).

- *Multi-dimensional in nature and not binary (tacit and explici*t): Rather than assuming that knowledge is binary, being tacit or explicit, the practice-based perspective emphasises that knowledge is both explicit and tacit as well as individual and collective. It explicitly acknowledges that all knowledge has both explicit and tacit dimensions that are inseparable.

- *Embodied in people and socially constructed*: Challenges the objectivist assumption that knowledge is separate and independent from people and values (individually and collectively). In this context knowledge reflects both individual and social/community values.

- *Knowledge can be contested*: Contested on the basis of different factors including world views, professional perspectives and values to the dynamics and power and conflict between individual and groups when working collaboratively, for example between nurses, doctors and patients working in a clinical context (Nicolloni 2011 cited in Hislop 2013).

These assumptions fundamentally challenge the belief that objective knowledge is independent of social interaction (culture) and is value free.

**Theories of knowledge**

*"..it may be one explaining what conditions must be satisfied and how they may be satisfied in order for a person to know something"* (Lehrer, 1990, p.5).

Differentiating knowledge from opinions and belief is an important dimension of epistemology and, from the practical perspective of the researcher, there is a specific need to demonstrate credibility in assertions /propositions generated from research undertaken and on what basis. Derived from classical philosophy (Plato 428-347 BC), the concept and criteria defined by *Justified True Belief* (JTB) has historically been used as a framework to evaluate a given knowledge proposition's claim to be true and meaningful. While not watertight (Gettier 1963 cited in Jonathan et al. 2017), JTB provides a framework to explore how insights generated from a research enquiry can provide reliable insights.

Different theories of knowledge explore different perspectives and criteria for evaluating knowledge claims and how they can be demonstrated:

*Correspondence Theory*: Knowledge, as acquired through the empirical mode of enquiry, assumes humans are independent observers of an independent reality with true knowledge, in the form of facts, being an absolute and true reflection of this reality (Zalta & Marian 2015).

*Coherence Theory:* Associated with constructionism and interpretivism, it places emphasis on the construction of meaning through human interaction with reality and each other. The theory emphasises the need to demonstrate coherence[16] and consistency[17] between knowledge proposition relating to the same object/subject (Young 2016).

[16] Coherence (n): "*the quality of being logical and consistent*" (Oxford English Dictionary 2012a).

[17] Consistent (adj.)*:* "*Following a regular pattern. Unchanging*" (Oxford English Dictionary 2012b).

*Utility*[18] *Theory*: From a pragmatic point of view, truth boils down to whether or not a given proposition proves to be useful in a practical context (Feilzer 2010 citing Rorty, 1999). As William James states, '*It is useful because it is true. It is true because it is useful*' (James, 1907, np).

A further aspect of the pragmatic approach reflects its emphasis on *Warranted Assertibility* where proposition acquires the status of being warranted '*..through the ongoing, self-correcting processes of enquiry'* (Dewey 1941). The concept emphasises the emergent and convergent nature of knowledge as a product of a dynamic process of enquiry and practice. Rather than being absolute, truth statements/judgments are contextualised in relation to past and future that may eventually lead to an ultimate truth (Boyles 2006).

*"The 'absolutely' true, meaning what no farther experience will ever alter, is that ideal vanishing-point towards which we imagine that all our temporary truths will some day converge"* (James 1907, p.150).

Although not exhaustive, different theoretical perspectives illustrate the absence of a consensus on what constitutes knowledge and truth. They also highlight the importance and impact of underlying assumptions on how knowledge can be acquired and validated in the context of a given research enquiry.

**Theoretical perspective**

A theoretical perspective provides the link between epistemological assumptions about knowledge and knowing to a detailed methodology and methods (Crotty, 2012). Theories elaborate the underlying assumptions concerning the knowledge sought in relation to the research question asked and context being studied. The broad theoretical framework informing my research methodology is *interpretivism* with its emphasis on the social construction of meaning. This is manifested in several relevant streams of theory and practice.

[18] Utility (n): "*The state of being useful or profitable*" (Oxford English Dictionary 2012f).

*Pragmatism*

In historical context, pragmatism as a body of theory is anchored in post-Civil-War America in the second half of the 19th century and the emergence of a post-war optimism and progressive view of human culture and society (Crotty, 2012, p.74; Menand 2001). Shaped by the work of William James, Charles Sanders Pierce and John Dewey, pragmatism explored the notion that humans are active agents in producing meaning as they interact in the world around them and address the challenges of day-to-day life.

| **Principles of Pragmatism** | |
|---|---|
| 1. | Recognises both the importance of the natural or physical world as well as the emergent social and psychological world e.g. culture, language, institutions etc. |
| 2. | Places a high regard for the reality of the inner world of human experience in action. |
| 3. | Knowledge is viewed as being both constructed and based upon the world we experience and live in. |
| 4. | Replaces subject/external object dichotomy with process-based organism/ environment interaction. |
| 5. | Current belief and research conclusions are rarely if ever perfect, certain or absolute. |
| 6. | Warranted Assertibility (no absolute truth but rather an ongoing and self-correcting process of enquiry). |
| 7. | Different and conflicting theories and perspective can be useful; observation and experience are useful ways to gain an understanding of people and the world. |
| 8. | Views current truth, meaning and knowledge as tentative and changing over time. |
| 9. | Prefers action to philosophising. |
| 10. | Takes an explicitly value-orientated approach to research that is derived from cultural values e.g. progress |
| 11. | Organisms are constantly adapting to new situations and environments. Human thinking follows a dynamic process of belief, doubt, enquiry, modified belief, and new enquiry in an infinite loop. Where the researcher (research community) constantly tries to improve on past understandings in a way that fits and works in the world. |
| 12. | Generally rejects reductionism e.g. customs, thoughts and beliefs are no more than neurological processes. |

Table 5 The principles of pragmatism (Johnson and Onwuegbuzie 2004).

Pragmatism adopts an instrumentalist approach to knowledge and its related value, which was linked to whether or not practical outcomes arise from the application of ideas/theories in a real-world context. James refers to this as *'cash value'* in the context of lived experience (Mintz 2004). Knowledge and meaning, from a pragmatic perspective, are embedded in human experience (Stroll & Popkin 1982, p.321); truth and knowledge being based on what works within a real-world context and in addressing real-world challenges. Johnson and Onwuegbuzie (2004) explore the relevance of pragmatism to the adoption of research strategies utilising mixed research methods, thus highlighting a number of its guiding principles. Table 5 identifies a subset of these principles relevant to the development of the author's research strategy.

Symbolic interactionism, strongly aligned with the principles of pragmatism, was initially conceived in the lectures of G. Mead (1863-1931) and subsequently developed by his student Herbert Blumer (1900-1987). It reflected the central assumption that individuals and the world they live and work within are inseparable. The quest for knowledge and an understanding of meaning require the researcher to try to understand the world from the perspective of individuals and their social groups as they interact with each other and their wider world context. Key assumptions informing this approach include (Benzies & Allen 2001):

- Humans both individually and collectively act on the basis of the meaning the external world has for them.
- Meaning arises from the process of interaction between individuals and the wider world. The development of shared meaning provides the basis of action.
- The process by which humans interact with each other and with the wider world as the basis for generating meaning is emergent and subject to redefinition, relocation and realignment (Blumer 1969 cited in Benzies and Allen, 2001, p.543).

These assumptions are reflected in a diverse range of research methodologies and techniques (ethnography, participant observation, grounded theory, dramaturgical approach, labelling). As with phenomenology, an important element of social interactionism is for the researcher to ensure that the patterns of meaning identified are those of the social actors who are the focus of the study and not the researcher's own views and values.

*Phenomenology*

*"The aim is to physically experience a site in the way the ancestors might have in order to develop a deeper more nuanced understanding of how it was used and why it was important. For a full phenomenological experience, move about the site approaching the rock art from a number of directions, consider the views and sightlines to and from the panels, the nature of the terrain and how exposed it is to the elements and how that makes you feel"* (Ochota, 2016, p.92).

This quote illustrates the essence of a phenomenological approach in an archaeological context. Specifically, in the context of prehistory, where direct observation is not possible and written accounts do not exist to assist in interpreting the meaning associated with physical artefacts (in this case rock art). The approach explores a human connection across time, when the observer aims to experience the site and landscape in ways that correspond to how our ancestors would have experienced it, by approaching and experiencing the location within the landscape. Reflecting important aspects of interpretivism and rejecting the assumptions of positivism, phenomenology focuses on the inner world of human consciousness and the essence of meaning in our day-to-day lives as we interact with the world and with each other (Lindseth & Norberg 2004).

Initially conceptualised by Husserl (1859-1938), and further developed by Heidegger (1889-1976), the approach explores how people experience a given phenomenon through identifying the basic structures of meaning (Osborne 1994) and reflects the quest to return to *'..the primordial contents of consciousness..*' (Crotty, 2012 p.96). It assumes that this inner world of human consciousness and meaning making is central in influencing human behaviour and that it can be studied by the researcher, thus reflecting social interaction and a common and shared world of meaning. The emphasis is therefore on the discovery of emergent and essential meaning from the subject's perspective (Rosenthal & Bourgeois 1980; Osborne 1994; Crotty 2012)

*"The situation must be seen as the actor sees it*" (Psathas 1977 cited in Crotty, 2012 p.75).

In practice, methods of data collection focus on spoken or written accounts of personal experience of a given phenomenon and can include qualitative methods such as interviews, observation, artefacts and written documents. The approach to data collection and analysis aims *'..to see the phenomena [sic] as it really is..'* (Laverty 2008, p.23) reflecting key principles:

*Bracketing:* The process by which the researcher identifies their preconceived notions, ideas and assumptions about the phenomena being explored. This in effect acts to reduce any bias introduced by the researcher in the analysis and description of meaning through self-interrogation.

*Intuiting:* A process by which the researcher develops a shared understanding of the phenomena through immersion and empathy in relation to the phenomena under consideration and application of perception and imagination (Spiegelberg 1984 cited in Osborne 1994, p.175).

*Analysis:* Analysing the data collected through a process of coding and organising by themes which eventually distil into their essential meaning associated with the phenomena under consideration.

*Description*: The researcher describes the phenomena under investigation with validity reflecting the clarity, coherence and internal consistency of the analysis (Osborne 1994).

A distinction exists between descriptive and interpretive branches of phenomenology. The first, most closely aligned with Husserl, stressed the importance of identifying the essential essence and the structure of subjective meaning. To achieve this, the researcher was required to bracket out all personal experience, background knowledge /theory and biases that could influence the enquiry. A further assumption is that shared experiences can generate shared meanings (universal essences), between people and independent of context, enabling descriptions generated from the research to be generalised (Lopez & Willis 2004). Interpretive (hermeneutic) phenomenology emphasises interpreting experience by *'..bringing out and making manifest…'* (Lopez and Wills, 2004, p.728).

It stresses the importance of experience rather than merely what people know in the form of meaning, i.e. experience that is directly related to the wider contexts (social, cultural and political) which people navigate in their daily lives. Emphasis in research practice is placed on interpretation of the narratives of people, and a recognition that the meanings arrived at through a reflexive and interpretive study are a mix of the researcher's and the participants' perspectives (Koch & Harrington 1998).

The background knowledge, existing theory and understanding that the researcher brings to bear on the process of interpretation are valuable to the research enquiry (Lopez and Wills 2004). Findings from an interpretive study can be open to different interpretations of participant narratives, and research quality reflects the logic and plausibility. Rather than findings that are universal and can be generalised, interpretive studies provide insight into human experience embedded in a particular context. It is up to the researcher to interpret the meaning generated by the enquiry for a wider context e.g. professional practice (Lopez & Wills 2004; Wojnar & Swanson 2007).

*" This process of applying phenomenological hermeneutical interpretations can be described as a process of appropriation. When we have gained a new perspective and insights about new possibilities to relate to ourselves and others"* (Lindseth & Norberg 2004, p.151).

*Appreciative Inquiry*

A further theoretical perspective that draws upon constructionism and interpretivist principles is in the form of Appreciative Inquiry (AI). Anchored in a critique of action research, with its focus on identifying and solving problems, AI provides a framework for action in catalysing organisational change and knowledge management (Cooperrider & Srivastva 1987; Cooperrider & Whitney 2005; Thatchenkery 2008; Thatchenkery & Chowdhry 2007). Table 6 summarises AI's key characteristics.

| Characteristics of Appreciative Inquiry |
|---|
| 1. The social order at any given point is viewed as the product of broad social agreement, whether tacit or explicit. |
| 2. Patterns of social organisation are not fixed by nature in any biological or physical way; the vast share of social conduct is potentially stimulus free, and capable of infinite conceptual variation. |
| 3. From an observational view, all social action is open to multiple interpretations, none of which is superior in any objective sense. |
| 4. Historically embedded conventions govern what is taken to be true or valid, and to a large extent govern what we, as scientists and laypersons, are able to see. All observation is therefore theory laden and filtered through conventional belief systems and theoretical lenses. |
| 5. To the extent that action is predicated on ideas, beliefs, meanings, intentions or theory, people are free to seek transformations in conventional conduct by changing conventional codes (ideas systems). |
| 6. The most powerful vehicle communities have for transforming their conventions, and their agreement on norms, values, policies, purpose and ideologies is through the act of dialogue made possible by language. Alterations in linguistic practices, therefore, hold profound implications for changes in social practice. |
| 7. Social theory can be viewed as a highly refined language with a specialised grammar all of its own. As a powerful linguistic tool created by trained linguistic experts (scientists), many enter into the conceptual meaning system of culture and, in doing so, alter patterns of social action. |
| 8. Whether intended or not, all theory is normative and has the potential to influence the social order – even if reactions to it are simply boredom, rebellion, laughter or full acceptance. |
| 9. Because of this, all social theory is morally relevant; it has the potential to affect the way people live their ordinary lives in relation to one another. This point is a critical one because there is no such thing as a detached technical/scientific mode for judging the ultimate worth of value claims. |
| 10. Valid knowledge or social theory is a communal creation. Social knowledge is not out there in nature to be discovered through detached, value-free, observational methods (logical empiricism); nor can it be relegated to the subjective minds of isolated individuals (solipsism). Social knowledge resides in the interactive collectivity, it is maintained and put to use by the human group. Dialogue, free from constraint or distortion, is necessary to determine the nature of things. |

Table 6 Characteristics of Appreciative Inquiry (Cooperrider & Srivastva 1987, p.134)

Applied in practice, the principles of the appreciative method include:

*Constructionism:* Employees, through their interaction with others, co-construct the organisation they work within. The focus of the approach is to generate a new vision as the basis for collective action.

*Simultaneity:* The process of inquiry itself can act as a catalyst for change. Questions asked and explored are never neutral.

*Poetic*: Story telling between employees lies at the heart of the organisation. They *'...invoke sentiments, understanding and worlds of meaning..'* (Bushe 2013).

*Anticipatory*: Action in the moment is shaped by our image of the future and related expectations. The AI approach is focused on jointly crafting a positive vision for the future of a given organisation as the basis for inspiring collective action in support of achieving it.

*Positive:* Momentum and sustainability of change is based on social bonds between employees and positive effect (such as hope and joy, which provide a catalyst for *'..creativity, openness to new ideas and people, and cognitive flexibility..'* (Bushe, 2013, p.2).

**Summary**

*" Cognition is the most socially conditional activity in man, and knowledge is the paramount social creation"* (Fleck 1979 cited in Lincoln and Guba 1985, p.70).

This chapter has outlined the wider epistemological and theoretical context which has framed the author's perspective on the nature of knowledge and knowing in the context of this research enquiry. It has identified and explored key assumptions which distinguish constructionism and related interpretivist theories from other epistemological orientations such as positivism. While not exhaustive, it highlights theoretical principles that have been a point of reference in the design of this research enquiry. Providing a scaffolding within which the research strategy was iteratively developed and refined with priority attached to ensuring a high degree of alignment between epistemology and method reflecting the underlying assumption that meaning associated with our experience of reality is constructed through the interaction between individuals, objects and each other.

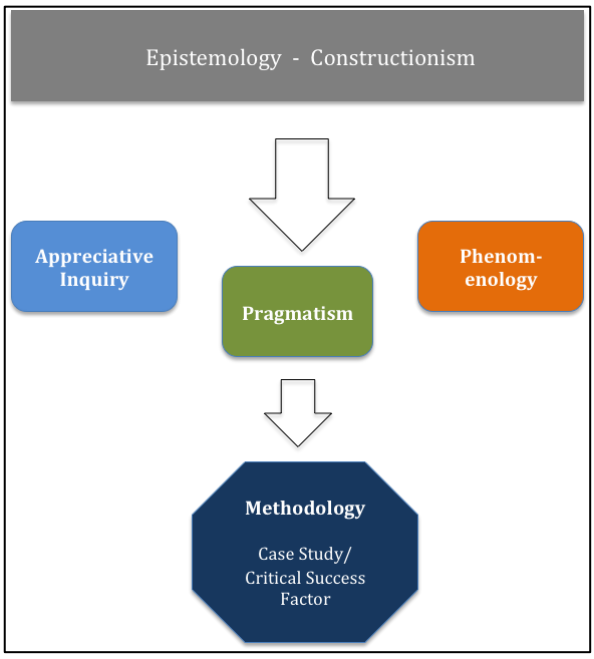



Figure 5 Structure of research strategy: epistemology, theory and methodology

Rather than being absolute, knowledge emerges through the process of KE practice, both in the context of given collaborations and through the actual process of enquiry. A collaborative process within each project exhibits different aspects of knowledge sharing and co-creation and collaborations involving several individuals working across professional disciplines, organisations and in a wider social context. The projects themselves explore emergent areas of technology, application and meaning, both as individuals and collectively as a team. This is the context within which meanings associated with knowledge exchange are explored and enabling factors act to shape the collaboration identified. The methodology and methods providing these insights are presented in Chapter 3.

# Chapter 3 Research Strategy: Methodology and Methods

*"Interpretive research is investigation that relies heavily on observing, defining and re-defining the meaning of what they see and hear"* (Stake, 2010, p.36).

Building on Chapter 2, Chapter 3 continues to develop the research strategy in relation to the methodology and methods adopted for data collection and analysis. Specifically, in exploring different dimensions of meaning attached to the process of knowledge exchange and the factors that have shaped the process of collaborations under investigation. The chapter addresses the role that methodology plays in relation to the following questions (Collis and Hussey, 2003 cited by Neville, 2007 p.2):

- Why certain data are collected?
- What data are collected?
- Where the data are collected from?
- How the data are collected?
- How the data are analysed?

| **Epistemology** | **Theoretical Perspective** | **Methodology** | **Methods** |
|---|---|---|---|
| Constructionism | Interpretivism:<br><br>Pragmatism<br>Phenomenology<br>Appreciative Inquiry | Case Study<br><br>Critical Success Factors | Semi-structured Interviews<br><br>Key Documents<br><br>Participant Observation |

Table 7 Framework for research strategy (adapted from Crotty, 2012)

## Methodology

The overarching methodology adopted for this enquiry is the Case Study incorporating the Critical Success Factor (CSF) method adapted for this enquiry. The case study provides a flexible structure in relation to accommodating constructionist and interpretive epistemological assumptions and related methods for data collection and analysis (Yin 2014; Johansson 2003). Johansson outlines different stages in the historical development of the methodology; from an initial emphasis on participant observation as the case study emerged as a preferred methodology within the discipline of anthropology, to a post-war emphasis upon quantitative methods inspired by logical positivism. Noting the emergence of a methodology that provided an eclectic and a pragmatic approach directed towards addressing the research question and context.

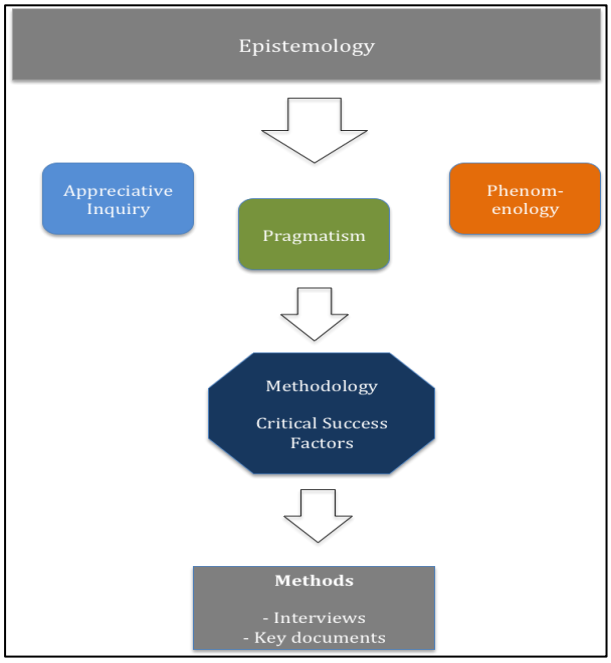



Figure 6 Structure of the research strategy: epistemology to methods

Different strands of interpretive theory and practice have informed the methodology and method (Figures 5 and 6). Its orientation reflects a qualitative and interpretive emphasis in exploring personal experience and meaning associated with the delivery of selected CX projects and the forces shaping their design and implementation. In practice this was an iterative process of discovery throughout the PhD journey. The principles reflected in the approach include (Stake, 2010, pp.47-55):

- *Situated and personal knowledge:* An exploration of personal knowledge in the context of a situated phenomenon (selected projects).
- *Role of empathy:* Empathy from the researcher in relation to participants and their experience provides the basis for understanding their perceptions of '*how things work*'.
- *Emphasis upon understanding and making sense of individual experience:* The '*thick descriptions*' described by Geertz (1993) as noted in Stake (2010, p.49) where *'.. the researchers describe the situation well, have emphatic understanding and compare present interpretations with those in research theory'*.
- *The role of the researcher:* To provide a personal interpretation of the findings. Where the interpretations are assertions which reflect the best developed meanings of important features of the analysis (reflecting the principles of hermeneutical phenomenology).
- *Triangulation:* To mitigate flaws in interpretation and maximise confidence in the insights generated by the researcher.

*Critical Success Factors: A framework for data collection and analysis*

*"Critical Success Factors (CSFs) are powerful because they make explicit those things that a manager intuitively, repeatedly, and even perhaps accidentally knows and does (or should do)"* (Caralli, 2004, p.12).

Within the context of the case study, the framework adapted for data collection and analysis draws upon the CSF method. Bullen & Rockart (1981, p.3) describe CSF as:

"*…the few key areas of activity in which favourable results are absolutely necessary for a particular manager to reach his goals*".

It places emphasis on the value of the tacit knowledge that practitioners in the process of collaboration possess (organisation, process, project) with the aim of making this knowledge explicit. The method is based on an analysis of data in the form of text collected through interviews with key actors (cases) and relevant documents associated with the processes under consideration. The concept emerged through the work of Daniel (1961), Rockart (1979) and Bullen and Rockart (1981), who further developed the concept and related methods. Subsequently, other researchers and practitioners have continued to use and adapt the method.

The method generates insights using data from within the process being studied (project/department/organisation). The context within which CSF was first developed related to the risks associated with data overload of senior managers working within large companies, in particular data generated by emergent ICT-based management information systems. Subsequent applications beyond ICT based systems include (Dobbins & Donnelly 1998):

- Identification of key statistical concerns for senior management.
- Assist in the development of strategic plans.
- Successful project design and delivery and causes of project failure.
- Evaluate the reliability of information systems.
- Identify business threats and opportunities.
- Design and implementation of knowledge management strategies.
- NASA and success of the Apollo space programme (Jones 2015).

*Adapted CSF method: identifying enabling themes and factors*

The key adaptation made by the author in the context of this enquiry is to focus on *Enabling Factors*[19] rather than *Critical Success Factors*. This change in emphasis reflects: i) difficulties in defining and evaluating success, given the different stages in implementation of the projects included in the study; ii) the meaning and criteria for judging success; and iii) the challenges in identifying causality.

[19] Factor (n): *" a circumstance, fact, or influence that contributes to a result*" (Oxford English Dictionary 2012e).

When adapted, the method focused on identifying enabling factors which support collaborations to achieve their stated goals, collaborations created to serve the interests of team members and wider stakeholders. The method provides a framework from which to explore, understand and frame key enabling factors which have influenced the CX collaborations in a variety of dimensions (team processes, behaviour/norms, administration, organisation, professional perspectives etc.). This is done in terms of both formal structures and the wider context associated with complex, multi-disciplinary teams working across organisational boundaries.

*Units of analysis*

*"...not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood"* (Baxter & Jack, 2008, p.544)

The units of analysis (project cases) included as part of the Case Study are six discrete projects designed and implemented as part of the CX programme between 2013 and 2016. Projects were selected on the basis of the analysis of the CX project portfolio. The aim of this analysis was to generate a non-probabilistic sample providing a range of projects reflecting different social contexts, technologies, challenges and partners. Six project (cases) have been included as part of the case study in providing for a range of different experiences and perspectives on knowledge exchange.

Three team members were identified for each case with interviews undertaken by the author, supported by an analysis of key project documents. Detail of the process of selection and the projects themselves are presented in Section 3 of the thesis with further detail provided in Appendix 4.

*Implementing the Critical Success Factor (adapted) method*

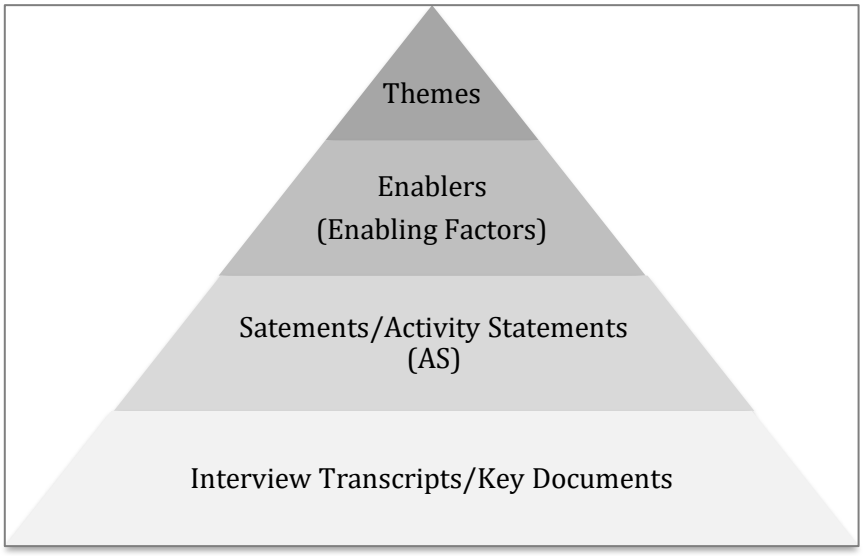



Figure 7 Deriving enabling themes and factors

The CSF analysis incorporates several steps in collecting and analysing data. The steps outlined in Figure 7 have been adapted from the work of Caralli (2004) and are focused on exploring the research question in the context of interview transcriptions and analysis of key documents. The method also draws on *Affinity Analysis* (Kawakita 1991 cited in Scupin 1997; Ulrich 2003; Kunifuji 2013). It is a technique for analysing data adapted for categorising and clustering activity statements into discrete groups sharing common characteristics. As Scupin (1997) notes, the technique of Affinity Analysis was developed to support the analysis of ethnographic data collected in his study of Nepalese hill farms, quoting Kawakita (Kawakita 1991 cited in Scupin,1997, p.234):

*"With masses of data spread out on my desk, I had been racking my brains to find some way to integrate them when I suddenly realized that depending on the spatial arrangement of the cards, you can see new meaning in them and find ways to systematize the data".*

While the method was designed to be undertaken by groups of researchers in the field, it has been adapted for use by the sole researcher in the context of this enquiry. A process of structuring and restructuring text to generate strategic themes reflects shared meaning (using word and excel software).

*Step 1  Scope of Work*

The scope of work reflects the unit of analysis and boundaries of the research being undertaken (see Chapter 1). A review of key documents (proposals/collaboration agreements/research outputs) and related interviews of key actors (PhD students, lead academics, external partners) involved in the case (projects) provide the main sources of data/text for analysis.

*Step 2  Identification of Activity Statement (AS)*

*"In our application of the critical success factor (CSF) method, we have found it useful to transform raw data into CSFs by using a series of repeatable and consistent processes, rather than relying on participants to directly identify CSFs"* (Caralli, 2004, p.24).

The Activity Statements refer to those actions and conditions identified by practitioners as being important in relation to effective collaboration. They have been defined on the basis of statements identified in the text of key documents and interview transcriptions of team members from the selected projects (3 individuals). The statements are identified on the basis of:

- Actions/conditions in relation to successful outcomes.
- Actions/conditions that should be taken/met to achieve successful outcomes.

Activity Statements are i) anonymised, ii) condensed to essential meanings, and iii) distilled into discrete elements that can provide the basis for further analysis. Judgment has been used by the researcher in transforming text into discrete positive statements which in turn are grouped by shared meaning and become the basis for Activity Statements. Where the statements are  ambiguous, clarification has been sought from the original text with reference to the interview questions and conversational context. If the researcher has not been able to clarify, the statements /comments have not been included in the analysis. Individual statements have been coded to facilitate tracing back to source (illustrative examples Table 8 and 9).

| **Participant A** | |
|---|---|
| **Statements (used to define Activity Statements)** | Para. |
| S25 The value of non-financial and non-IP benefits are important to incentivise micro SMEs to engage in small collaborative projects. | 23/25 196/ |
| S26 Universities must demonstrate how they can add value to SME R&D as an incentive to engagement e.g. access to thought leaders/access to larger projects etc./access to corporate partners/public sector partners. | 27/153 |
| S27 Encouragement for all participants to make their points to help create and empower culture. | 161 |
| S28 Micro-SMEs, in engaging with collaboration, should listen to partners and have clarity about what specialisms they bring to the collaboration and deliver in that area. | 35 |
| S29 Projects should focus upon delivering a minimal viable product as the basis for developing successful prototypes. | 135 |

Table 8 Example of statements (using words and phrases from transcripts)

*Step 3 Clustering Activity Statements into Enabling Factors (Enablers)*

Activity statements are grouped and regrouped into clusters of statements with a shared meaning and intention. Iterations are repeated by the researcher until each group is composed of statements which reflect a clear and shared meaning. Enabling factors (EF) are then drafted which provide a description of significant themes in each cluster of activity statements.

| **Enabling Factor** 5.1 Develop a good understanding of institutional systems and stakeholder objectives as the basis for designing project interventions that will generate value for partners. |
|---|
| AS7 Definition of a clear vision and strategy of how the planning system may be improved (to support a successful project intervention). |
| AS18 For successful intervention into the planning process, a deep understanding is required of planning policy and organisational context and stakeholder interests. |
| AS 50 Successful intervention into the existing planning processes needs to be based on a good understanding of the positives and negatives of the existing systems of engagement. |
| AS32 Knowledge of the local planning processes and wider context is essential to ensure that technology solutions meet local needs. |
| AS56 Collaborative projects should focus upon understanding the complex reality within which they are designing solutions and adding value to support partner organisations/user groups in achieving their goals e.g. effective public engagement with the planning process. |

Table 9 Clustering of activity statements and definition of enabling factor

*Step 4 Enabling Factors (Enablers)* into *Themes*

Building on the previous steps, strategic themes provide a higher-level description of the context within which groups of enabling factors are identified. The steps undertaken ensure that the strategic themes/enabling factors and related activity statements are anchored in a consistent and systematic process that is applied across different text sources for each project.

*Illustrative Figures of case enabling themes and factors*

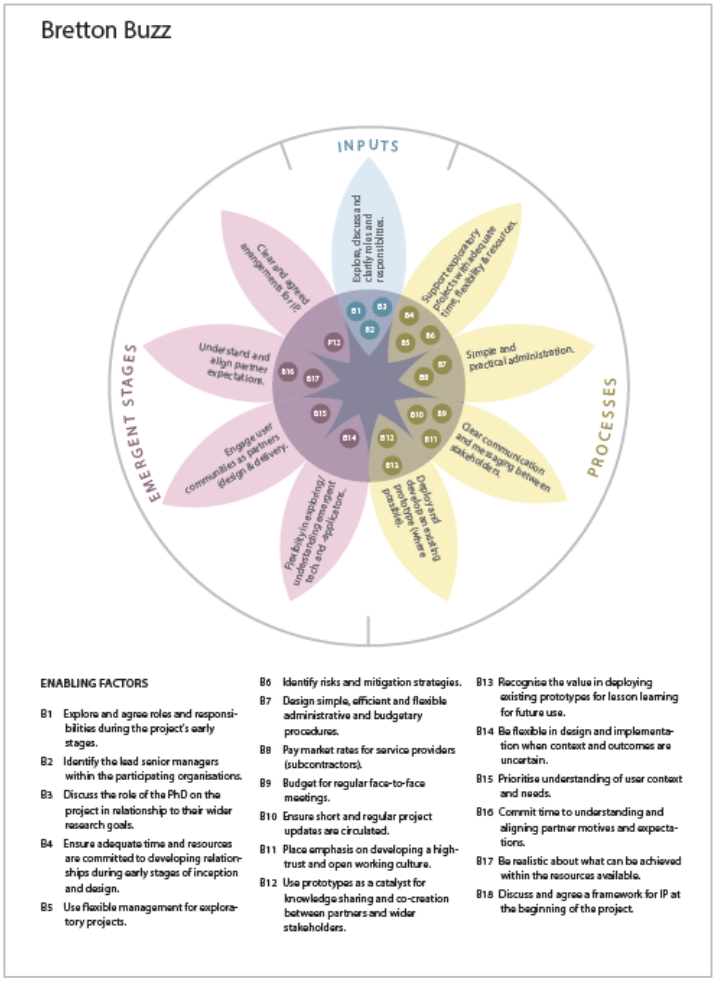



Figure 8 Illustrative example of case study graphic

A figure (illustrative example in Figure 8) is used for each project and the cross-case analysis (Section 3) to provide an overview of *Themes* and *Enablers*. A meta-framework (inputs/processes/emergent states) structures themes and enablers.

This is used to explore the insights generated from the case study analysis and from existing theory on team effectiveness (Chapter 9).

*Characteristics of the collaboration*

A further dimension of analysis is undertaken to address the proposition:

*That key characteristics of selected Creative Exchange project-based collaborations can be identified and used to support the development of a typology of knowledge exchange.*

The method outlined for enabling factors has been applied in the identification of insights from text that can be used to characterise the collaborations under study in terms of structure, processes and methodology. As with enabling factors, Affinity Analysis (AA) was used to group and regroup clusters of statements with a shared meaning and intention. Iterations (regroupings) are repeated until each group of statements reflect a clear and shared meaning. Key domains are identified from an initial analysis, which have then provided an overall framework for a cross-case analysis. Statements (themes) were drafted which provided a common description of the context for each cluster. These include:

- *Approach:* The overall approach to understanding context and defining solutions.
- *Context:* Relates to the wider organisational, cultural and technological context within which projects were implemented and which shape the design and delivery.
- *Complexity*: Professional and organisational mix of team members and wider stakeholders.
- *Scale:* Relates to resources e.g. available time and budget.
- *Team autonomy*: The degree of independence teams have in relation to self-management.

- *Motivation*: Motivation of team members and wider stakeholders.
- *Outcomes*: Project deliverables and impact.
- *Methodology*: The system of methods developed and deployed in support of project objectives.
- *Knowledge Exchange*: The dynamic process by which knowledge (tacit and objective) is transferred shared and co-created between team members and with wider stakeholders.

In summary, the CSF method as outlined echoes a number of principles of hermeneutic phenomenology illustrated in the method developed and outlined by Lindseth and Norberg, in their article *'A phenomenological hermeneutical method for researching lived experience*' (2004). Their study focused on using interview texts as the basis for exploring different dimensions of ethics experienced by clinicians in the context of their day-to-day practice. Addressing the perceived limitations of existing methods and a need to reveal patterns of meaning behind experience in a real-world context, the approach is considered relevant to the CSF method as adapted for this enquiry.

The hermeneutic approach, as they applied it, incorporated two essential elements: i) the creation of a text through interviews and ii) the interpretation of the text as the basis for distilling meaning.

*"We use our artistic talents to formulate the naive understanding, our scientific talents to perform the structural analysis and our critical talents to arrive at a comprehensive understanding"* (Lindseth & Norberg, 2004, p.151).

Their interpretation and analysis of interview text/narratives incorporated three elements:

*Naïve reading*: A first reading where the researcher generates an overall sense of meaning and context.

*Structured Analysis*: Distilling text into units of meaning and grouping into themes.

*Comprehensive Understanding*: A further analysis and grouping into '*..main themes, themes and sub-themes…'* as the basis for reflection on their relation to the research context and question.

The final dimension of the analysis being the presentation of insights in everyday language as the basis for conveying meaning, approximating as far as possible the lived experience of everyday life (in this context for clinicians and patients). A worked example of case analysis (Bretton Buzz) is included in Appendix 1.

**Ethics approval and data collection**

Ethics approval was sought from and granted by Lancaster University for this research project (Appendix 2). Supporting documentation (Appendix 3) was approved as part of the overall approval process and included:

- Participant Information Sheet (Interview).
- Participant consent form.

With reference to the Kendal Blood Test Visualisation project, additional approval was secured from the NHS Research and Innovation team at The Royal Preston Hospital *(*Appendix 2).

*Sources of Data*

Different sources have been used to collect and triangulate data in relation to the research question and propositions. These include i) documentation, ii) archives of minutes and internal reports, iii) workshop reports, and iv) artefacts. The primary source of data/text are the transcriptions of each interview undertaken.

*Desk Research (preparation)*

Key project documents were identified and archived in advance of interviews. These included the project proposal, collaboration agreements, progress reports, impact statements, web sites and blogs, identification of artefacts. Desk research was undertaken for each of the partner organisations.

*Creative Exchange Hubs*

Contact was made with the Knowledge Exchange Associate[20] at each academic partner institution (Lancaster University, The Royal College of Art and Newcastle University). This took place in advance of contacting the lead PhD for each project and included a presentation of i) selection criteria, ii) a briefing note on research questions, methodology and methods and iii) outline of requirements in terms of time from participants.

*Interviews (planning and implementation)*

Reflecting the overall research question, propositions and resources available, three individuals were selected to reflect three perspectives (PhD, academic and non-academic). Those interviewed included the lead PhD, reflecting their central role in the project design and delivery; the lead academic and an individual identified from an external partner. Discussion with the associates (and the lead PhD on the project) informed the identification of individuals to be interviewed. In contacting and briefing proposed participants, emphasis was placed on: i) the exploratory nature of the research in the context of the PhD; ii) the fact that the enquiry was not evaluating its success or failure; and iii) the confidentiality of the interview process in terms of the anonymity of data in analysis and presentation. Confirmation was sought and secured from each participant in advance of each interview.

*Interview questions (semi-structured questionnaire)*

The aim of the interviews was to explore the context of each project and the collaborative process. The insights generated were used to i) identify key themes and related important enabling factors, and ii) identify characteristics of the collaboration in terms of structure and approach (along with data from the document review). Key questions were identified in order to provide a consistent framework for each interview and related discussion, which lasted up ninety minutes, depending on the time availability of interviewees.

[20] One individual employed by each university to support and coordinate CX programme activities and PhD inputs (in addition to research).

The questions provided a consistent structure for a guided discussion and were modified in light of the initial three interviews, specifically to avoid duplication. An element of the interview process (which was used for the first two interviews and then subsequently dropped) was a mapping exercise where an attempt was made to identify discrete knowledge exchange events in relation to each project (transfer/sharing and creation). Due to the time taken (in the context of time available) and a lack of clarity and consensus on the terms used, this element of the initial approach was dropped.

*Recording, transcription, review and archiving of data*

All interviews were recorded on a small digital recording device. The recordings have been stored on the researcher's encrypted computer under the project and the interviews were subsequently transcribed (with transcriptions likewise securely stored on the researcher's computer). The presentation of the results arising from research will be anonymous with no names identified in the case study text. Quotes presented are also anonymous, with the exception of the Kendal project where prior agreement was secured by the participants as to their being named in the context of subsequent material being presented and published.

**Research quality**

*"Without rigor, research is worthless, becomes fiction, and loses its utility"*
(Morse et al., 2002, p.14).

With reference to Morse, the essence of research quality is rigour, and its demonstration, in the design and implementation of a given enquiry. Rolfe[21] (2006, p.305) citing Hope and Waterman (2003), identifies three different perspectives on research quality. The first, reflecting positivist assumptions, uses the criteria applied for scientific enquiry with an emphasis on the need to demonstrate reliability, validity, external validation and objectivity of the research (Yin 2014). Through mirroring positivist assumptions, credibility of research findings can be assured and provide the basis for a justification as a true reflection of an independent reality.

[21] Writing with reference to qualitative research undertaken in a clinical context.

An alternative position reflects the argument that social research is undertaken from within a different paradigm than the natural science (reflecting Weber's emphasis on *understanding* rather than the *explanation* as sought in the natural sciences). As a result of the different character and aims, social sciences require a different set of criteria that are more closely aligned with a constructionist epistemology (Crotty 2012, p.67).

Guba (1981) emphasised '*trustworthiness*' as the overarching concern of research quality from this second position. A given research study needs to demonstrate credibility, transferability, dependability and conformability through a range of methods including *'negative cases, peer debriefing, prolonged engagement and persistent observation, audit trails and member check'* (Morse et al., 2002, p.15). Shenton (2004, p.64) relates the four categories adapted for qualitative analysis to the criteria adopted within a positivist paradigm:

*Credibility*: Demonstrating the alignment of the research findings with the reality under study. Reflecting the premise that the researcher has provided an accurate reflection of the phenomena, as stated by Merriam (Merriam 1998 cited in Shenton, 2004, p.65), *'How congruent are the findings with the reality'*.

*Transferability (*external validity/generalizability): Exploring and demonstrating that the findings from the study can be applied to other contexts. Given the specific context and methodology adopted for the study, it is not assumed that findings can be generalised as such. However, reflecting Bassey's perspective (Bassey 1981 cited in Shenton, 2004, p.65), sufficient information is required for the readers and practitioners to determine whether insights from the study are relevant to their own practice and operational context.

*Dependability (*reliability): While not assuming that the research outcomes could be replicated (assuming the same question, methodology/methods and collaboration/ context), the criteria focus on the need to demonstrate the validity of the research design and its implementation as the basis for generating confidence in its findings.

*Confirmability (*objectivity): A need to generate and demonstrate objectivity in how the researcher has designed and implemented their research strategy noting the importance of minimising the influence of the researcher's own biases on data collection and analysis.

Adapted from Shenton (2004, p.73) and (Guba 1981), Table 10 provides a list of actions focused on addressing research quality in the context of the enquiry.

| **Criteria** | **Provision made by the researcher** |
|---|---|
| Credibility | Adoption of appropriate, well-recognised research methods.<br>Development of early familiarity with culture of participating organisations.<br>Random sampling of individuals serving as informants.<br>Triangulation via use of different methods, different types of informants and different sites to reduce effect of investigator bias.<br>Tactics to ensure honesty in informants.<br>Iterative questioning in data collection dialogues.<br>Negative case studies.<br>Debriefing sessions between researcher and supervisors.<br>Peer scrutiny of project.<br>Use of reflective commentary.<br>Description of background.<br>Member checks of data collected and interpretations/theories formed.<br>Thick descriptions of phenomena under scrutiny.<br>Examination of previous research to frame findings. |
| Transferability | Provision of background data to establish context of study and detailed description of phenomena in question to allow comparisons to be made. |
| Dependability | Employment of overlapping methods<br>In-depth methodological description to allow study to be repeated. |
| Confirmability | Triangulation to reduce effect of investigator bias.<br>Admission of researcher belief and assumptions<br>Recognition of shortcomings in study's methods and their potential effects.<br>In-depth methodological description to allow integrity of research results to be scrutinised.<br>Use of diagrams to demonstrate audit trail. |

Table 10 Measures to address Guba's criteria for research quality

A third position, identified by Rolfe (2004), reflects an assertion that there are no pre-determined criteria for demonstrating the value of qualitative research. Further, that this reflects the lack of consensus amongst the research community as to the appropriate criteria to adopt; and lastly that the absence of a coherent and meaningful set of criteria reflects the lack of a unified body of theory, methodology and method that can be described as qualitative research (Rolfe, 2004).

**Summary**

*"There is inflexibility and uncompromising harshness, a rigidity implied in the term rigour that threatens to take us too far from artfulness, versatility and sensitivity to meaning and context*" (Sandelowski cited in Nelson, 2008, p.319).

The case study methodology (with multiple cases), combined with an adaptation of the CSF method, provides a framework for data collection and analysis that is strongly aligned with the underlying epistemology and theoretical orientation of the research study. The methodology and methods facilitate different dimensions of meaning to be explored from the perspective of individual team members, drawing on their tacit knowledge and direct experience of project-based team working using data generated from the real-world context of CX projects. Projects that are operating across a variety of social contexts in terms of emergent applications, organisations, professional disciplines and stakeholder context and needs. The methodology and methods are also aligned with the need to incorporate and demonstrate rigour in the design and delivery of the research study.

While different perspectives on the concept of knowledge and how it can be acquired are often related to a simple distinction between quantitative and qualitative methods, on examination they highlight the importance and power of the different epistemological assumptions that shape a researcher's own approach to a given enquiry and choice of methodology and methods.

One area illustrating this alignment is the emphasis placed by Lincoln and Guba (1989) on the need for researchers to validate their interpretation of the data with the participants in the research process. Member checking (returning to the participants following data analysis) or peer checking (peer or panel of experts to reanalyse the data) are ways of ensuring and demonstrating that the findings and insights are correct.

Where Lincoln and Guba (1989) regard this as a central theme in demonstrating research quality, Sandelowski (1993) cited by Rolfe (2004, p.305) and Koch and Harrington (1998, p.885), note that if the researcher has adopted an interpretivist orientation, where multiple realities and meanings are assumed to exist in relation to the phenomena under investigation, then it is unlikely that participants nor peer researchers will arrive at the same insight and conclusions in terms of categories /themes and meanings (Rolfe, 2004; Morse et al. 2002). This is further reinforced by the interpretative phenomenological tradition, which stresses the role of the researcher's own judgment in contributing to the insights generated (Ricoeur cited by Lindseth & Norberg 2004, p.145).

The aim of the researcher has been to strike a balance between rigour and the *'artfulness, versatility and sensitivity'* that Sandelowski (1993) identifies. While the insights from the case study analysis are not aimed at developing generalisable patterns, as with a positivist approach, it is important to the author that research quality can be demonstrated and that the analysis will enable the research insights to be of use in other research and operational contexts.

# Section 2

## *Framing Knowledge Exchange with Reference to Existing Theory and Practice*

## Section 2 Introduction

*Section 2* identifies and explores concepts and insights identified from existing literature in areas identified as relevant to the policy and practice of knowledge exchange, specifically research and theory exploring the themes of Innovation, Knowledge Management and Innovation Systems (Figure 9).

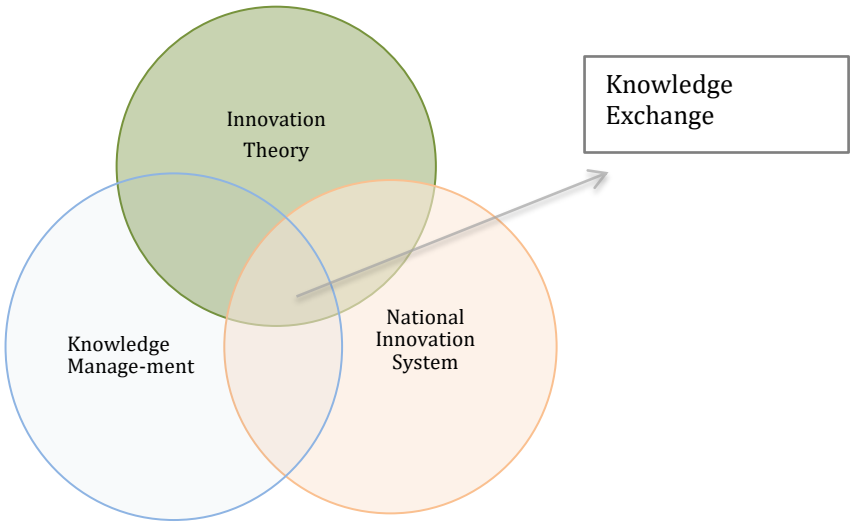



Figure 9 Dimensions of KE explored through the literature review

*Chapter 4* presents different perspectives, paradigms and models exploring the process of *innovation* and identifying their underlying assumptions and how these models have developed over time. From simple linear, staged models to non-linear system-based perspectives which focus on social interactions between individuals and organisations through formal and informal networks (systems). These are assumptions which have a significant impact in shaping policy, investment and business strategies including those associated with the role of universities in catalysing innovation and their related approaches to engagement with wider society.

*Chapter 5* proceeds to outline *Knowledge Management* (KM) as a discrete area of research, policy and practice and explores its relevance to knowledge exchange. The emergence of KM as an important dimension in economic and innovation theory reflects a growing emphasis on the role of knowledge as a critical driving force to business and wider economic success. It identifies concepts, models and assumptions of knowledge management and further develops the research context.

*Chapter 6* provides an overview of the *National Innovation System* (NIS) as a conceptual framework to position, describe and develop the concept of knowledge exchange and related modes of university external engagement.

# Chapter 4 Insights into Knowledge Exchange from Innovation Theory and Practice

*"Successful innovation is first and foremost about creating value"*
(von Stamm 2004, p.13).

Schumpeter made a clear distinction between the meaning of invention and innovation. He characterised invention as a creative act by which a new idea or process comes into being, and innovation as an entrepreneurial act bringing a new idea or technique into widespread use (Lazonick 2010; Graham 2011; Kotsemir & Abroskin 2013). He also identified a typology of different types of innovation (Schumpeter 1942, p.66):

- Introduction of a new good.
- Introduction of a new method of production.
- Opening of a new market.
- Conquest of a new source of raw material or half-manufactured good.
- Implementation of a new form of organisation.

An alternative expression of the same distinction is provided by Fagerberg et al. (2005, p.5) who see the difference in terms of the first occurrence of an idea for a product or service (invention) and the attempt to carry it out in practice (innovation). Over time, additional dimensions to its meaning have been introduced including a distinction between product and production (Scherer 1997), a recognition of social and organisational innovation (Mulgan 2006) and impact on existing markets (Bower & Christensen 1995; Christensen 2006). Further definitions distinguish between incremental and radical innovation (Schumpeter 1942, Norman & Verganti 2014) and between sustaining and disruptive innovation (Christensen, 1995). The assumption being that small changes to existing products and services can be the basis for success rather that the introduction of the entirely new. Norman and Verganti (2014) explored the different factors leading to radical and incremental innovation. They note that radical innovation is relatively rare and catalysed by changes in technology and/or meaning in contrast to incremental innovation.

| **Incremental vs. Radical** | **Sustaining vs. Disruptive** |
|---|---|
| *Incremental* | *Sustaining* |
| "*Incremental product innovation refers to the small changes in a product that help improve its performance, lower its costs, and enhance its desirability" (Norman & Verganti, 2014, p.6).* | Improvements to existing products/ services to meet the needs of current customers. |
| | Enables the lead companies in a given market to sustain their market position and competitive advantage e.g. British Telecom. |
| Continuous refinement of existing technologies (products) with improvements in small, incremental steps. The cumulative impact can be significant but incremental innovation works within existing structures with a low degree of uncertainty in terms of outcomes (Graham 2011). | |
| *Radical* | *Disruptive* |
| The introduction of entirely new technologies/concepts, which bring about significant changes in existing structures. Radical innovation is not a small change to an existing technology but is completely new. | A technology that leads to products, which are cheaper and simpler than the existing product but that provides the opportunity for the new product/service to capture lower-end market share. |
| A fundamental break with the past and new structures/markets. | Over time, this share can grow and result in the incumbent losing out to the new technology, e.g. Digital technology vs. film-based photography, mobile phones vs. fixed lines, laptop computers vs. mainframe, low cost airlines vs. mainstream airlines. |
| '*Creative destruction'* is a phrase used by Schumpeter to describe the impact of radical innovation on existing markets e.g. Nuclear Power. | |
| Adapted from Schumpeter (1942) | Adapted from Bower and Christensen (1995) |

Table 11 Innovation and market impact

**From a neoclassical to a Schumpeterian perspective**

*"The foundation of neoclassical orthodoxy is the theory of the optimizing firm. The Schumpeterian agenda seeks a theory of the innovating firm"* (Lazonick 2011, p.72).

From the 19th century, the discipline of economics has been at the forefront in attempting to understand and explain material change and well-being. This pre-eminent position largely reflected the discipline's emphasis on material development and analysis of the production, distribution and consumption of resources, goods and services. At the heart of the neoclassical model are assumptions about the rationality of human decision-making. Expressed in terms of utility/profit, emphasis is placed on the maximising behaviour of individuals and firms in the context of their interaction in the market place (Keita 1992).

This perspective identified efficient markets as the central driver to economic growth. Where the interaction of supply and demand for inputs, goods and services is mediated through price under assumed conditions of perfect competition. Within this framework; technology, knowledge and innovation are identified as exogenous[22] to explaining the dynamics of change. The neoclassical approach ignored the value of a historical perspective in studying economic development (Lazonick 2010). Instead, emphasis was placed on market equilibrium or movements towards equilibrium as the principal driving force in economic development. The limitations of the neoclassical model's ability to identify and fully understand the forces that catalysed the Industrial Revolution in the 19th century led to new avenues of research. This research included a wider range of variables and their relationship to economic growth, not least innovation in terms of process and impact (Fagerberg et al. 2005; Lamoreaux et al. 2008).

[22] Exogenous (n): *"Having an external cause or origin"* (Oxford University Press n.d.).

The most significant challenge to the neoclassical paradigm emerged from the work of Schumpeter who rejected the ahistorical approach to economic development and challenged its core assumption of treating technology and innovation as exogenous and irrelevant in exploring causality (Ruttan 1954; Carlsson 2007; Thelen 2009; Fagerberg et al. 2005; Godin 2017). Schumpeter's methodology integrated historical analysis with economic theory, emphasising the dynamic nature of economic and social change over time. He explicitly identified innovation as a key driver and the role of entrepreneurial individuals and companies in catalysing technology-based innovation.

A dimension in Schumpeter's analysis was the role of creative destruction as a primary force to socio-economic change (Lazonick 2010; Graham 2011; Śledzik 2013, p.91). A process whereby entrepreneurial individuals and companies introduced new business models, processes, products and services that challenged and often destroyed existing markets/companies. Schumpeter related cycles of creative destruction to the wider concept of business cycles of economic expansion and collapse.

*The firm at the centre of analysis*

Schumpeter's emphasis on the entrepreneurial firm provided impetus for researchers to begin to study decision-making at the enterprise level (Lamoureaux et al. 2008; Chandler 1962, Edith Penrose 1959 cited in Jones & Zeitlin 2008; Fagerberg et al. 2005). Alfred Chandler, in his seminal work *Strategy and Structure* (1962), explored the development of enterprises in a historical and market context, principally through case studies of large American companies.[23] While not the first, his research provided new insights into corporate decision-making. He explicitly studied why decisions are made and resources allocated, structures developed and innovation managed in support of strategic objectives (Lazonick 2010), as well as how capabilities evolve in relation to external opportunities and pressures.

[23] Dupont, General Motors and Sears Roebuck.

The firm rather than the market becomes the focus of analysis, reflecting Chandler's observation that more economic activity occurs in the firm than the wider market (Lamoreaux et al. 2008). Edith Penrose (*The Theory of the Growth of the Firm*, 1959) added further dimensions of analysis, highlighting the importance of resources, skills and organisational learning to commercial success (O'Sullivan 2005). While not replacing the neoclassical paradigm, the work of Schumpeter, Penrose and Chandler opened up business history and innovation as new themes for research and practice, placing the firm at the centre of enquiry. Their work also began to define innovation as a dynamic process of interaction between internal resources and capabilities of the firm in relation to the opportunities and threats from its wider operating environment.

*Technology and research as drivers to corporate success*

The recognition by industrialists that technology was critical for commercial success can be traced to the second half of the 19th century. Graham (2011) notes that decisions to invest in scientifically driven Research and Development (R&D) became an integral element of corporate strategy. The development of strategic R&D also reflected the political imperative (and related public funding) to maintain the science base during periods of war. While corporate research functions emerged in the 19th century, the pace picked up during the 20th with the creation of internal R&D laboratories as a key component of corporate strategy and structure. This was accompanied by investments in research infrastructure (space, equipment, talent, lawyers), aimed at sustaining a competitive advantage by ensuring access to relevant technologies. The concept of the closed innovation model reflected the behaviour of large corporate organisations in their strategies of vertically and horizontally integrating to create entire innovation systems within their organisational boundaries e.g. Kodak Research Laboratory (1912), Bell Laboratories (1920s). The development of a technology-focused innovation infrastructure (often with government sponsorship), was identified as a '*dominant and superior model'* of US corporate capitalism (Graham, 2011, p.353). The absence of such integrated and closed systems was also used to explain the underperformance of US competitors in the first half of the 20th century.

*Innovation in the 21st Century: a growing emphasis on SMEs*

*"Innovation in the 21st century is radically different to that of the preceding one"* (OECD, 2010, p.1)

An alternative perspective on the changing context and character of innovation is provided by Thurik (2009). Taking a historical perspective, he distinguishes between the managed economy, dominating economic analysis and policy from the 19th Century to the 1980s, and the entrepreneurial economy, that emerged from 1980 onwards (a change reflected in both economic statistics and policy). Thurik characterises the *'managed economy*' as dominated by large corporate enterprises focused on mass production and sustaining competitive advantage through economies of scale in relatively stable markets. Under this structure, capital and labour are the most important factors of production.

The '*entrepreneurial economy'* reflected the growing share of economic activity captured by SMEs,[24] occurring against a background of competition from low-cost producers abroad and the growing importance of the service sector relative to manufacturing (OECD 2010). In 2015, across the European Union, SMEs accounted for two-thirds of employment and three-fifths of value added in non-financial sectors with the majority of SMEs employing fewer than ten people (Muller et al. 2016). The importance of the entrepreneurial economy also reflected a growing recognition that knowledge was a key factor in securing and sustaining competitive advantage. This was accompanied by a change in the locus of innovation, from large-scale R&D departments to small companies able to identify and move quickly to capture emergent opportunities:

*"... innovation in the knowledge economy is coming from creativity and the unexpected and this is more likely to be found in new and small operations than in the systematic research that characterises large R&D laboratories"* (OECD, 2010, p.27).

[24] Small and Medium-sized Enterprises (SME) (n*): "The category of micro, small- and medium-sized* enterprises *(SMEs) is made up of* enterprises *which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro"* (European Commission 2018).

Small entrepreneurial businesses demonstrate a capacity to '*create and exploit*' knowledge in relation to opportunities emerging from a dynamic market place in large part driven by emergent demand and increased competition which in turn reflects '*rising incomes, increasing speed of product life cycles, new and emergent technologies and a growing number of market niches*' (OECD, 2010, p.26). While focused on emergent technologies, non-technology-focused innovation reflecting the value of business models, processes, structures, capabilities and approaches were also identified as generating important opportunities. Other drivers include globalisation, open/distributed innovation (rather than closed models), social innovation and the *'Silicon Valley business mode*l' with emphasis on creating an enabling environment to support early stage companies e.g. venture capital (OECD, 2010).

**Models and modes[25] of innovation**

*"…a model is a conceptualisation or theorisation put into a schema, graph or diagram…Calling such conceptualisation a model serves practical or pragmatic purposes, in addition to organising knowledge. It highlights societal and policy uses and serves rhetorical purposes*" (Godin 2017, p.2).

Different models and modes have been developed to illuminate the processes of innovation and have subsequently been used to inform the design of business strategies and public policy (i.e. the modes and models are used to inform the design). *Science Technology and Innovation* (STI) is one mode of analysis (Jensen et al. 2007) emphasising the creation and exploitation of codified knowledge generated through formal structures of corporate/public research and development (approximating to the technology push and the managed economy identified by Thurik 2009). In contrast, the *Doing-Using-Interacting* (DUI) mode of innovation reflects the importance and value of tacit knowledge, generated through collaboration within teams and across informal networks and in response to opportunities and challenges arising in working environments.

[25] Mode (n): *"A way or manner in which something occurs or is experienced, expressed, or done"* (Oxford Unversity Press n.d.).

Godin places models at the heart of his analysis of innovation; specifically exploring models in the historical context within which they emerged, developed, spread and were replaced. He argues that rather than reflecting an absolute truth, models simplify reality and are, '*fluctuating, changing and contested'* within their social context (Godin, 2017, p.4). They are developed and refined in relation to alternative models and competing ideas as much as they provide an accurate reflection of a dynamic and changing wider world. He identifies two dominant types of model; process and system. *Process (temporal) models* are defined in terms of steps, actions and stages through which innovation occurs, providing a framework to describe and understand how successful innovation takes place. In contrast *System (social) models* are defined and focused on the social context within which innovation occurs, identifying important actors (individuals, organisations and instructions) and how they interact as the main focus of analysis and policy (OECD 1978 cited by Godin 2017, p.5).

Important themes influencing early models of innovation emerged during the 19th century from the discipline of anthropology. Summarised as the '*Invention versus Diffusion'* debate (Godin 2013), this discourse provided a framework for exploring important factors influencing socio-economic development and informed more recent models of innovation. The discourse was often framed in the context of models of economic and social development, which are linear in nature and which identified a path of social evolution from primitive to civilised. The debate crystallised into a dichotomy between invention and diffusion as the primary driving forces to development reflecting evolutionary social theories (Godin and Lane 2013). The related ideas influenced the emergence of sequential theories of innovation that integrated both within a single framework – characterising innovation as a time-bound journey moving through stages from invention to diffusion.

*Technology Push*

*"Science Finds, Industry Applies, Man Conforms"* (Motto of the World Exhibition in Chicago, 1933).

While a corporate model of technology push innovation emerged in the 19th century, the publicly funded research driven model is attributed to Vannevar Bush in the report, *Science: The Endless Frontier*, published in 1945, while in his role as Director of the Office for Scientific Research and Development and at the request of President Roosevelt (Godin 2008; Caraça et al. 2009; Freeman 1995). This report presented a post-war vision for US economic success based on government-funded research. It also explicitly recognised the important role that universities play as part of the national innovation system. Bush argued that science-based research and the technologies emerging from that research had been critical to the Allies' success in World War II. On the same basis, such public investment could provide a strategic driver to economic success in post-war America.

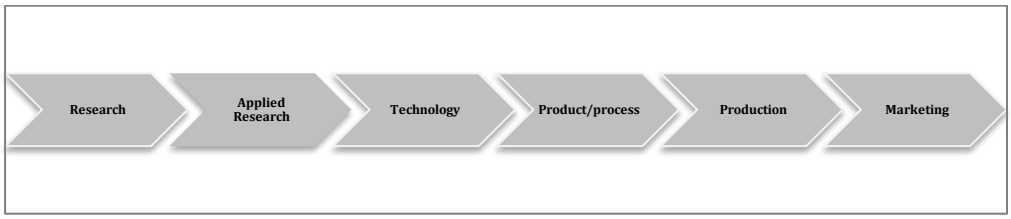



Figure 10 The research-driven linear model of innovation

While many large firms in Europe and the US had recognised the importance of R&D, Bush highlighted the critical role that publicly funded research can play in catalysing economic growth. The strength of his argument rested on a *Technology Push* innovation model and the assumption that publicly funded research leads, through stages, to economic growth. Richard C. Maclaurin, Professor of Economics and President of MIT, 1909 to 1920, crystallised this model (Figure 10) in terms of discrete and sequential stages by which basic science provides the impetus in generating new products (Maclaurin 1953). Bush's arguments provided the logic and justification for post-war US government investment and led to the creation of the National Science Foundation (1950). This investment was mainly in high-technology sectors such as computing, electronics, aviation and communication, reflecting their strategic importance and economic potential (Graham, 2010). In the UK during the first decades of the 20th century, a poor economic performance relative to Germany's led to the government establishing the Department of Scientific and Industrial Research (1915), a policy where public research expenditure appears to be predicated on the same assumption of linkages between research and the wider economy.

*Demand Pull*

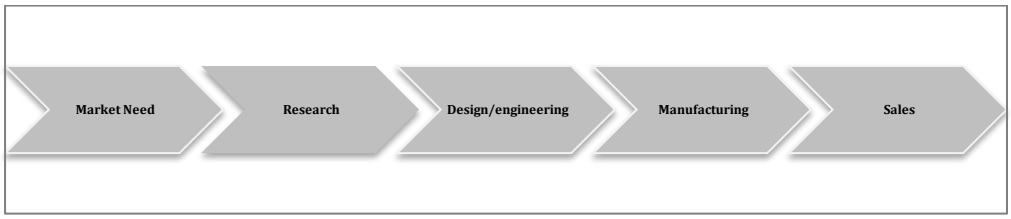



Figure 11 Demand Pull model of innovation

After the Second World War, the Technology Push model came under increasing scrutiny (both by government and corporate management), with their growing concerns reflecting a failure of R&D departments to generate a pipeline of commercially viable products which in turn reflected a lower return on investment than expected (Graham, 2010).

The concept of demand-pull models of innovation (Figure 11) emerged during the 1970s. It was inspired by insights from Project Hindsight, which was commissioned by the US Department of Defence in 1965 to evaluate the outrun of research and development and identified related factors contributing to success. The report stressed the importance of identifying '*need'* as key to successful exploitation of applied research. Market/user need was specifically identified as being of central importance in successfully applying research outcomes.

*"Nearly 95 percent [of innovations in weapons systems] were motivated by a recognized Defence need"* (Sherwin & Senson 1967, p.1577).

This challenge to Technology Push was reinforced by new perspectives on the innovation process emerging from *innovation studies* as a discrete discipline and area of research. Godin & Lane (2013) note that the demand-pull model was correlated with the emergence of interdisciplinary innovation studies during the 1970s and the creation of research groups, notably Science Policy Research Unit (SPRU) at the University of Sussex and the Policy Research in Engineering, Science and Technology Unit (PREST) at the University of Manchester. Innovation Studies explored a wider range of factors (other than science-based research) from different perspectives as drivers to successful innovation (Godin & Lane 2013).

By identifying the role and importance of market need/opportunity in successful innovation, the model challenges the primary importance attached to basic research and Technology Push. Explicitly, demand-pull models reflect the assumption that successful innovations '*..arise in response to a specific need..*' (Rothwell & Robertson 1973, p.213); a need that is socially and economically embedded in the wider society. The work of Schmookler (Scherer 1997) provided an economic and empirical framework that substantiated the importance of demand-pull factors.

The emphasis on market demand (reflecting unmet needs) as critical for successful innovation, led to a growing lexicon (and related support mechanisms) associated with the imperative to link research with needs. Concepts such as coupling, brokering, transfer, liaison, fusion, interaction and communication came into both public and corporate practice and continue to the present. In particular, related innovation strategies emphasised the key roles that coupling and marketing played in effectively match-making needs together with research investment.

*Open Innovation (OI): A new paradigm?*

*"The use of purposive inflows and outflows of knowledge to accelerate internal innovation and to expand the markets for external use of innovation, respectively"* (Chesbrough 2006).

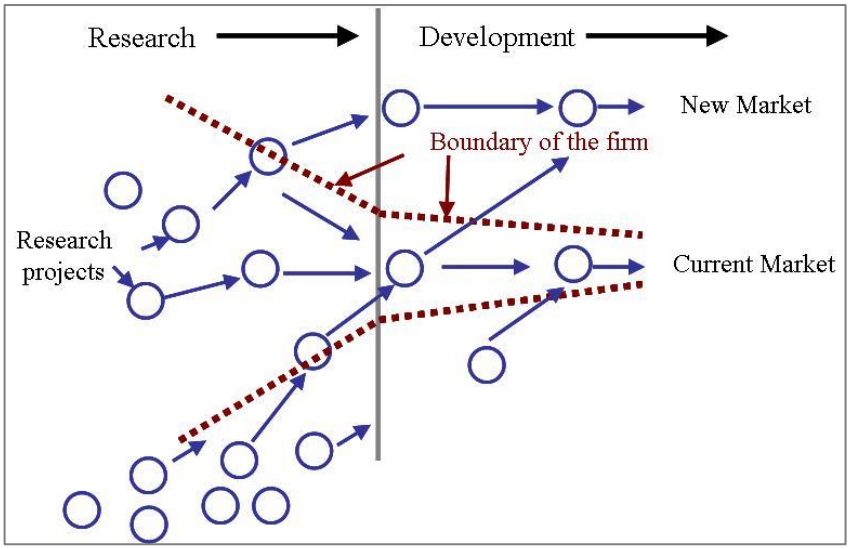



Figure 12 Illustration of the open innovation model (Emedia 2015)

A debate about open and closed innovation models has resurfaced in recent years with the work of Chesbrough (Chesbrough 2003; Chesbrough & Crowther 2006; Gassmann et al. 2010). He describes open innovation as a new and emergent model characterised by a high degree of corporate permeability. This openness is defined in terms of inflows and outflows of technology, investment, knowledge and related strategic partnerships (Figure 12). In this respect, the open model is posited as a paradigm shift in relation to the prevailing closed model of innovation (where innovation takes place behind corporate boundaries).

While recognising its descriptive power (Trott & Hartmann 2009) argue that neither the theory nor practice of Open Innovation support the proposition of a paradigm shift.[26] Key points include:

- The presentation of open innovation in relation to a closed innovation model is a false dichotomy.

- That *'closed innovation*' hardly existed in practice with key characteristics of closed innovation based on extreme examples i.e. Xerox and its Palo Alto Research Centre (PARC).

- In terms of observable behaviour, companies have long been practising different forms of open innovation for decades, and some even centuries.

- Companies have always responded to external opportunities, threats socio economic drivers to change e.g. technology, globalisation (Zegveld & Rothwell 1985).

[26] The concept of the paradigm shift refers to a radical change in an approach, model or perspective reflecting changes in their underlying assumptions. Thomas Kuhn originally identified the concept in relation to the development of scientific theory and practice being characterised by periods of stability followed by disruption rather than a gradual and stable process of development (Kuhn 1970).

Arguing that the strategic relationships with external partners have long been recognised as critical to successful innovation, and speaking with reference to US experience, Graham states that open innovation was historically common (before the turn of the 20th century), often centred on work places and machine shops. This model was characterised by strategic relationships between companies in the same sector to develop new products. Powell and Grodal (2005) refer to several studies, which demonstrate that companies increasingly relied on inter-organisational networks to tap into dispersed knowledge.

While the concept of open innovation has gained a high profile in terms of management and policy practice, it remains predicated on a linear journey from science and technology to product (albeit taking place both within and outside the boundaries of the company). Chesbrough's assertion that OI represents a paradigm shift is open to question. However, its emphasis on networking and strategic relationships in support of innovation does reflect a change in emphasis that is strongly aligned with emergent models of innovation described below and the value of universities as partners in the innovation journey. It also implicitly recognises different dimensions of knowledge and the value of diverse sources of such knowledge.

**A non-linear perspective**

*"Models that depict innovation as a smooth, well-behaved linear process badly miss-specify the nature and direction of the causal factors at work. Innovation is complex, uncertain, somewhat disorderly and subject to changes of many sorts*"
(Kline & Rosenberg 1986, p.1).

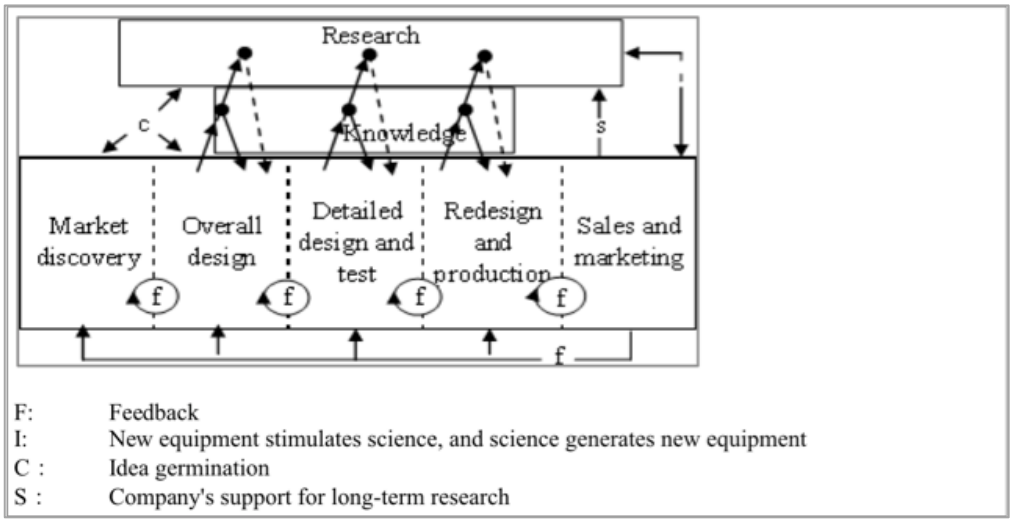



Figure 13 Chain-linked model of innovation (Kline & Rosenberg 1986)

Based on their professional experience, Kline and Rosenberg argued that the process of innovation was iterative and uncertain. Their chain-linked model (Figure 13) incorporated an emphasis on market needs, which create and shape opportunities for the use of existing technology and reveal gaps in knowledge that can drive future research. Key features include:

- Innovation begins with knowledge about a commercial opportunity in relation to existing products/services or an opportunity for the creation of a new product (not science- or technology-driven research).

- A key driver to innovation is design (not technology), that acts to explore and drive product adaptation and development through iterations between market/consumer and the capabilities of the company.

- Feedback loops are critical through the innovation journey reflecting the process through which knowledge is accessed and applied in adapting and developing new products.

- Research needs are identified when existing knowledge is insufficient to solve a problem identified during the iterative process.

Within this framework, accessing and applying knowledge becomes the critical factor in capturing opportunities (both explicit and tacit knowledge), with iterations becoming a key aspect of the innovation process.

*Five generations of innovation*

*"Innovation is not a stable unit of analysis"* (Leydesdorff 2005, p.2).

Rothwell (Rothwell 1994; Barbieri & Álvares 2016) provides an overarching and inclusive framework within which he situates both linear and non-linear models (Table 12).

The framework implies an evolution of thinking and practice in how innovation can be understood and managed. The models develop from a relatively simple linear journey (from research to product) towards multi-track and multi-dimensional processes characterised by factors and feedback loops, both within and between organisations and external networks.

A key characteristic of the fourth and fifth generation models is a reliance on external sources of knowledge, both tacit and codified, with networking playing a critical role in successful innovation. It is a process of innovation that is speeding up, driven by short product cycles and rapid technological change. In this context, both formal and informal sources of knowledge (universities, learning institutions, professional bodies, informal networks etc.) are key elements of a coherent innovation strategy. In reflecting on the meaning of innovation through the lens of Rothwell's framework (Rothwell & Robertson 1973; Rothwell 1994) we have moved from the assumption that innovation is fundamentally based on codified knowledge to a broader and more complex process that encompasses a growing number of dimensions, types and sources of knowledge.

| Generation | Model | Characteristics |
|---|---|---|
| First | Technology Push | Linear and sequential journey form discovery to commercialisation. Emphasis on R&D and transformation of research outcomes with little emphasis on understanding the market context. |
| Second | Market Pull | Linear sequential process with greater emphasis on real or perceived market need and demand as a guide to R&D investments. |
| Third | Coupling | Linear and sequential but with more interaction between the stages and can combine Technology Push with Market Pull approaches. More feedback loops with greater integration between R&D and marketing functions. |
| Fourth | Interactive | Linear and sequential but with greater integration between functions (R&D, marketing, production and design) within the corporate entity and externally with both suppliers and consumers. |
| Fifth | Networking | Non-linear incorporating greater flexibility and further integration in processes, strategy and approach between functions, consumers and suppliers. Emphasis upon networking and collaboration with external stakeholders and co-development of innovation strategies, methods, products etc. |

Table 12 Adapted from Rothwell's Five Generations of Innovation (Rothwell 1994)

*The Innovation Matrix (Phillips Design)*

*"The design discipline has by nature a considerable expertise in integrating technologies, generating and interpreting end user insights and marketing information and above all, visualizing outcomes, all of which the discussion needed for successful innovation"* (Kyffin & Gardien 2009, p.68).

As developed by Kyffin and Gardien (2009), with reference to case studies from Phillips Design, the innovation matrix illustrates a non-linear design-led model of innovation related to emergent technology. This innovation framework draws on different models. The first is the *Three Horizons of Growth* (Baghai et al.1999), which stresses the role that companies have to play in navigating three dimensions of strategy in attempting to innovate (products and services*); Horizon 3*: creating viable options; *Horizon 2*: developing new businesses and *Horizon 1*: defending and extending the companies' core business (Figure 14).

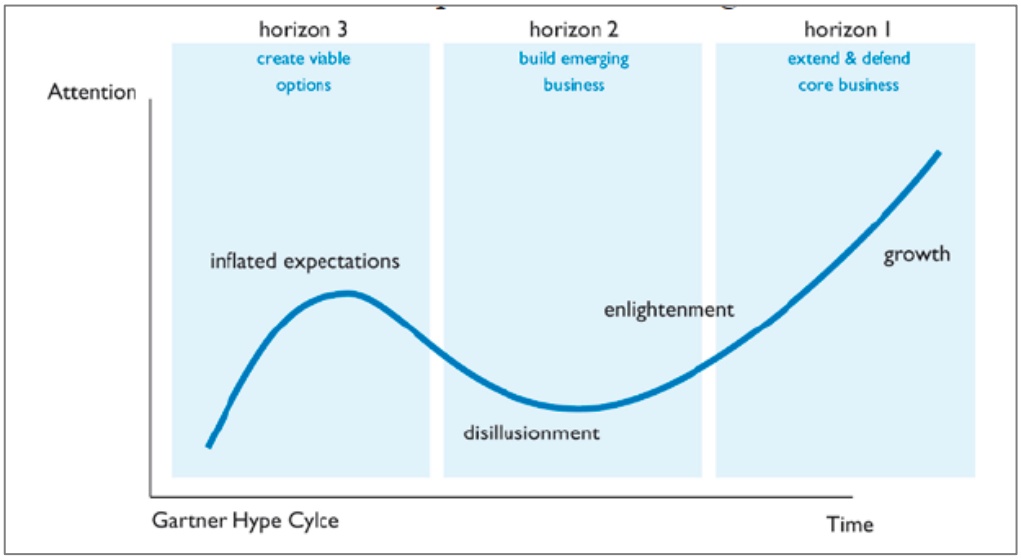



Figure 14 Three Horizons of Growth and the Gartner Hype Cycle (Kyffin & Gardien 2009, p.59)

This is integrated with the *Gartner Hype Cycle* (Panneta 2016) which outlines the journey that new and emergent technologies travel in generating viable products and services. A process which moves from the early stage of excitement and hype associated with initial discovery, through to disillusionment, when initial expectations are not met, followed by enlightenment when applications not foreseen at the time of conception are discovered and lead to sustained growth. A final dimension of their analysis, addressing how value is treated during each phase (identifying, developing, communicating), is informed by the work of Lanning and Michaels (1988 cited in Kyffin and Gardien 2009, p.62).

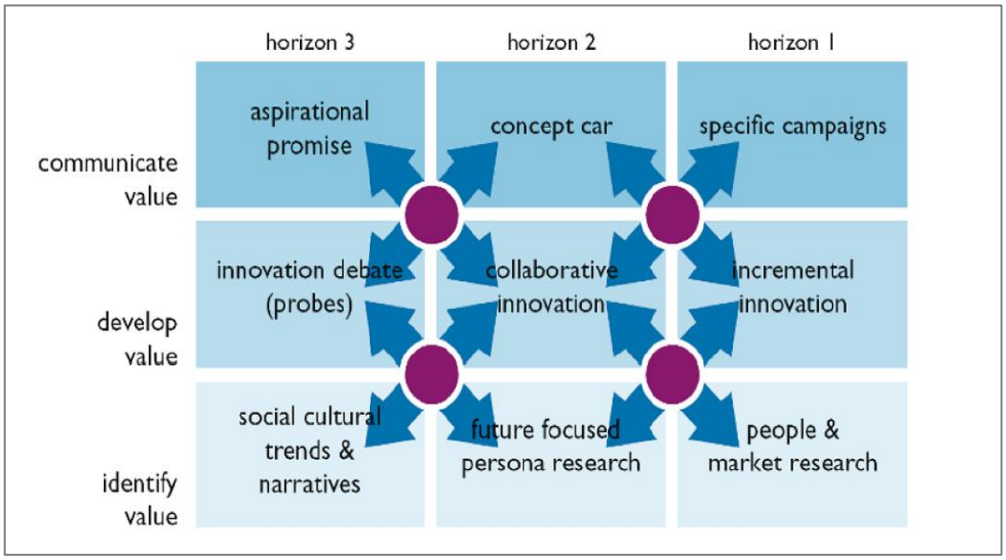



Figure 15 Routes to navigating the innovation matrix (Kyffin and Gardien 2009, p 67)

Key points include:

- An exploration of a non-linear process where the eventual successful application of the emergent technology is not known at the beginning of the journey. The traditional linear model is therefore not appropriate in this emergent context.

- The model highlights that different competencies and capabilities are required for each phase where value is emergent. Imposing a business-case straitjacket on emergent technology/applications can undermine their successful development by closing down options too soon.

- The '*identify/develop/communicate*' dimensions highlight different activities related to product development relevant for each Horizon. Early phase activities (Horizon 3) are associated with exploration and understanding context as the basis for catalysing discussion and debate.

- In turn, this catalyses a process of mapping the most appropriate applications (collaborative innovation), which subsequently provides the impetus for further product development (incremental innovation) and getting the product to market.

- Design as a tool for research and communication provides a mix of capabilities to support navigation of the innovation landscape. This supports the process by which ideas and contexts are understood as the basis for defining and developing early stage prototypes (products and services) and then getting these to market (playing the role of champion throughout the journey (Carlson & Wilmot 2006).

*"Possibly the most important and overriding message of this examination is that making innovation more successful requires managing imaginative ideas in different ways and not by following the well-beaten path that all too often ends up being a road to nowhere*" (Kyffin & Gardien 2009, p.68).

**Summary**

Chapter 4 has identified different ways of thinking about innovation as a process together with different perspectives on how innovation can be managed. These are models which reflect a growing complexity in the understanding of innovation (Kotsemir & Meissner 2013) moving from simple time-bound and staged linear processes to complex social system perspectives that include different actors and factors interacting across a wider social context (Godin 2017).

It is a process involving different types of knowledge (codified and tacit), generated and shared across increasingly wide networks (local, national and international) and actors (corporate and micro-businesses, public bodies, third sector, users etc.). It takes place against the background of shortened product lifecycles, emergent and uncertain opportunities for technology and social and market needs. While different models may reflect the changing perspectives of academics and business leaders as much as the process itself (Godin 2017), they (and their underlying assumptions) have a profound influence in shaping public and private policy and related measures directed at enabling innovation. This includes both the importance and role of universities as catalysts for innovation in its broadest sense.

Since Schumpeter, research into innovation has become increasingly multidisciplinary (economics, management theory, organisational and systems theory, knowledge management, sociology, anthropology, economic, business history, design etc.) with many dimensions of innovation identified in process and management. Concepts such as user innovation, innovation tool kits (von Hippel 1976), design-led innovation and human-centred design (Verganti 2008) and emergent 6th generation models (Chaminade 2002; Jacobs and Snyder 2008 cited in Kotsemir & Meissner 2013 p.10) all highlight the growing appreciation of the social context within which innovation takes place and the variety of internal and external factors that need to be considered.

The emergence of *Agile Management* (Agile Alliance 2016; Eck et al. 2001) reflects a further response to the dynamic context where new products and services are developed on the back of emergent technologies, applications and user needs (see Chapter 10 and 11).

Design,[27] in theory and practice, provides alternative perspectives to the traditional mind set of managers (and management thinking) in their approach to innovation (Acha 2006; Norman & Verganti 2014; Verganti 2008; Kyffin & Gardien 2009; von Stamm & Trifilova 2009; Cruickshank et al. 2012; Cruickshank 2013; Cruickshank 2014). Leveraging professional and creative expertise that can help organisations unlock value from existing and/or new products and services (Hobday et al. 2011), shaping viable solutions aligned with user and wider social needs and reflecting qualities such as empathy, integrative thinking, optimism, collaboration and visualisation (Cruickshank & Evans 2012).

[27] *"Design is the conscious decision-making process by which information (an idea) is transformed into an outcome, either tangible (a product) or intangible (a service)"* (Stamm, 2004, p.11).

## Chapter 5 Insights from the Theory and Practice of Knowledge Management

*"If you want to manage something you should at least have an idea on the nature of what it is you are managing*" (Essers & Schreinemakers, 1997, p.25).

Concepts associated with the meaning of knowledge provide a starting point in the exploration of different models and approaches to knowledge management. From classical civilisations to the present, the nature of knowledge and knowing has been central to philosophical discourse and debate. While these debates and related schools of thought shape the researcher's perspective on knowledge sharing, creation and application (Chapters 2 & 3), this chapter focuses on a narrower analysis of knowledge in the context of collaboration. It draws on the distinction between tacit and codified knowledge and their underlying assumptions (Chapter 2).

This chapter demonstrates how these assumptions shape different policies and approaches to knowledge management in practice and provide insights into the theory and practice of knowledge exchange. Gourlay notes that a distinction between two broad types of knowledge is generally agreed (Gourlay 2006) in KM the labels tacit and explicit are used while in other disciplines different names/concepts are preferred. Alavi and Leidner (2001) identify several perspectives on knowledge through a review of definitions and related frameworks by which knowledge is understood:

| Perspective | Operational Implication |
|---|---|
| Knowledge vis-à-vis data and information | Emphasis on data, access to data and increasing capacity to assimilate data. |
| Knowledge as a state of mind | Emphasis on enabling individuals to expand their personal knowledge to the benefit of the organisation. |
| Knowledge as an object | Knowledge as something that can be stored and manipulated. |
| Knowledge as a process of knowing and acting | Emphasis on the application of expertise. |
| Knowledge as a condition of access to information. | Also related to knowledge as an object with emphasis on organising knowledge to facilitate access and retrieval. |
| Knowledge as a capability with the potential to influence future action. | Emphasis on learning and experience as the basis for interpreting information and determining relevance to decision-making. |

Table 13 Perspectives on knowledge and their operational implications (adapted from Alavi & Leidner, 2001, p.111)

Gourlay refers to the concepts of '*Knowledge How*' and '*Knowledge That*' (adapted from Sahdra & Thagard 2003 cited by Gourlay 2006, p.1425):

*Knowledge How (broadly aligned with the tacit)*: Knowledge where meaning is dependent on situation and context:

*"it does not appear meaningful to consider it as 'knowledge' apart from someone who knows and the situation in which they act".*

*Knowledge That (broadly aligned with the explicit)*: Knowledge that can be expressed in symbols such as language/numbers/forms existing independently of individuals and a given context.

**Knowledge Management as a discrete area of research, policy and practice.**

*"Corporate Knowledge Management is primarily directed towards the pragmatic objective of finding principles that may ensure the successful application and utilisation of knowledge…"* (Essers & Schreinemakers 1997, p.26).

From the 1950s onwards, a growing interest among academics and corporate managers focused on exploring the nature and role of knowledge in the context of organisational success (building on and developing insight from Penrose and others); with particular attention on its role in securing competitive advantage (Drucker1969; Sveiby1997; Alavi & Leidner 2001; Nonaka,1991; Nonaka et al. 1996; Nonaka et al., 2003; Dalkir 2011).

The list presented below summarises key milestones marking the emergence of knowledge management in theory and practice (adapted from Skyrme, 2002, p.2 and Dalkir 2011, pp.15-26, with additions by the author).

- **1959** - Penrose, *The Theory of the Growth of the Firm*, (A resource-based theory of the firm).
- **1959** - Drucker - Concept of the knowledge worker emerges, *The Landmarks of Tomorrow.*
- **1987** - Erik Sveiby/Tim Lloyd - *Managing Knowhow.*
- **1987** - '*Managing the Knowledge Assets into the 21st Century'* round table (between US academia, business and government) – one of the first nationwide efforts to harness intellectual capital.
- **1990** - *Core Competencies and the Corporation* Prahalad and Hamel.
- **1990** - Senge - The concept of the *learning organisation.*
- **1991** - Appointment of L. Edvinsson as Vice President of intellectual capital for Skandia, the first formal board-level appointment related to knowledge management.
- **1991** - Nonaka, Publication in Harvard Business Review of article by Nonaka on the '*knowledge-creating company'*, expanded and published as a book with Hirotaka Takeuchi (1995).
- **1991** - Lave & Wenger, Brown and Durgoud, *Communities of Practice*.
- **1993** - '*Intellectual capital: your company's most valuable asset'* – article by Tom Stewart in Fortune that helped raise awareness of Knowledge Management among the business community.
- ***1994*** - *The Fifth Discipline Field Book: Strategies and Tools for Building a Learning Organization*, Senge.
- **1995** - First business seminars and conferences in the US e.g. Knowledge for Strategic Advantage – co-sponsored by Arthur Andersen and the American Productivity and Quality Centre.
- **1996** - *The Balanced Scorecard: Translating Strategy into Action*, Kaplan and Norton.
- **1998** - The World Bank identifies Knowledge for Development as the topic for its annual world development report.

- **2000 -** KM programmes (teaching and research) emerge in universities.
- **2007** - *Appreciative Inquiry and Knowledge Management,* Thatchenkery and Chowdhry.

The body of work represented in the above list, while not exhaustive, reflects a growing recognition of changes taking place in the structure of western capitalist economies. It marks a transition from manufacturing to service-based industries dependent on information and knowledge-based resources (people) for success. It is the emergence of post-industrial economies where the knowledge economy is defined by the OECD as:

*"..economies which are directly based on the production, distribution and use of knowledge and information"* (OECD 1996, p.7).

This growing emphasis on knowledge, relative to other factors of production (labour, land, capital), was not to deny the critical role of knowledge in historical economic development, but rather its growing importance relative to the other factors in post-industrial economies (OECD 1996). Echoing the early work of Penrose, concepts such as the learning organisation (Agyris and Schon 1974; Senge 1990; Buchanan & Huczynksi 2017) and knowledge-based theories of the firm recognized knowledge as the basis for achieving and sustaining competitive advantage. Tallman, with reference to the work of Kogut and Zander, recognises the importance and value of knowledge as the basis for competitive edge in the market place (Tallman 2003; Kogut and Zander 1993). Against this background, knowledge management emerged as a discrete area of research and corporate practice, focused on managing knowledge as an organisational asset, where Knowledge Management is defined by Harish (Harish, 2013, p.293 citing Alle 1997; Alavi & Leidner 2001; Davenport & Prusak 1998) as:

*"...managing the corporation's knowledge through the process of creating, sustaining, applying, sharing and renewing knowledge to enhance organizational performance and create value"*

Paulin and Suneson (2012, p.81) stress the inter-organisational nature of knowledge management (KM):

*"A fundamental part in knowledge management is to spread and make knowledge accessible and usable within or between chosen organizations….".*

Dalkir defines the concept in terms of:

*"…the deliberate and systematic coordination of an organization's people, technology, process and organizational structures in order to add value through reuse and innovation. This is achieved through the promotion of creating, sharing and applying knowledg*e" (Dalkir 2005, p.3).

The remainder of this chapter presents an overview of different models of KM and their underlying assumptions.

*The Data, Information, Knowledge and Wisdom pyramid (DIKW)*

Ackoff's *Data, Information, Knowledge, Wisdom* pyramid (DIKW), identifies knowledge as being fundamentally data-driven (Ackoff 1989; Bernstein 2011; Robertson 2013). It reflects underlying philosophical assumptions (positivism, inductivism and operationalism[28]) and an emphasis on absolute meaning and logic in the process by which knowledge is created (in the form of sequential steps). Specifically, causal links by which information can become knowledge, i.e. assumptions, *'which makes control of a system possible'* (Ackoff 1989, p.4).

[28] Operationalism (n): *"A form of positivism which defines scientific concepts in terms of the operations used to determine or prove them*" (Oxford University Press n.d.).

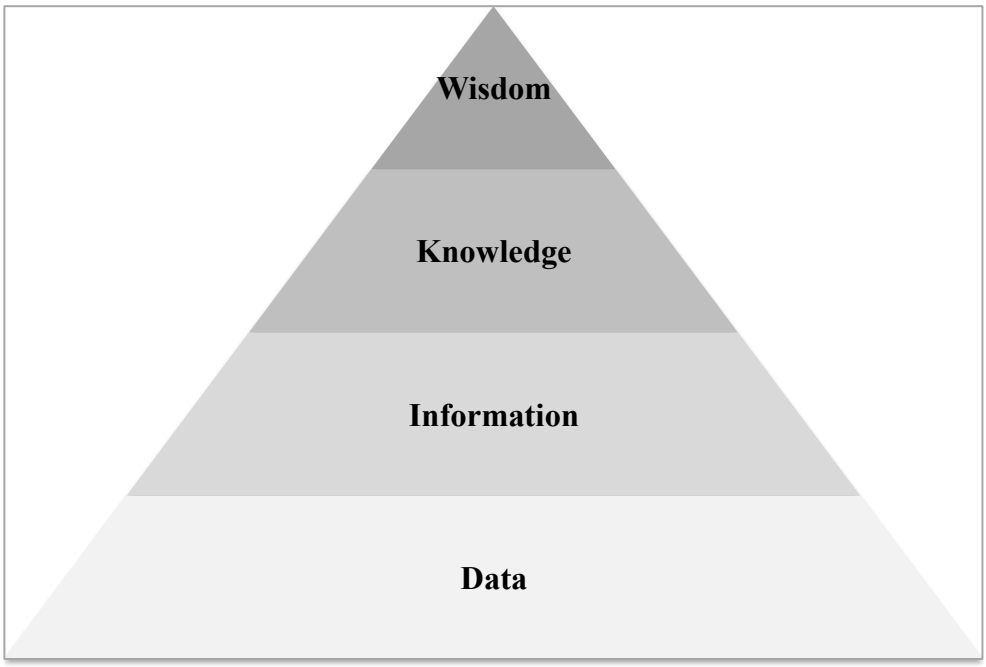



Figure 16 A hierarchical view of data, information and knowledge (Bernstein 1989, p.69)

This perspective reflects the assumption of a logical and measurable relationship between categories and the steps that lead from information to knowledge (Figure 16). This in turn provides a basis for operationalizing (automating) knowledge creation. The matrix is strongly aligned with systems-intensive areas of theory and practice, notably library science (Hislop 2013), with a related emphasis on information technologies as the basis for knowledge management systems. Alavi and Leidner (2001) note that in IT literature, a hierarchy of knowledge emerges which reflects a logical set of relationships where data becomes information, which in turn provides the basis for knowledge and wisdom.

Reflecting on this systems-based approach, Dalkir notes:

*"With the advent of the information or computer age, KM has come to mean the systematic, deliberate leveraging of knowledge assets"* (Dalkir 2011, p.17)

| Category | Description |
|---|---|
| **Wisdom** | Wisdom is the ability to increase effectiveness. Wisdom adds value, which requires the mental function we call judgment. The ethical and aesthetic values that this implies are inherent to the actor and are unique and personal. |
| **Knowledge** | Knowledge is know-how and is what makes possible the transformation of information into instructions. Knowledge can be obtained either by transmission from another who has it, by instruction, or by extracting it from experience. |
| **Information** | Information is contained in descriptions, answers to questions that begin with such words as: Who, What, When and How Many. Information systems generate, store, retrieve and process data. Information is inferred from data. |
| **Data** | Data are defined as symbols that represent properties of objects, events and their environment. They are the products of *observation*. But are of no use until they are in a useable (i.e. relevant) form. The difference between data and information is functional, not structural. |

Table 14 Ackoff's knowledge pyramid defined (Rowley 2007, p.166)

In a review of research and models which draw upon the DIKW hierarchy, Rowley (2007) stresses that while an agreement emerges on the definition and overall relationship between data, information and knowledge (data and information being inputs into knowledge), there is no agreement on the transformational process by which the process is completed. Factors such organisation, structuring, coding, archiving and accessing are all identified as characteristics of a process by which information is made useful and available. However, she notes that explicit knowledge as recorded in information systems and documents is nothing more than information. This reflects the role that human agency (understanding, experience and personal insights) play in using information as the basis for generating knowledge and increasing capacity for taking action.

*A model of knowledge creation*

In contrast to the information processing models of knowledge creation (embodied in the knowledge pyramid), an alternative perspective is provided by Nonaka and colleagues (Nonaka & Lewin 1994; Nonaka et al.1996) addressing both the tacit and explicit dimensions of knowledge creation. The *Socialisation, Externalisation, Internalisation and Combination* (SECI) model (Figure 17) emphasises the dynamic and social nature of knowledge generation and is explicitly driven by the interaction between tacit and explicit knowledge on a journey which is defined and shaped by place and context. At the heart of this journey, Nonaka highlights the importance of tension and resolution as driving forces in the process of creation, diffusion and knowledge application.

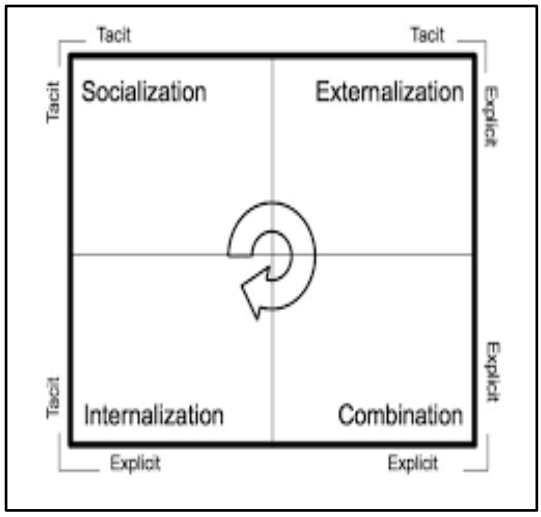



Figure 17 The Socialization, Externalization, Combination and Internalization Model (Nonaka & Toyama 2003, p.5)

Nonaka and colleagues outline a multi-dimensional social process (Nonaka, 1991; Nonaka et al,1996; Nonaka et al. 2000; Nonaka, Nonaka and Toyama 2003). It is a process which draws upon positivism and practice-based assumptions concerning knowledge and knowing, specifically in relation to the differences between explicit and tacit knowledge (Hislop 2013). It involves both a conversion of tacit into explicit knowledge and individual into collective, organisational knowledge. By making a distinction between tacit and explicit knowledge, SECI provides a framework for analysis that goes beyond a concept of a simple step-by-step '*information processing'* exercise as the driver for knowledge creation.

Nonaka and Toyama note that:

*"Knowledge is created in the spiral that goes through seemingly antithetical concepts such as order and chaos, micro and macro, part and whole, mind and body, tacit and explicit, self and other, deduction and induction, and creativity and efficiency"* (Nonaka and Toyama 2003, p.1).

This knowledge spiral reflects a journey of creation which is dynamic and characterised by ongoing social interaction between individuals, organisation and the wider environment, catalysing a process by which tacit knowledge becomes explicit and generates new knowledge. Through social interaction, conditions are created within which knowledge is shared, transferred, created and applied**:**

**Socialisation** (*Tacit to tacit*)*:* The sharing and creation of tacit knowledge through social interactions. The sharing of experience, mental models and insights e.g. mentoring, on the job training, brainstorming, cafés etc.

**Externalisation**: (*Tacit to explicit*): A process by which tacit knowledge is captured and made explicit by a process of writing down, programming, quantifying and making tangible. This process may be facilitated by a third party.

**Combination**: (*Explicit to explicit*): A process of combining different elements of explicit knowledge within the organisation into something new, such as through creating training programmes and courses, generating a database that combines and organises different elements of explicit knowledge.

**Internalisation**: *(Explicit to tacit knowledge*)*:* A process by which knowledge spreads and is embedded into a social context, individual and organisational e.g. learning by doing.

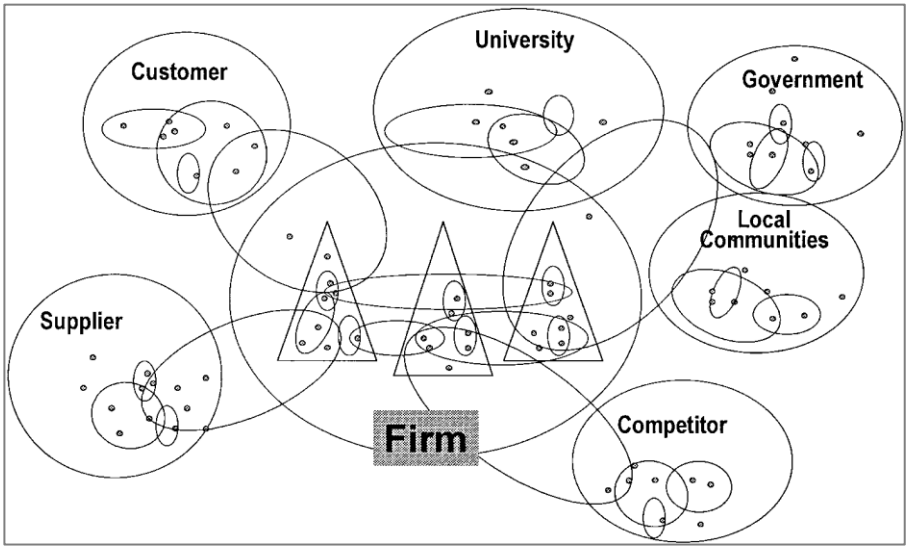



Figure 18 The organisation as an organic configuration of Ba (Nonaka and Toyama 2003, p.8)

Nonaka and Toyama (2003) stress the central role that context (Ba)[29] plays in providing a shared space inclusive of different dimensions; physical, digital, mental (Figure 18). This constitutes a space where social interaction takes place and where information acquires meaning (in many ways aligned with the concept of *Agora* introduced by Gibbons with reference to the concept of Mode 2 knowledge production in Chapter 6).

In this role, context catalyses social interaction at a specific time and location (physical and virtual) or can take place across time and place. Ba is permeable, flexible and is created with reference to need. At an organisational level, it can be embedded in project teams, micro communities, informal meetings, online social networking, café culture and workshops, and it can reach across organisational boundaries e.g. joint ventures, partnerships, co-design etc. Context and organisational boundaries (aim/strategy/objectives) provide the framework within which knowledge transfer, sharing and application takes place. This is social interaction creating a basis for building a new and shared picture of reality, and it can be dialectic and facilitated, reconciling and synthesising different perspectives into a central driving force (Nonaka and Toyama 2003).

[29] Inspired by the Japanese philosopher Nishida cited in Nonaka and Toyama (2003, p.6).

Critiques of the SECI model address a number of different dimensions of the perspective. Gourlay (2006) identifies an epistemological inconsistency in its treatment of knowledge, specifically, the assumption that all *tacit* knowledge is convertible; '..*the omission of inherently tacit knowledge*..'. The view is also taken by Powell et al. (Powell et al. cited Bandera et al. 2017, p.166) that the definition of what constitutes knowledge appears to be largely based on corporate management's belief about what is/is not knowledge, and is therefore subjective (Gourlay 2006, p.1416).

Essers and Schreinemakers (1997) note the challenges of needing to reconcile different groups and their assumptions about what constitutes knowledge and how it can be justified in the absence of agreed standards, explicitly between the subjective and the objective dimensions addressed in the context of the SECI model. They draw on the work of Kuhn and the concept of incommensurability (Kuhn,1970 cited by Essers and Shreinemakers 1997, p. 29). Gourlay also critiques a lack of empirical evidence to support the four stages of the SECI process itself (Gourlay 2006). A further observation by Bandera (2017) is the focus on knowledge creation in corporate environments when a significant part of innovation takes place in entrepreneurial SMEs.

**An overview of alternative KM models**

Table 15 outlines different perspectives on Knowledge Management. These explore how different types of content can be managed and the importance of the relationship between tacit and explicit. They reflect the complexity of the knowledge creation, sharing and application process by going beyond the information-processing model and address a wider social context within which KM takes place.

| Name | Date | Key Theme |
|---|---|---|
| Beer, Beer and Bennet | 1981 1989 | Systems-based model of the organisation. Emphasis on the interaction of independent agents to self-organise in relation to goals as the basis for patterns of complex behaviour. The key challenge is to manage how individuals remain a functioning part of the organisation. Internal knowledge networks are critical in connecting and sharing knowledge. |
| Complex Adaptive Systems Model Wigg | 1993 | Based on a knowledge matrix that goes beyond the simple tacit/explicit distinction. The model identifies four types of knowledge (factual, conceptual, expectations and methodological) in three forms (public, shared expertise and personal). This provides a framework for organising and managing knowledge which stresses the development of semantic networks driven by organisational need. |
| The Boisot I Space Model | 1995 | Emphasises a distinction between physical asset and the 'information/knowledge good' extracted from data given meaning and context by observation. Emphasis on a shared language as the basis for transmission. Codification and abstraction key to successful KM although the importance of context in creating meaning is accepted. Generates a typology of knowledge that includes codified, abstract and diffused. |
| Kroog and Roos | 1995 | An epistemological approach with emphasis on individual and social knowledge. Stresses that knowledge is embedded within individuals and across the relationships they form with other people. |
| Choo and The Sense Making | 1998 | Explores how knowledge is created and then absorbed into the decision-making process of the organisation. In particular, explores how information from the wider environment is processed in the form of new knowledge and making sense of that knowledge through creation of shared meaning. |
| Bhatt Inukshuk Model | 2000 2001 2002 | Emphasis on strategic alignment of KM efforts and the role of leadership, policy, strategy and people. Explores factors that enable successful KM outcomes. |
| Canadian Government (Girard) | 2005 | Canadian government recognised KM and bespoke nature of how companies implement it. Identifies shared enablers and drivers for success including: technology, leadership, culture, measurement and process. The model reflects the SECI processes. |

Table 15 Models of Knowledge Management (adapted from Dalkir 2011, pp. 59 -96)

**Implementing KM: from command and control[30] to an enabling approach.**

*"The assumption that technology can replace human knowledge or create its equivalent has proven false time and time again"* (Davenport & Prusak 1998, xi).

Reflecting an evolution of thinking, approaches to implementing knowledge management reflect assumptions and related processes by which knowledge can be created/co-created, transferred and shared. They cover a spectrum: from information processing, emphasising objective knowledge, technology and a mechanistic hardwiring of an organisation, to approaches that stress the social nature of knowledge management and the importance of appropriate culture and context for successful knowledge creation and application:

*"...an organisation's context for knowledge sharing, called collaborative climate, can be seen as the shared mental space, where knowledge sharing and creation take place. Behaviours, attitudes and atmosphere that characterise the life in this mental space are perceived by the knowers and become elements in the knowledge assimilated (Polanyi,1958) by them."* (Sveiby and Simons 2002 cited in Sveiby 2007, p.1639).

[30] Command and control (n): "*a situation in which managers tell employees everything that they should do, rather than allowing them to decide some things for themselves"* (Cambridge Dictionary n.d.).

| Wigg ('93) | McElroy ('99) | Bukowitz & Williams ('03) | Zack ('96) |
|---|---|---|---|
| Creation | Individual and group | Get | Acquisition |
| Sourcing | learning | Use | Refinement |
| Compilation | Knowledge claim | Learn | Storage/retrieval |
| Transformation | validation | Contribute | Distribution |
| Dissemination | Information acquisition | Assess | resentation |
| Application | Knowledge validation | Build/sustain | |
| Value realisation | Knowledge integration | Divest | |

Table 16 Implementing KM: a comparison of process models (Dalkir 2011, p.33).

While knowledge management has generated high expectations, it has often failed to meet these expectations (Essers & Schreinemakers 1997; Sveiby 2007; Dalkir 2011). Two of the main challenges facing the discipline are its overemphasis on the role of technology (and, by definition, explicit knowledge) combined with too low a priority attached to the social context within which knowledge generation and application occurs. This argument is also stressed by Von Krogh, Ichijo and Nonaka, who, by building on the knowledge spiral and importance of social context, explore the implications of building an enabling organisation.

This positive, enabling approach to knowledge management also reflects the underlying epistemological assumptions of Appreciative Inquiry (Chapter 2), both as a theory exploring how organisations evolve and as a methodology of practice. Assumptions which reflect a belief that organisations are systems of shared meaning and beliefs that are constantly being maintained though social interaction. Embodying structures and cultures which are fluid and that can be shaped by '*intentional collective action'* through co-designing and working collectively to achieve a positive vision of the future. Thatchenkery & Chowdhry (2007, p.44) distil this down to a process where:

*"This innovative action research model was developed with the idea that it would take the best ideas of the organizations and attempt to reinforce and build upon them in a positive way while working within the current culture of the organization".*

A central proposition of the AI approach is that the role of management is to facilitate rather than control the process of managing knowledge. In this context, the negative impact of other factors are identified, such as 'hyper-competition'[31] and command and control styles of management, specifically in undermining the application of creativity, the sharing of information between colleagues and the development of social relationships identified as necessary for successful knowledge sharing and application. In applying the principles of AI in practice, the Appreciative Sharing of Knowledge (ASK) method provides a staged process for the design and delivery of a knowledge management strategy through collectively identifying (with employees) a vision for the future, important enablers and related supporting and incentivising actions.

Table 17 identifies knowledge enablers' supporting actions that were identified in the context of applying the ASK method in the Public Service Organisation[32] (PSO), a public-sector organisation in the USA, presented by Thatchenkery & Chowdhry (2007, pp.147-151).

[31] Hyper-competition is a concept that reflects a working culture shaped by an operating environment characterised by extreme competition undermining the process of knowledge sharing and creation.

[32] Authors noted that the details of the organization were anonymous.

| Knowledge Enabler | Description |
|---|---|
| Empowerment[33] | Manifested in a sense of shared commitment and responsibility to organisational success and an egalitarian and responsive leadership style from management. This was reflected in a high degree of staff autonomy in how they organised themselves and a belief that team members would take responsibility for successful delivery. |
| Collaboration | Formal and informal collaborations across teams and organisational boundaries. Collaborations were supported by management and identified as an important catalyst for knowledge sharing. |
| Belief in mission | A shared understanding amongst all staff and related commitment to the organisation's overall purpose and aims. |
| Building relationships | Emphasis on building and sustaining relationships across the organisation against the background of values and behaviours which supported this aim e.g. communication, empathy, facilitation, mentoring and a sense of community. |

Table 17 Knowledge enablers in the context PSO case study

Strongly aligned with the value attached to the enabling environment, the AI approach can be contrasted with alternative perspectives which identify knowledge as a tangible commodity. Approaches based on this assumption place emphasis on managing knowledge like any other factor of production (e.g. capital), focusing on the need to optimise the relationship between inputs and outputs in the search for efficiency and enhanced productivity. An approach which assumes that knowledge can be possessed, measured, stored, processed and distributed to people who are identified as potential users (Thatchenkery & Chowdhry 2007).

[33] *'Empowerment is evident when individuals in an organisation gradually acquire the autonomy, freedom and authority to make appropriate decisions within the domain of their influence'* (Thatchenkery 2005 cited in Thatchenkery & Chowdhry 2007, p.146).

*Communities of practice*

*".. a group of people along with shared resources and dynamic relationships, who assemble to make use of shared knowledge in order to enhance learning and create shared value for the group"* (Seufert et al. 1999; Adams and Freeman 2000 cited in Dalkir 2011, p.145).

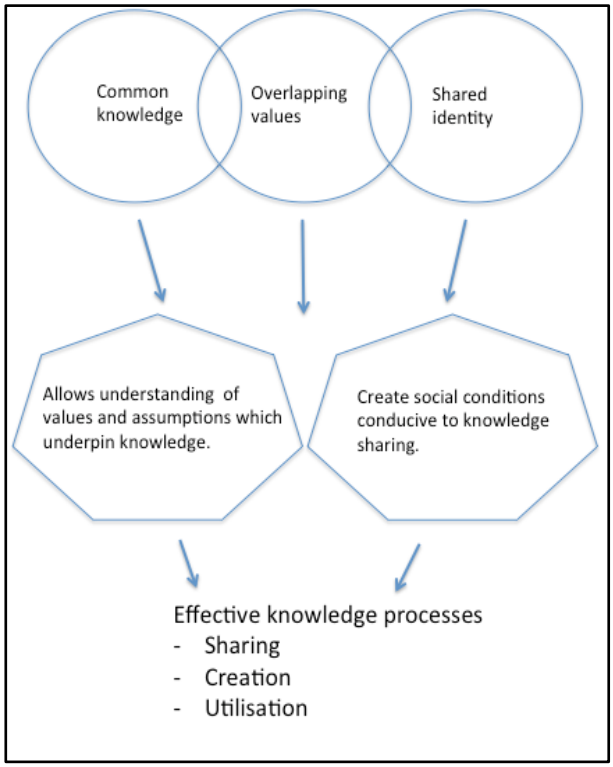



Figure 19 How communities of practice underpin knowledge processes (adapted from Hislop 2013)

The importance of social interaction and the critical role of tacit knowledge is also reflected in the concept of Communities of Practice (COP), adopted by many organisations as part of their overall package of KM measures (Lave & Wenger 1991;Wenger & Snyder 2000; Wenger et al. 2002). Strongly reflecting the practice-based theories of knowledge (Chapter 2), COP are knowledge-sharing communities and networks, both within and across organisations. An important characteristic is their informality reflected in a high degree of autonomy in how people self-organise within the context of formal organisational structures. The primary role of managers is to enable rather than control (Buchanan & Huczynksi 2017, p.414).

Figure 19 illustrates the enabling role that Communities of Practice can play in the sharing, creation and application of knowledge, both through individual interactions with other members of the community and through accessing knowledge embedded in the network itself. This principle is also captured in the central role that micro-communities can play in generating and sharing knowledge within an organisation and which often exist outside the formal organisational boundaries, where micro-communities are defined as:

*"…the small groups within an organisation whose members share what they know as well as common values and goals*" (Van Krogh, Ichijo and Nonaka 2000, p.2).

**Summary**

The overview of key theories and models associated with knowledge management has outlined how the discipline has developed over recent decades. It illustrates the importance of underlying epistemological and theoretical assumptions which act to shape how models are defined and applied in practice. In a review of knowledge management literature, Paulin and Suneson (2012) identify a lack of clarity in the meaning and use of concepts associated with Knowledge Management, noting that fundamental concepts such as knowledge transfer and knowledge sharing are frequently used interchangeably:

*"… without making a distinction between them and sometimes without sufficient explanation from which perspective the terms are used"* (Paulin & Suneson 2012, p.81)

In explaining the concept '*blurriness*' and inconsistencies in meaning, they identify underlying assumptions about the concept of knowledge, with particular reference to Sveiby's distinction between *knowledge as object* (aligned with explicit knowledge) and *knowledge as a social construct* embedded in context and individuals (aligned with the concept of tacit knowledge).

They identify a preference towards using the term and concept *knowledge transfer* for those working from a 'knowledge as object' perspective, and *knowledge sharing* for those orientated from a 'knowledge as social construct'. These fundamental differences in underlying approaches to the concept of knowledge reflected in these two broad approaches to knowledge management.

The '*knowledge as object'* (corresponding to codified knowledge) perspective reflects a mode of KM that emphasises the processing of data/information; utilising technology to catalyse the management, control and the creation of knowledge. This approach stresses the need to identify and remove barriers to the processes (Paulin & Suneson 2012). The second approach, '*knowledge as a social construct'*, is reflected in a mode of KM which places the emphasis on the social context and dynamic process of social interaction as the primary catalyst for successful knowledge sharing, co-creation and application. The operational emphasis of this approach is placed on developing the enabling environment within which these interactions take place.

A number of dimensions of knowledge management are identified as being directly relevant to knowledge exchange:

- *Concept*s exploring both the nature of knowledge (explicit and tacit) and different process and characteristics by which knowledge is created, diffused and applied including transfer, sharing, creation and application.

- Emphasis on *Knowledge Creation* incorporating both *explicit and tacit dimensions* of knowledge is directly relevant to the mode of knowledge exchange explored through the Creative Exchange. Where collaborations are inclusive of multiple disciplines, areas of professional practice and forms of collaboration where emphasis is on the creation of knowledge through the act of collaboration itself.

- The concept of the Knowledge Spiral as a *dynamic and iterative process* of tension and resolution (synergising) by which knowledge can be co-created.

- The role of *context and organisational enablers* (such as Ba) provides opportunities for the design and deployment of new techniques to support knowledge sharing, creation and application. References to the potential role of design theory and practice in shaping new approaches for facilitating the links between creativity to innovation and problem-solving business level are a case in point (Cruickshank & Evans 2012).

As identified in the context of KM, many concepts (e.g. knowledge transfer, sharing and creation) are applied in the theory and practice of knowledge exchange, often without a shared agreement on meaning. Subsequent chapters will explore these concepts further in the context of developing a typology for knowledge exchange.

## Chapter 6 The National Innovation System: A framework of analysis

*"...increased productivity, competitiveness, and national wealth. And ultimately, the major problems of our age – poverty, health, and the environment – will only be addressed through our collective ability to innovate"* (Carlson et al. 2006 cited in Nielsen 2011, p.6).

Endogenous economic growth theories (1960s onwards) provide a framework of analysis that treats human capital, innovation and knowledge as internal variables to their models. This assumption leads to the conclusion that policies, internal processes and investment (public and private) can play a central role in driving and shaping economic growth (Arrow 1961; Romer 1994; Rebelo 2001). Such interventions have the potential to generate positive externalities[34] and spillovers, where knowledge directed to a particular purpose has unforeseen benefits in other areas of the economy.

This perspective is in marked contrast to neoclassical models that treated such factors as external and beyond influence. Against this wider landscape of economic theory, more detailed models emerged in relation to exploring and understanding innovation as a process that could be managed. These models in turn provided the basis for the design of enabling policy and strategy. Process models subsequently gave way to systems-based perspectives (Godin 2017), reflecting a complex interplay of different social elements as the framework within which innovation occurs.

The impetus to acknowledge universities' role in the innovation system was re-enforced by the concept of the Knowledge Economy (Drucker 1969). This concept emphasised the central role of knowledge as the critical factor in driving commercial and economic success and the role that universities play in generating and diffusing knowledge in society (both in teaching, research and outreach).

[34] Externality: *"refers to situations when the effect of production or consumption of goods and services imposes costs or benefits on others which are not reflected in the prices charged for the goods and services being provided"* (OECD n.d.).

Within the systems-based frameworks described below, universities are recognised as playing a central role in the generation and diffusion of knowledge. As such they have the potential to play a strategic role in catalysing innovation in support of wider social and economic well-being. This is the broader context within which the concepts of Technology Transfer (TT), Knowledge Transfer (KT) and Knowledge Exchange (KE) as modes of university collaborations with non-university partners are situated.

*The National Innovation System (NIS)*

*"The national innovation systems approach stresses that the flows of technology and information among people, enterprises and institutions are key to the innovative process"* (OECD, 2008, p.7).

The concept of the National Innovation System (NIS) was crystallised in the 1980s, inspired by the work of Freeman (1987;1995) and built on by Lundvall (1999; 2007; 2009), Edquist (Edquist 1997; 2001; 2009) and others, both in research and practice. However, its roots can be traced back to the 19th century, notably the attempt by the German government to coordinate different policies and institutions in order to compete with Britain's pre-eminent economic position (List, 1841, cited in Freeman 1995, p.5).

In the 20th century, the concept of the Military Industrial Complex came to symbolise the symbiotic relationships between government, industry and universities in developing military capability during and after WWII. At a theoretical level, the NIS model was influenced by the wider academic work on systems theory and its underlying logic:

*"...a set of two or more interrelated elements with the following properties:*

- *Each element has an effect on the functioning of the whole*
- *Each element is affected by at least one other element in the system*
- *All possible subgroups of elements also have the first two properties"*

(Ackoff, 1981, cited in Laszlo & Krippner 1998, p.8).

The NIS integrates different elements (social actors) including government, companies and universities. The framework is used to describe and understand how these elements interact in generating an enabling environment that supports innovation. A central assumption is that the stronger the coordination between these different elements, the more successful an economy can be in terms of innovation and performance. While initially focused upon technology, the NIS evolved to encompass social innovation (Godin 2007; Freeman 1987), and is most recently encapsulated by challenge-led funding focused on addressing social needs and challenges, marking a break from a historical emphasis on Science Technology and Innovation (STI) (Kallerud et al. 2013).

**The Triple Helix**

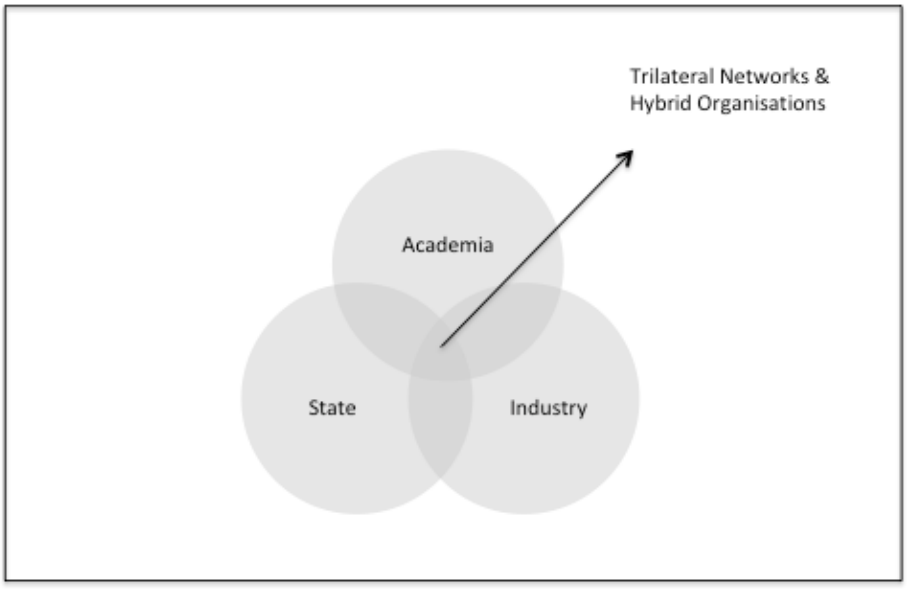



Figure 20 The Triple Helix Model of Innovation (adapted from Etzkowitz & Leydesdorff 2000, p.111)

The Triple Helix (Figure 20) is a spiral systems-based model (Etzkowitz & Leydesdorff 2000; Etzkowitz 2002; Etzkowitz 2007) placing emphasis on the interaction between three elements; government, industry and universities. While adopting a systems perspective, the model is different from the NIS in that it identifies universities as playing the central enabling role.

The model provides a framework to support an understanding of how these elements interact (politically, socially, organisationally, individually) and a tool for designing interventions to catalyse and support innovation (Norman & Verganti 2012). Etzkowitz and Leydesdorff note with reference to the Triple Helix[35] that it:

*"…is generating a knowledge infrastructure in terms of overlapping institutional spheres, with each taking the role of the other and with hybrid organizations emerging at the interfaces"* (Etzkowitz & Leydesdorff 2000, p111).

The NIS Triple Helix and its variants recognise that innovation occurs within a complex matrix of relationships, which act to facilitate dynamic flows of technology, information, people, funding and ideas (OECD 1997). This perspective places emphasis on an ecology of dynamic networks which facilitate flows of technology, knowledge, finance between people, enterprises and institutions. The interactions create an enabling environment for innovation that places university collaboration at the heart of the model. This is a role that goes beyond teaching and research and focuses on the transfer, sharing, creation and leveraging of knowledge through the act of collaboration which has the potential to support wider economic and social development (Etzkowitz 2002, 2007; Etzkowitz et al. 2000).

*A wider policy context*

A number of UK policy reviews over the last two decades have applied systems-based concepts as a framework of analysis and policy development, specifically addressing HEI[36] engagement with the wider economy and community:

- Our Competitive Future (Department of Trade and Industry, 1999).
- Lambert Review of Business-University Collaboration (Lambert 2003).

[35] The comment was made with reference to a third type of Triple Helix Model, where overlapping spheres illustrate a shared space for interaction. This is contrasted with configurations where: i) authority and control were given to government; and ii) actors operate separately with clearly defined boundaries and modes of interaction.

[36] Higher Education Institute.

- Increasing the economic impact of Research Councils (Research Council Economic Impact Group 2006).
- The Race to the Top (Sainsbury et al. 2007).
- Gower's Review/IP (Gower 2006).
- Innovation Nation (DIUS 2008).
- Universities, Business and Knowledge Exchange (Abreu et al. 2008).
- The Changing State of Knowledge Exchange (Lawson et al. 2016).
- How universities can drive prosperity through deeper engagement (Johnson 2017).

Themes addressed in these reports included:

- The role and importance of universities as part of the national innovation system.

- A recognition that innovation is non-linear and that policies and tools must reflect this wider concept.

- A need to acknowledge the value of disciplines other than science and technology.

- Investment as necessary to maximize the wider socio-economic benefits.

- The value of high-trust relationships and networks as critical in catalysing and supporting successful collaborations (Abreu et al. 2008).

- Barriers to engagement often reflect issues related to the demand side.

The ongoing policy discourse[37] surrounding the role of universities in catalysing wider economic and social development highlights a dynamic interplay between the changing assumptions surrounding the innovation process and their influence on policy and investment in universities' role in their engagement activities.

[37] In the UK context and internationally.

*A changing research context*

*"...the production of knowledge and the processes of research are being radically transformed"* (Nowotny et al. 2003, p.179).

The purpose of exploring the HEI research context is to continue to frame the concept and practice of knowledge exchange. Factors influencing the research environment are identified and the concepts of Mode 1 and Mode 2 knowledge production introduced. A shift in the modes by which knowledge is produced within universities is closely aligned with the concept of the Triple Helix Model and the systems approach to innovation more generally. A critical reflection on the analysis is not provided, but key characteristics are identified.

In *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies* (Gibbons et al. 1994), the concepts of Mode 1 and Mode 2 knowledge production are introduced. The concepts are used to explore changes in expectations surrounding the wider impact of research and assumptions concerning its design and delivery (Nowotny et al. 2003).

*Mode 1* knowledge production reflects a traditional model of research as undertaken within universities, governed by agreed ideas, values, methods and norms that act to shape and govern the production, validation and diffusion of knowledge within clearly defined fields of enquiry. It is characterised as being historically anchored in the sciences (theoretical and experimental) and the empirical approach, occurring within traditional disciplinary and organisational boundaries, addressing problems and challenges set and solved in an academic context. Its primary focus is to generate demonstrably new knowledge as judged against standards of research excellence using established academic research criteria, principally through peer review (Gibbons et al. 1994; Nowotny et al. 2003; Boehm 2015; Cruickshank 2013).

In contrast, *Mode 2* is defined as an emergent approach to knowledge production which steps beyond traditional organisational, disciplinary and social boundaries. The approach stresses a clearer and reflexive relationship between research (priorities and outcomes), wider social context, the process of innovation and economic and social development. Gibbons and colleagues (Gibbons et al.1994; Nowotny et al. 2003) identified its key characteristics as:

- *Knowledge produced with reference to its wider application and use*: An approach to knowledge goes beyond the physical, social and psychological boundaries of the university and academic disciplines, reflecting the wider social context within which knowledge is both produced and applied to the needs of diverse groups across society.

- *Transdisciplinarity*: Working together across disciplinary, professional and social boundaries to generate a shared and agreed approach to knowledge creation, application and diffusion through a variety of channels: a dynamic approach which may be emergent.

- *Heterogeneity*: Diversity in the range of organisations, skills, experience and backgrounds of those involved in the knowledge production processes across a range of different social context and locations. This places greater emphasis on interaction with different groups in the production process.

- *Socially accountable and reflexive*: An awareness and influence of wider social issues, challenges and opportunities in relation to research priorities and applications. This is also reflected in the desire of different social groups to influence the setting of research priorities, the diffusion of outcomes and interests in how knowledge generated is applied.

- *Quality of research*: Mechanisms and criteria ensuring quality control go beyond Mode 1 reliance on peer review to include a number of political, economic and social criteria including value for money and impact.

"*Knowledge production becomes diffused throughout society. This is why we also speak of socially distributed knowledge"* (Gibbons et al. 1994, p.4).

Factors identified as drivers to this shift include:

- *Research priorities*: A growing number of non-academic interests with a role in influencing research priorities and related funding reflecting different political and social reasons (at an international and national level). This comes up against a political imperative to ensure that investment in research is aligned with wider socio-economic needs.

- *Commercialisation*: Diversification of funding sources for universities and research programmes (e.g. private funding) and growing emphasis on the value and ownership of Intellectual Property (IP) within universities; thus, providing the basis for managing its use and exploitation.

- *Accountability*: Increasing investment in management functions within the HEI sector accompanied by a growing emphasis on the need to measure and account for the wider impact of research.

Cruickshank explores the emergence of the '*impact*' culture in a UK context, reflecting on the increasing emphasis placed by funding bodies on the need to demonstrate a wider social and economic impact of research funding reflected in the use of impact metrics in the mainstream management of research grants, defined as:

" *..an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia*" (HEFCE 2017b).

This is clearly demonstrated in the Research Assessment Exercise (RAE) and the Research Excellence Framework (REF). Noting that the impact culture is not likely to be diluted, Cruickshank stresses the imperative for research institutions and academics to explore ways of reconciling how traditional models of research and excellence can work together with emergent approaches to knowledge production and the growing emphasis on the need to demonstrate social relevance and impact.

The models outlined have been developed over time along with a critique of their underlying assumptions and implications. While the critique is not explored in the context of this thesis, the two approaches to knowledge production co-exist, with the second, Mode 2, being inclusive of disciplines (arts and humanities) and research contexts that go beyond the traditional science-based domain of Mode 1. Watson (Watson 2009; 2011; 2014 cited in Boehm 2015, n.p.) stressed the importance of social enterprises and the not-for-profit sector as part of wider network of contacts, partners and sources of knowledge (context) within the frame of the Triple Helix. Carayannis defined a third mode of knowledge production which developed the concept of networked knowledge and the '*innovation ecosystem'* reflecting the value of socially embedded knowledge. Highlighting the role of a hub or focal point:

"…*where people culture, and technology meet and interact to catalyse creativity, trigger invention, and accelerate innovation*…" (Carayannis & Campbell 2012, p.4).

In a later reflection on the original concept of Mode 1 & 2 concept, Gibbons and colleagues (Nowotny et al. 2003, p.192) reflected upon the theme of context in the original model and introduced *'Agora'* as a concept related to knowledge production;

"…*problem-generating and problem-solving environmen*t…"

A place for:

*"…. primary knowledge production – through which people enter the research process, and where 'Mode 2' knowledge is embodied in people and projects*".

This concept goes beyond the traditional boundaries of academia and industry to include knowledge holders from wider community and social contexts.

**University engagement and three modes of collaboration**

The systems-based models have provided the opportunity to explore universities' '*third mission'* (over and above teaching and research). While initially focused on transforming and transferring scientific knowledge into usable and commercial technologies (Mode 1), models of university engagement have evolved to include a much wider network of disciplines, relationships and methods of collaboration. Reflecting systems-based models of innovation combined with the growing emphasis on research impact, knowledge exchange provides important mechanisms for connecting universities and research with a wider society.

HEI engagement is now reflected in many diverse types and patterns of collaboration. The Higher Education-Business and Community Interaction Survey undertaken annually by the Higher Education Funding Council (HEFCE) provides data on the value of KE[38] activities across UK universities. These activities include collaborative R&D, commercialisation (spin out/IP/licensing), delivery of training, consultancy and services with commercial or wider social benefits.

Hughes and Kitson (Hughes & Kitson 2013; Lawson et al. 2016) outline the evolving roles expected from universities as they engage with external partners. In a survey of UK academics (Abreu et al., 2008; Lawson et al. 2016, p.57), a wide range of university-based interactions were mapped (Lawson et al. 2016). Going beyond traditional mechanisms of TT and commercialisation, they included non-science-based disciplines, methods and forms of engagement grouped under the headings of *'People, Community, Problem Solving*'.

[38] KE in this context describe a continuum of activities inclusive of transfer-based models.

Figure 21 illustrates the percentage of reports against types of interaction illustrating that transactional/contractual forms of knowledge exchange are not the most prevalent when placed in the context of the much wider landscape of social contacts, relationships and informal networking (Lawson et al. 2016, p.56).

The modes of collaboration defined as Technology Transfer (TT), Knowledge Transfer (KT) and Knowledge Exchange (KE) mainly occur in the formal dimensions of university collaboration (transactional/contractual). As such, they are characterised as project-based and are initiated and delivered within a framework of formal arrangements in relation to both funding and delivery. These are collaborations which incorporate, to varying degrees, explicit and tacit dimensions of knowledge, reflecting different knowledge-based activities from transfer, sharing and exchange to co-creation.

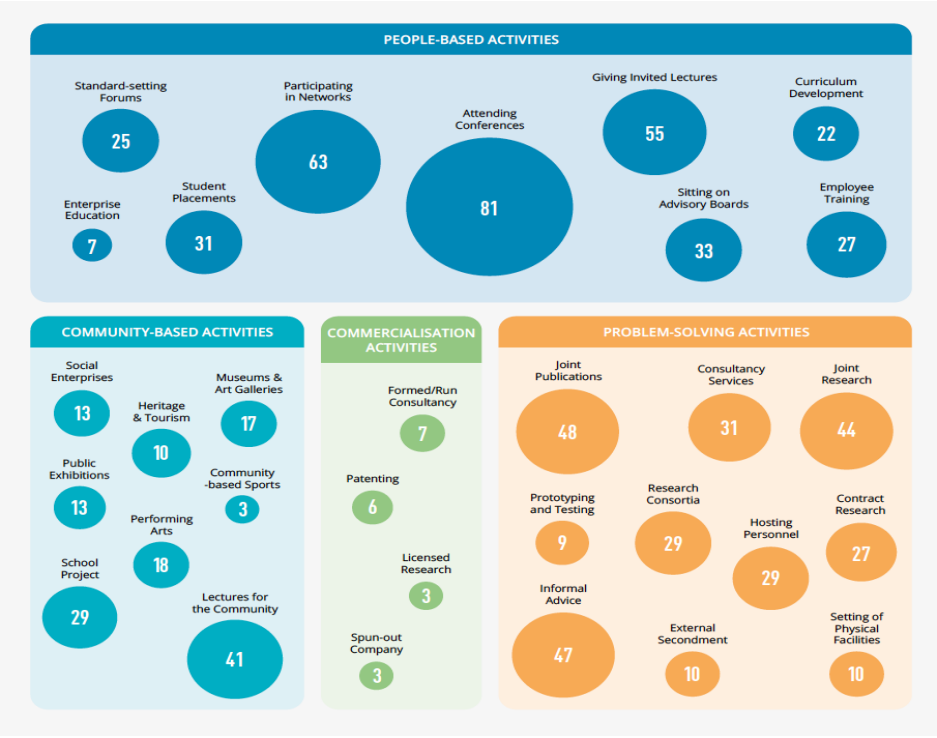



Figure 21 Academic interactions with external organisations[39] (Lawson et al. 2016, p.57)

[39] The larger the balloon reflects a higher percentage of survey respondents.

Projects focused upon leveraging university and partner knowledge and expertise to innovate in product/service/process/approach are increasingly focused on addressing a range of wider social and economic challenges, the *'grand societal challenges'* (Benneworth 2009). The concepts and names associated with different modes of collaboration are subject to refinement and modification over time, with a clear pathway from linear, process models strongly aligned with codified knowledge generated form science and technology (TT/KT) towards a wider and more diverse mix of disciplines, types and sources of knowledge (KE).

The concepts, policy and practice of TT, KT and KE are defined as three distinct modes of such collaboration (see Chapter 10 for detailed typology). Each approach to engagement reflects underlying assumptions about the process of innovation and knowledge more generally. The collaborations are characterised as time-bound, team-based projects, funded by public and/or private sponsors to achieve mutually agreed goals, and that address needs and opportunities across different sectors, partners and contexts.

*Technology Transfer*

*"Technology transfer is the process of transferring scientific findings from one organization to another for the purpose of further development and commercialization. The process typically includes:*

- *Identifying new technologies*
- *Protecting technologies through patents and copyrights*
- *Forming development and commercialization strategies such as marketing and licensing to existing private sector companies or creating new start-up companies based on the technology"* (AUTM 2017).

The emergence of TT as an explicit concept has been attributed (Godin 2009) to Vannevar Bush in his report, *Science: The Endless Frontier* (1945). The report outlined a vision for US post-war economic recovery and success, based on government funding in science and technology-focused research.

While many firms in Europe and the US had recognised the strategic importance of science and technology in generating corporate success (Graham 2011), Bush's report acknowledged the linkages between public investment in R&D and the commercialisation of technology. This linkage became central to the arguments supporting continued public funding of university-centred R&D.

TT is aligned with Mode 1 knowledge production and reflects the linear model of innovation (Chapter 4), which identifies basic research as the primary driving force in the development and commercial exploitation of technologies. At its heart is the assumption that successful innovation originates in scientific breakthrough and emphasises the value of explicit/codified knowledge. The stages by which basic research generated new products and services, were explicitly articulated by W.R. Maclaurin (Professor of Economics and President of MIT 1909-1920). Godin (2008; 2017) argues that Maclaurin played a critical role in recognising that innovation was a dynamic process and in defining the discrete stages by which research outcomes become products.

The policy, enabling infrastructure and tools of Technology Transfer evolved from this model over succeeding decades. The technology transfer toolkit includes dedicated staffing, IP policy and agreements, incubators and business support for spin outs, investment funds and licensing frameworks (supported by public sector funding). The OECD (1997) notes that the model and related enabling infrastructure have been established in many countries. The HEBCI survey demonstrates its continuing influence.

*Knowledge Transfer*

*" It's all about the transfer of tangible and intellectual property, expertise, learning and skills between academia and the non-academic community" (*Cambridge University Centre for Technology Management, 2009).

Knowledge Transfer is a concept that has been adopted to describe technology and non-technology driven collaborations. While incorporating a wider mix of disciplines and dimensions of knowledge, KT remains predicated on a linear model of innovation where knowledge and skills generated within universities are transferred; i.e. a transfer from those who hold the knowledge to those who need and can use it and delivered through different mechanisms e.g. Knowledge Transfer Partnerships.

Over the past decade, a critique of the traditional transfer-based models has emerged, stressing the inability of Technology Transfer in particular to meet expectations in generating positive economic and commercial returns. At the university level, it is argued that too much attention has been given to a small number of success stories, which has acted to distort an objective analysis of the effectiveness of the policy and related mechanisms based upon this linear model. It is contested that, when looked at in a wider context, other forms of Knowledge Transfer (e.g. collaborative research, consultancy, CPD) have greater impact (estimated at up to 3 times, Hagen 2008*)*. The point is echoed by Abreu et al. (2008, 2009) stressing the diversity, scale and varied values associated with diverse forms of engagement, where engagement activities go beyond purely transactional and contractual form of relationships to include a wider range of different types of collaborations (Figure 20). Questions have also been raised about Technology/Knowledge Transfer's primary emphasis on science and technology. However, the critique did not bring into question the underlying logic that universities are a key component of the innovation system.

*Knowledge Exchange*

*"..to encourage co-creation and co-production of research agendas; to have a significant and transformative effect on the creative and cultural life and health and well-being of the nation; and to enlarge the contribution to the arts, public engagement and policy formation"* (AHRC 2018).

The emergence of knowledge exchange as a distinct concept and mode of collaboration is strongly aligned with Mode 2 knowledge production. It also provides a framework which is strongly aligned with the non-linear systems-based models of innovation identified in Chapter 5. In *'Knowledge Transfer without Widgets; the Challenge of the Creative Economy'* (2006), Crossick explores a non-linear process of knowledge creation and dissemination, where new knowledge is generated through the act of collaboration. From this perspective, he sets out a critique of the dominant transfer paradigm identifying a mismatch between the linear, transfer-based models with the characteristics of creative practice and the creative and digital sectors of the economy. This theme has been central to the work of AHRC's four Knowledge Exchange hubs of which CX is one.

**Summary**

While often used interchangeably, the concepts of Technology Transfer, Knowledge Transfer and Knowledge Exchange reflect different underlying assumptions about the nature of knowledge, the means by which it is created, the process by which innovation takes place and types of interventions that can facilitate it. The growing use of the term knowledge (rather than technology) as the central driving force in modes of university collaboration reflect an acknowledgement that universities can contribute to innovation in a variety of ways, across a number of disciplines and through a broader range of mechanisms, partners and contexts.

Of particular relevance to this research enquiry is the definition of knowledge §through the process of collaboration itself, drawing on the tacit and explicit dimensions of knowledge through an iterative process of transfer, sharing and co-creation. This shift in emphasis is reflected in the concept of Modes 1 and 2 and an appreciation that knowledge production goes beyond traditional science-based disciplines and methodologies and is inclusive of wider networks of sponsors, clients, collaborators and social contexts (Lawson et al. 2016). It is also reflected in the priorities of public-sector investment and mechanisms designed to support university collaborations.

A point of possible confusion arises in relation to the concept and use of the term knowledge exchange, particularly, whether it is used to describe a discrete mode of collaboration or a continuum of collaborations. When defined as a *mode of collaboration*, KE describes a non-linear and iterative process of project design and delivery with emphasis upon co-creation and co-production of knowledge through the act of collaboration between universities and stakeholders across a variety of social context and inclusive of a wider range of discipline, including the Arts and Humanities. Alternatively, as a *continuum* (which is often reflected in the term's use), it can reflect a wide span of activity, inclusive of transfer-based methods of engagement as well as co-production models.

# Section 3

## *Case Study and Cross-case Analysis*

## Section 3 Introduction

*'..not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood.."* (Baxter & Jack 2008, p.543)

The overall purpose of this research enquiry is reflected in the statement that **to design and enable knowledge exchange initiatives successfully, it is necessary to understand the intention, context and characteristics of this mode of collaboration and the factors that shape the delivery of related projects** (Chapter 1). One of the overarching objectives for the study being to catalyse discussion amongst knowledge exchange practioners as the basis for reflecting on how KE enabling support and measures can be designed to best effect. This focus on the overall nature of knowledge exchange, rather than the content and context of individual projects, is reflected in the research question:

**Can we improve the design and delivery of knowledge exchange through insights from existing theory identified from the literature review and case study analysis based on selected projects implemented through the Creative Exchange.**

The emergent context of the Creative Exchange, as reflected the nature of the Digital Public Space and the novel approach to PhD research, was a central point of reference in the design and implementation of the research strategy. The methodology and methods were adapted to facilitate an iterative process of exploration and discovery and accommodate the emergent nature of knowledge in relation to the research question. The process by which insights were generated and structured reflected both inductive and abductive analysis in building a multi-dimensional model exploring the characteristics and dynamics of KE collaborations in the context of the CX.

The Case Study, incorporating six case projects, supported by the adapted CSF method (Chapter 3), provided a framework for analysis that placed emphasis on understanding KE from the perspective of CX project team members. The approach involved a step-by-step, iterative process of identifying units of meaning from interview transcripts and key documents. The researcher used spreadsheets to record activity statements which were then grouped and re-grouped into clusters of shared meaning (from statements to enabling factors and finally to enabling themes).

The insights presented in Section 3 represent the final stages of the analysis with Appendix 1 providing a worked example. The decision not to include detailed transcripts in the Appendices reflects the principle of anonymity, agreed with all those interviewed prior to their participation in the study. While the inclusion of anonymised transcripts was considered, it was felt that it would still have been possible to identify the individuals with reference to information available in the public domain.

Illustrative figures for each case, described in Chapter 3, play a central role in supporting the reader in navigating case complexity by providing an overview of enabling themes and factors identified. The subsequent case narrative provides additional layers of detail enabling the reader to explore the insights in more depth. The use of illustrative figures continues in Chapter 9 (Cross-case analysis) where they present an overview of themes and factors grouped into categories across cases.

The Kendal project (Chapter 7) gave the opportunity for the researcher to explore the collaboration from the perspectives of observer, patient/user and team member. This enabled direct insights into the clinical context and user needs to be identified, in addition to experience of team working in a design led CX project. For the other case projects (Chapter 8), the role of the researcher was that of observer and interpreter, with insights gained from transcripts and key documents. Chapter 9 (Cross-case analysis) explores shared characteristics, enabling categories, themes and factors in selected case projects. It begins by referencing existing theory associated with team effectiveness, which is drawn on to develop a framework supporting the cross-case analysis. The existing theory is then adapted to incorporate insights from the case study.

# Chapter 7 The Kendal Project (Case 1)

## Project profile

*Objective* To explore and evaluate different creative options for improving how data from monthly blood tests is visualised for patients with the aim of improving patient engagement and understanding. This is to take the form of a working digital prototype of a visualisation tool.

*CX Cluster* Public Service Innovation and Democracy

*Budget* £500 & PhD student's time

*Status* Ongoing at time of interviews

*Project Partners*[1]

- Lancaster University (Creative Exchange Lead)
- Westmorland General Hospital (Dialysis Unit)

*Wider Stakeholders*

- Royal Preston Hospital (Renal team)/Lancashire Teaching Hospitals NHS Foundation Trust

*Sources of Data*

*Key Documents*

- Creative Exchange Project Proposal
- Creative Exchange Collaboration Agreement
- Project TOR/Prototype Design Brief
- Project completion report
- NHS guidance for renal patients.
- Improving the Visualisation of Renal Blood Test Results to Enhance Patient-Clinician Communication, 12th EAD Conference, April 2017 (Gradinar et al. 2017)

*Interviews*

- Heather Hill — Renal Dietitian, Royal Preston Hospital, Lancashire Teaching Hospitals.
- Professor Paul Coulton — Lancaster University, Academic lead
- Adrian Gradinar — CX PhD, Lancaster University

## Background

This chapter presents the CX project *Improving the presentation of renal blood test results (Kendal)*. This case is one of the six projects included as part of this research enquiry. Unlike the five cases presented in Chapter 8, the author was directly involved in the delivery team. His role as both a renal patient and PhD researcher provided a lens to explore different themes associated with knowledge and knowledge exchange, both in a clinical context and in the context of the collaboration itself.[40]

Following discussion with the renal dietitian (Heather Hill, Lancashire Teaching Hospital Trust), it was decided to develop a project for The Creative Exchange (CX). Discussions were subsequently held with potential team members at Lancaster University (Professor Paul Coulton and CX PhD Adrian Gradinar) and Dr Ahmed (Renal Consultant) to provide an appropriate mix of skills and experience. Following approval by the Health Research and Innovation Department at Lancashire Teaching Hospitals Trust (LTHTr), a proposal was formally submitted to the CX in January 2013. Ethics approval was granted by Lancaster University on March 25th, 2015 (Appendix 2). The Centre for Health Research and Innovation (Lancashire Teaching Hospitals) identified the project as service innovation without a related need for NHS ethics approval (Appendix 2).

The project's *immediate objective* was to develop a working prototype to demonstrate novel and creative ways of visualising blood test results to assist renal patients (and their families/carers) in understanding and managing a chronic health condition. The tool aimed to provide a catalyst for more effective knowledge sharing between patients and clinicians as the basis for the joint development of management strategies for chronic kidney disease (CKD). The *wider goal* of the project was to demonstrate the value that design, as a professional and research discipline, can bring to the renal team at Lancashire Teaching Hospitals Trust (LTHT).

[40] Heather Hill Renal Dietitian (Lancashire Teaching Hospitals), Adrian Gradinar, CX PhD and Professor Paul Coulton (Creative Exchange at Lancaster University).

*The clinical context*

*"Individuals with CKD are required to change nearly every aspect of their life, following complex regimes involving multiple medications, special diets and fluid restriction"* (Wright Nunes et al. 2016, pp.1-4)

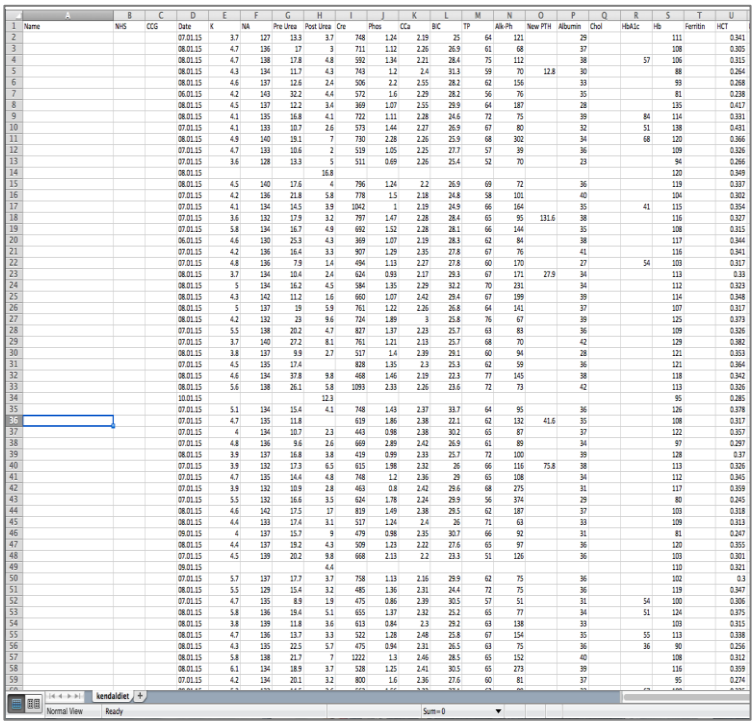
Chronic Kidney Disease (CKD) is a clinical term used to indicate a deterioration in kidney function (National Institute for Health and Care Excellence (NICE) 2015). CKD is classified in five stages with the fifth stage regarded as kidney failure. Deterioration in function can occur over a period of years or very suddenly often requiring immediate clinical treatment. Stages 4 and 5 reflect severe impairment where health cannot be maintained requiring patients to undergo regular dialysis treatment or a kidney transplant.

As of 31st December 2014, it was estimated that 58,968 adult patients were receiving renal replacement therapy[41] (dialysis) in the UK. Within Lancashire Teaching Hospital Trust there were 523 hospital haemodialysis patients, 87 home haemodialysis patients and 11,601 clinic patients in 2016 (The Renal Association 2017). Routine blood tests are carried out for all patients (monthly or as required). The results are viewed by the renal team and adjustments to diet, medication and dialysis treatment are made as needed, in consultation with each patient. The results of tests can be made available to patients in two ways (the source of the data is the same):

- The renal team accesses the results in a clinical setting via a secure, online platform that is available to NHS staff only. They then discuss/interpret the test result data with patients (Figure 22).

- Patients can also access blood test results online (e.g. from home) via the NHS website *Patient View.* This secure online platform requires individual patients to register for access via their local hospital. Additional support in interpretation of the results can be provided by renal staff on request.

[41] The term renal replacement therapy (RRT) refers to dialysis.



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Name | NHS | CCG | Date | K | NA | Pre Urea | Post Urea | Cre | Phos | CCa | BIC | TP | Alk-Ph | New PTH | Albumin | Chol | HbA1c | Hb | Ferritin | HCT |
| 2 | | | | 07.01.15 | 3.7 | 127 | 13.3 | 3.7 | 748 | 1.24 | 2.19 | 25 | 64 | 121 | | 29 | | | 111 | | 0.341 |
| 3 | | | | 08.01.15 | 4.7 | 136 | 17 | 3 | 711 | 1.12 | 2.26 | 26.9 | 61 | 68 | | 37 | | | 108 | | 0.305 |
| 4 | | | | 08.01.15 | 4.7 | 138 | 17.8 | 4.8 | 592 | 1.34 | 2.21 | 28.4 | 75 | 112 | | 38 | | 57 | 106 | | 0.315 |
| 5 | | | | 08.01.15 | 4.3 | 134 | 11.7 | 4.3 | 743 | 1.2 | 2.4 | 31.3 | 59 | 70 | 12.8 | 30 | | | 88 | | 0.264 |
| 6 | | | | 08.01.15 | 4.6 | 137 | 12.6 | 2.4 | 506 | 2.2 | 2.55 | 28.2 | 62 | 156 | | 33 | | | 93 | | 0.268 |
| 7 | | | | 06.01.15 | 4.2 | 143 | 12.2 | 4.4 | 572 | 1.6 | 2.29 | 28.2 | 56 | 76 | | 35 | | | 81 | | 0.238 |
| 8 | | | | 08.01.15 | 4.5 | 137 | 12.2 | 3.4 | 369 | 1.07 | 2.55 | 29.9 | 64 | 187 | | 28 | | | 135 | | 0.417 |
| 9 | | | | 08.01.15 | 4.1 | 135 | 16.8 | 4.1 | 722 | 1.11 | 2.28 | 24.6 | 72 | 75 | | 39 | | 84 | 114 | | 0.331 |
| 10 | | | | 07.01.15 | 4.1 | 133 | 10.7 | 2.6 | 573 | 1.44 | 2.27 | 26.9 | 67 | 80 | | 32 | | 51 | 138 | | 0.431 |
| 11 | | | | 08.01.15 | 4.9 | 140 | 19.1 | 7 | 730 | 2.28 | 2.26 | 25.9 | 68 | 302 | | 34 | | 68 | 120 | | 0.366 |
| 12 | | | | 07.01.15 | 4.7 | 133 | 10.6 | 2 | 519 | 1.05 | 2.25 | 27.7 | 57 | 39 | | 36 | | | 109 | | 0.326 |
| 13 | | | | 07.01.15 | 3.6 | 128 | 13.3 | 5 | 511 | 0.69 | 2.26 | 25.4 | 52 | 70 | | 23 | | | 94 | | 0.286 |
| 14 | | | | 08.01.15 | | | | 16.8 | | | | | | | | | | | 120 | | 0.349 |
| 15 | | | | 08.01.15 | 4.5 | 140 | 17.6 | 4 | 796 | 1.24 | 2.2 | 26.9 | 69 | 72 | | 36 | | | 119 | | 0.337 |
| 16 | | | | 07.01.15 | 4.2 | 136 | 21.8 | 5.8 | 778 | 1.5 | 2.18 | 24.8 | 58 | 101 | | 40 | | | 104 | | 0.302 |
| 17 | | | | 07.01.15 | 4.1 | 134 | 14.5 | 3.9 | 1042 | 1 | 2.19 | 24.9 | 66 | 164 | | 35 | | 41 | 115 | | 0.354 |
| 18 | | | | 07.01.15 | 3.6 | 132 | 17.9 | 3.2 | 797 | 1.47 | 2.28 | 28.4 | 65 | 95 | 131.6 | 38 | | | 116 | | 0.327 |
| 19 | | | | 07.01.15 | 5.8 | 134 | 16.7 | 4.9 | 692 | 1.52 | 2.28 | 28.1 | 66 | 144 | | 35 | | | 108 | | 0.315 |
| 20 | | | | 06.01.15 | 4.6 | 130 | 25.3 | 4.3 | 369 | 1.07 | 2.19 | 28.3 | 62 | 84 | | 38 | | | 117 | | 0.344 |
| 21 | | | | 07.01.15 | 4.2 | 136 | 16.4 | 3.3 | 907 | 1.29 | 2.35 | 27.8 | 67 | 76 | | 41 | | | 116 | | 0.341 |
| 22 | | | | 07.01.15 | 4.8 | 136 | 7.9 | 1.4 | 494 | 1.13 | 2.27 | 27.8 | 60 | 170 | | 27 | | 54 | 103 | | 0.317 |
| 23 | | | | 08.01.15 | 3.7 | 134 | 10.4 | 2.4 | 624 | 0.93 | 2.17 | 29.3 | 67 | 171 | 27.9 | 34 | | | 113 | | 0.33 |
| 24 | | | | 08.01.15 | 5 | 134 | 16.2 | 4.5 | 584 | 1.35 | 2.29 | 32.2 | 70 | 231 | | 34 | | | 112 | | 0.323 |
| 25 | | | | 08.01.15 | 4.3 | 142 | 11.2 | 1.6 | 660 | 1.07 | 2.42 | 29.4 | 67 | 199 | | 39 | | | 114 | | 0.348 |
| 26 | | | | 08.01.15 | 5 | 137 | 19 | 5.9 | 761 | 1.22 | 2.26 | 26.8 | 64 | 141 | | 37 | | | 107 | | 0.317 |
| 27 | | | | 08.01.15 | 4.2 | 132 | 23 | 9.6 | 724 | 1.89 | 3 | 25.8 | 76 | 67 | | 39 | | | 125 | | 0.373 |
| 28 | | | | 07.01.15 | 5.5 | 138 | 20.2 | 4.7 | 827 | 1.37 | 2.23 | 25.7 | 63 | 83 | | 36 | | | 109 | | 0.326 |
| 29 | | | | 07.01.15 | 3.7 | 140 | 27.2 | 8.1 | 761 | 1.21 | 2.13 | 25.7 | 68 | 70 | | 42 | | | 129 | | 0.382 |
| 30 | | | | 08.01.15 | 3.8 | 137 | 9.9 | 2.7 | 517 | 1.4 | 2.39 | 29.1 | 60 | 94 | | 28 | | | 121 | | 0.353 |
| 31 | | | | 07.01.15 | 4.5 | 135 | 17.4 | | 828 | 1.35 | 2.3 | 25.3 | 62 | 59 | | 36 | | | 121 | | 0.364 |
| 32 | | | | 08.01.15 | 4.6 | 134 | 37.8 | 9.8 | 468 | 1.46 | 2.19 | 22.3 | 77 | 145 | | 38 | | | 118 | | 0.342 |
| 33 | | | | 08.01.15 | 5.6 | 138 | 26.1 | 5.8 | 1093 | 2.33 | 2.26 | 23.6 | 72 | 73 | | 42 | | | 113 | | 0.326 |
| 34 | | | | 10.01.15 | | | | 12.3 | | | | | | | | | | | 95 | | 0.285 |
| 35 | | | | 07.01.15 | 5.1 | 134 | 15.4 | 4.1 | 748 | 1.43 | 2.37 | 33.7 | 64 | 95 | | 36 | | | 126 | | 0.378 |
| 36 | | | | 07.01.15 | 4.7 | 135 | 11.8 | | 619 | 1.86 | 2.38 | 22.1 | 62 | 132 | 41.6 | 35 | | | 108 | | 0.317 |
| 37 | | | | 07.01.15 | 4 | 134 | 10.7 | 2.3 | 443 | 0.98 | 2.38 | 30.2 | 65 | 87 | | 37 | | | 122 | | 0.357 |
| 38 | | | | 07.01.15 | 4.8 | 136 | 9.6 | 2.6 | 669 | 2.89 | 2.42 | 26.9 | 61 | 89 | | 34 | | | 97 | | 0.297 |
| 39 | | | | 08.01.15 | 3.9 | 137 | 16.8 | 3.8 | 419 | 0.99 | 2.33 | 25.7 | 72 | 100 | | 39 | | | 128 | | 0.37 |
| 40 | | | | 07.01.15 | 3.9 | 132 | 17.3 | 6.5 | 615 | 1.98 | 2.32 | 26 | 66 | 116 | 75.8 | 38 | | | 113 | | 0.326 |
| 41 | | | | 07.01.15 | 4.7 | 135 | 14.4 | 4.8 | 748 | 1.2 | 2.36 | 29 | 65 | 108 | | 34 | | | 112 | | 0.345 |
| 42 | | | | 07.01.15 | 3.9 | 132 | 10.9 | 2.8 | 463 | 0.8 | 2.42 | 29.6 | 68 | 275 | | 31 | | | 117 | | 0.359 |
| 43 | | | | 07.01.15 | 5.5 | 132 | 16.6 | 3.5 | 624 | 1.78 | 2.24 | 29.9 | 56 | 374 | | 29 | | | 80 | | 0.245 |
| 44 | | | | 08.01.15 | 4.6 | 142 | 17.5 | 17 | 819 | 1.49 | 2.38 | 29.5 | 62 | 187 | | 37 | | | 103 | | 0.318 |
| 45 | | | | 08.01.15 | 4.4 | 133 | 17.4 | 3.1 | 517 | 1.24 | 2.4 | 26 | 71 | 63 | | 33 | | | 109 | | 0.313 |
| 46 | | | | 09.01.15 | 4 | 137 | 15.7 | 9 | 479 | 0.98 | 2.35 | 30.7 | 66 | 92 | | 31 | | | 81 | | 0.247 |
| 47 | | | | 08.01.15 | 4.4 | 137 | 19.2 | 4.3 | 509 | 1.23 | 2.22 | 27.6 | 65 | 97 | | 36 | | | 120 | | 0.355 |
| 48 | | | | 07.01.15 | 4.5 | 139 | 20.2 | 9.8 | 668 | 2.13 | 2.2 | 23.3 | 51 | 126 | | 36 | | | 103 | | 0.301 |
| 49 | | | | 09.01.15 | | | | 4.4 | | | | | | | | | | | 110 | | 0.321 |
| 50 | | | | 07.01.15 | 5.7 | 137 | 17.7 | 3.7 | 758 | 1.13 | 2.16 | 29.9 | 62 | 75 | | 36 | | | 102 | | 0.3 |
| 51 | | | | 08.01.15 | 5.5 | 129 | 15.4 | 3.2 | 485 | 1.36 | 2.31 | 24.4 | 72 | 75 | | 36 | | | 119 | | 0.347 |
| 52 | | | | 07.01.15 | 4.7 | 135 | 8.9 | 1.9 | 475 | 0.86 | 2.39 | 30.5 | 57 | 51 | | 31 | | 54 | 100 | | 0.306 |
| 53 | | | | 08.01.15 | 5.8 | 136 | 19.4 | 5.1 | 655 | 1.37 | 2.32 | 25.2 | 65 | 77 | | 34 | | 51 | 124 | | 0.375 |
| 54 | | | | 08.01.15 | 3.8 | 139 | 11.8 | 3.6 | 613 | 0.84 | 2.3 | 29.2 | 63 | 138 | | 33 | | | 103 | | 0.315 |
| 55 | | | | 08.01.15 | 4.7 | 136 | 13.7 | 3.3 | 522 | 1.28 | 2.48 | 25.8 | 67 | 154 | | 35 | | 55 | 113 | | 0.338 |
| 56 | | | | 08.01.15 | 4.3 | 135 | 22.5 | 5.7 | 475 | 0.94 | 2.31 | 26.5 | 63 | 75 | | 36 | | 36 | 90 | | 0.256 |
| 57 | | | | 08.01.15 | 5.8 | 138 | 21.7 | 7 | 1222 | 1.3 | 2.46 | 28.5 | 65 | 152 | | 40 | | | 108 | | 0.312 |
| 58 | | | | 08.01.15 | 6.1 | 134 | 18.9 | 3.7 | 528 | 1.25 | 2.41 | 30.5 | 65 | 273 | | 39 | | | 116 | | 0.359 |
| 59 | | | | 07.01.15 | 4.2 | 134 | 20.1 | 3.2 | 800 | 1.6 | 2.36 | 27.6 | 60 | 81 | | 37 | | | 95 | | 0.274 |

Figure 22 Example of current format for printing blood test results (on ward)

*Inspiration for the project*

The inspiration for the project arose from the researcher's direct experience as a renal patient and his observations of how the current system for communicating blood test results worked in practice and how this system might be improved for the benefit of both clinicians and patients. Issues considered important included;

- an overreliance on numerical data;
- varying ability (from excellent to poor) and time made available (little to as much time as needed) by clinicians in explaining test results;
- varying capacity of patients to concentrate and absorb information.

The observations prompted the question as to whether the current method of presenting blood test results could be improved, specifically on the dialysis unit and in clinic, through exploring a new approach to catalyse effective knowledge sharing between patients, families/carers and clinicians.

| Stage | Context | Capacity | Questions | Information[42] |
|---|---|---|---|---|
| Crisis<br>Month 1 | Hospital | Very limited | Will I survive?<br>What has happened?<br>What will happen (treatment)?<br>Will it hurt/have side effects? | Random conversation with doctors and nurses.<br><br>Observation |
| Recovery<br>Month 1/6 | Home/ dialysis unit | Limited | What has happened and will happen to me?<br>Why do I feel so tired?<br>Side effects and prognosis.<br>Can I get back to any normality? | Conversations with doctors and increasingly with nurses.<br>Observation<br>Leaflets |
| **Transition Months 6/12** | **Home/ dialysis unit** | **Limited but better able to absorb and understand information.** | **Greater understanding of the clinical journey.**<br><br>**Gaining confidence about managing CKD.** | **Targeted conversations with consultant, dietitian, some nurses.**<br>**Observation of fellow patients.**<br>**Renal charity websites.** |
| New Normal<br>Month 12 + | Home/ dialysis unit | Adapting to a new normal but impacted by dialysis cycle. | Desire to take responsibility for managing dialysis process.<br>Learning how to self-manage and considering home dialysis. | Targeted conversations<br>Web searches e.g. charity websites.<br>Trial and error in learning self-management |

Table 18 A patient's journey: a personal reflection on the stages of recovery

[42] Ranked in order of subjective importance.

Table 18 provides an overview of a patient's journey, highlighting important stages of recovery leading to a new normal. Inspiration occurred during the transition phase, where blood tests were recognised as critically important in understanding CKD and how to manage it. A key characteristic of recovery were factors impacting on the patient's capacity to absorb and understand data, and this insight was confirmed through observation of fellow patients. This reinforced the value in exploring creative ways of presenting test results to present information as simply as possible to assist in patient learning, help clinicians in their interactions with patients and explore new ways of empowering patients to become active partners in the management of a chronic health condition.

*A clinician's perspective*

*"I believe that our data visualisation tool could offer patients a new interactive way of presenting blood results to patients and helping them achieve steps towards increased knowledge, understanding and self-management"* (Hill 2017).

The clinical partner for the project was Heather Hill (Renal Dietitian) with further clinical support provided by Dr Ahmed (Renal Consultant) and Scott Rayner (Renal IT Manager). In the context of renal failure, the role of the dietitian is critically important in supporting patient management of their condition. Using the monthly blood test results, the dietitian undertakes consultations with each patient to review results and discuss diet. The overall aim is to keep the patient as well as possible, prevent malnutrition, optimise blood results and minimise complications associated with CKD.

High levels of potassium and phosphate are common side effects of CKD and particularly dangerous as they can lead to cardiac arrest, bone disease, calcification of blood vessels and increased mortality. Potassium and phosphate levels can be controlled by a diet low in these minerals and taking medication (for phosphate). Currently 56% of patients (based on 2015 data) at the Kendal haemodialysis unit do not meet the UK Renal Association Clinical Practice Guidelines for phosphate control (Mactier et al. 2011). This mirrors the national picture and led to the dietitian to reflect upon whether current management methods could be improved.

*Alignment with NHS policy*

"*We will do more to support people to manage their own health – staying healthy, making informed choices of treatment, managing conditions and avoiding complications*" (NHS England et al. 2014, p.12)

The importance of patient involvement in managing chronic health conditions is recognised in NHS guidance. The National Institute for Health and Care Excellence (NICE 2015) highlighted that patients with CKD should be supported and encouraged in self-management and in accessing their test results and medical data. The guideline also advised that '*When developing information or education programmes, involve people with CKD in their development from the outset*' (NICE 2015, p.181).

**Project Methodology**

The Double Diamond (Design Council 2017) illustrates a design-led approach reflected in the methodology adopted in project delivery. It is a process characterised by divergent and convergent thinking with emphasis on iterations from conception to delivery (understanding of context and needs, generating ideas, prototyping, testing and refining to find a workable solution).

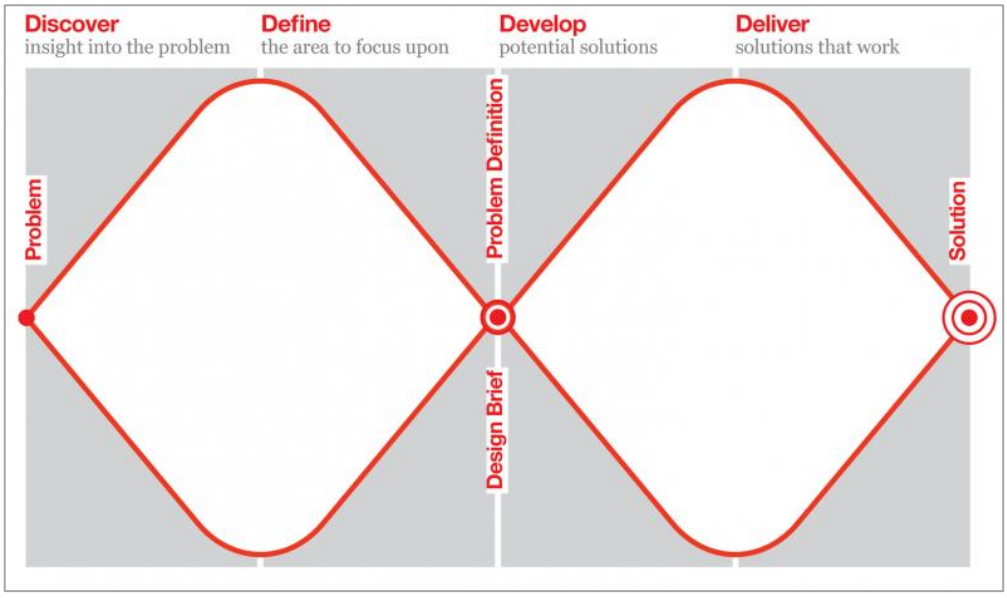



Figure 23 The Design Double Diamond

*Discovery*: Discussion between team members was important for both transferring and sharing knowledge and developing an understanding of the renal context of the project. This included a visit to the Dialysis Unit at Royal Preston Hospital and discussion with the Renal IT Manager. The site visit provided an opportunity for the team to see a dialysis unit and place the project in a wider context of clinical care and data management. These conversations were reinforced by the literature review[43] and a process of developing a shared understanding between patient, dietitian and the wider team in relation to questions and sources of information associated with interpreting test results.

*Definition:* Based on conversations, desk research and a site visit, a clearer understanding of the design challenge and needs of both clinicians and patients was achieved (manifested as a design brief). The project aim was confirmed as being to help both clinicians and patients understand and act on blood test results to be achieved through presenting them in a more easily understood format. The brief stressed that the prototype was to be designed to be viewed by multiple users in a variety of clinical settings including the dialysis unit, ward and clinic e.g. by the multi-disciplinary renal team, patients, families and carers via tablet and desktop. The IT system was analysed in order to identify how the prototype could be embedded into the system and made available to clinicians.

*Development:* Mock-ups were developed through a series of iterations with the delivery team. Initial mock-ups of the prototype were presented to the North West region's monthly renal dietitian's meeting, with discussion highlighting issues related to design. The output was used to refine a design brief for the final phase of design and delivery.

[43] These were done using Cochrane library, Medline /Pub med, CINAHL and EMBASE.

*Delivery*: The final stage of Phase 1 included the development of a fully working prototype which was used as the basis for Phase 2 testing and evaluation with a wider group of patients.

The design-led methodology, reflected in the Kendal project, was strongly aligned with Action Research (AR). Swann (2002, p.5) notes that:

"*Action research arises from a problem, dilemma, or ambiguity in the situation in which practitioners find themselves*".

A number of relevant principles of AR were reflected in the Kendal design-based methodology (adapted from Andriessen 2008; Swann 2002);

- project situated in a social context/practice;
- emphasis on generating change towards a desired future state;
- collaborative and equitable team working to explore and find solutions;
- working through a cyclical process of planning-acting-observing-reflecting and learning.

As the Kendal team worked together to iteratively explore opportunities for improving day to day professional practice and patient experience, it's methodology was aligned with principles of AR including an emphasis on a cycle of prototyping- feedback-refinement, with focus on finding a viable solution aligned to the clinical/patient context and needs. Andriessen (2008) and Swann (2002) are among those academics and practitioners who have recognised such similarities in method and emphasis between the design-based approach and AR.

An infographic for the project is presented in Appendix 6.

*Catalysing a shared understanding*

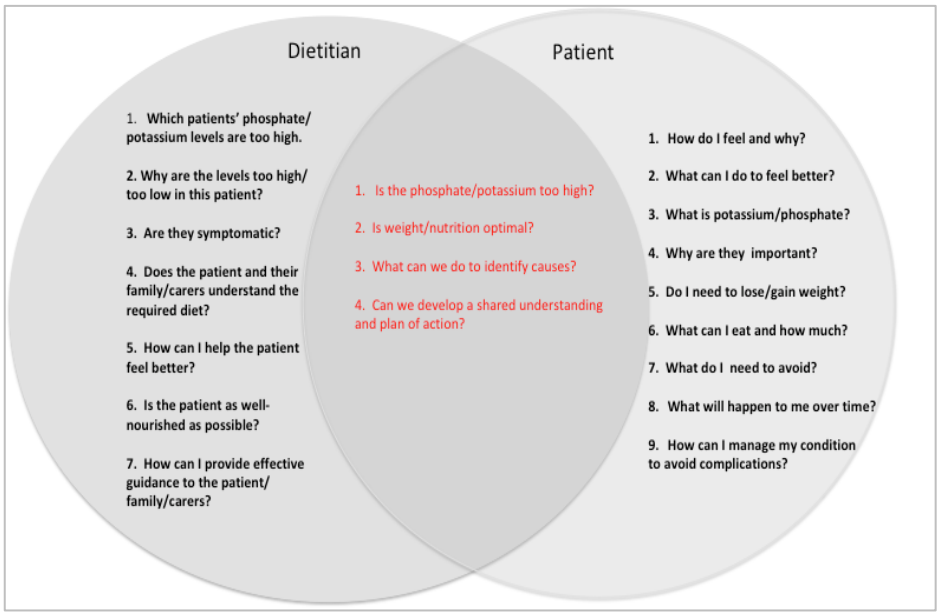



Figure 24 Mapping shared questions related to blood test results between dietitian and patient

An initial priority for the team was to align the project to the needs of both clinicians and patients. Figure 24 illustrates the landscape on which the team explored the development of the prototype. The map was generated by the dietitian and patient in conversation and shared and discussed with team members. It illustrates key questions posed by dietitian/patient in relation to managing diet and importantly identifying their overlap in terms of respective questions and interests. This overlap then provided the context within which the prototype would be developed. The aim of this exercise and related discussion was to facilitate a shared language and understanding across the team as to the needs that would be addressed by the prototype.

*Literature review*

A literature search was carried out (March 2015) by the Library and Information Service at Lancashire Teaching Hospitals Trust.[44] The initial search did not reveal any relevant results and the search criteria was broadened to include non-renal patients.

[44] Cochrane Library, Medline/Pub med, CINAHL and EMBASE. The search terms were: 'data visualization', 'data visualization', 'graphs', 'computer graphics', 'graphics', 'audio visual aids' and 'health communication'.

Clinicians recognise that people learn in different ways, with the research suggesting that new approaches to dietary education required, particularly with younger patients.

*Collinson and colleagues* concluded that:

"*Using the same dietary education techniques may not be suitable for all ages, more innovative approaches supported by skilled health professionals are needed to motivate and engage with younger patients to promote self-management and adherence*" (Collinson et al. 2014, p.1).

*Brewer and colleagues, in* a study of 106 adults, explored the comparison between tables and graphs in communicating health records. They concluded that bar graphs required less time and experience to convey results (Brewer et al. 2012).

*Tang and colleagues,* in a randomised trial of 415 patients, explored online management of Type 2 diabetes (Tang et al. 2013). The study concluded that a nurse-led multidisciplinary health team can manage a population of diabetic patients to achieve positive results using online services (sharing data and knowledge for managing the disease). There was no explicit reference to how data was visualised.

*Garcia-Retamero and Hoffrage* explored visual representation of statistical data for improving diagnostic inferences (clinicians and patients) (Garcia-Retamero & Hoffrage 2013 pp.31-32). The study included 81 doctors and 81 patients who made diagnostic inferences about three medical tests. Their conclusions noted that that doctors/patients made more accurate inferences when information was communicated in natural frequencies relative to probabilities and that visuals aids boosted the accuracy of the inferences made.

*Elder and Barney* (2012) explored preferences for communicating test results to primary health care patients. Their insights were generated from a semi-structured interview of twelve adult home-based patients, over half of whom had a chronic condition requiring regular testing. This study identified factors that supported test results being incorporated into personal health decision-making. The resulting algorithm included (Elder & Barney 2012, p.168):

"*..communication elements (the purpose of the test, the actual results with desired values, clinician guidance, and a graphical representation) and appropriate choice of notification technique (phone/visit for diagnostic tests and all significantly abnormal results and mail/e-mail/web for all others)".*

*Morton and colleagues* looked at educational background in relation to health outcomes in CKD. They found that lower educational attainment is associated with an increased risk of cardiovascular disease and mortality for people with moderate to severe CKD, reaching the conclusion that educational attainment should be taken into account in care strategies. New interventions for CKD patients need to be carefully evaluated before implementation in order to ensure they are relevant and appropriate for the target audience (Morton et al. 2016).

*Wright Nunes and colleagues* point out that *'We need to do a better job helping people manage their complex health conditions*'. In terms of CKD, they go on to say that,

"*..the real dilemma and our collective challenge remain in how to help patients change multiple behaviours that include diet restrictions, complex medication regimens, and healthy lifestyle implementations without becoming overwhelmed*" (Wright Nunes et al. 2016, p.1).

*Web search*

The topic of the web search was the '*visualisation of renal blood tests*' subsequently expanded to include '*visualisation of blood tests'* and the impact of digital technology on shared healthcare decision-making. The search highlighted initiatives exploring the potential impact of digital technologies on four key dimensions:

i) wellness and fitness;
ii) biometric and clinical data;
iii) visualising blood tests and lab results (in theory);
iv) shared decision-making and clinical guidance.

In the '*Future is Now*' report (Ham & Brown 2015), emergent opportunities are placed in the context of drivers impacting on healthcare across developed economics; notably rising costs, limited budgets and growing social and personal expectations about the quality of healthcare and life. The search illustrated how digital technologies are catalysing opportunities for enhanced patient engagement although there was limited work in the field of visualisation of blood tests with no specific references citing the role of blood test results in supporting renal patients. Further insight included:

A distinction between the well-being/fitness applications (Google, Apple, Samsung) and web-based initiatives (including Apps.) focused upon self-/co-management of chronic health conditions. In the future, the apps under development may have the capacity to draw upon clinical data (e.g. Apple) or self-generate biometric data (e.g. Samsung).

- A range of initiatives, (largely clinically led or in partnership with clinicians), exploring co-management of chronic health conditions, focused upon collaboration between clinicians and patients. The initiatives used different dimensions of digitally enabled technologies from websites, text-based services to mobile applications.

- A variety of largely web-based tools focused upon providing information and guidance to patients on a range of health-related topics including renal e.g. *My Kidney* (Guy's and St Thomas & Kings College NHS Foundation Trust 2016) and *Phosphorous Mission*, renal-focused animation and game (Sanofi Ltd. 2016).

*Defining the design brief*

The following design principles were identified, informed by desk research, team discussions, a site visit to a dialysis unit and presentation and discussion of an early stage prototype with a group of regional renal dietitians. These principles distilled from this process informed the subsequent design process and resultant prototype:

- Focus on understanding and addressing clinicians/patient needs.
- Simplicity.
- A prototype aligned with clinical guidance and practice.
- A practical and low-cost solution.
- A tool that will meet the varying needs of patients with different capabilities in different contexts (from the dialysis bed to consultation room).
- A prompt for discussion between clinician, carers and patients that can catalyse shared understanding.
- Emphasis on quickly developing workable prototype that can be used for testing/gaining user feedback.

The prototype uses a binary colour system to show where a given value is situated in relation to a target range; green when a result is within the accepted range and purple when the value is outside the range. It is presented as a dashboard, a stylised view of the patient's data, which aims to make it easier to understand. It places emphasis on colour and shape in conveying important information about the value of a given test metric in relation to its target range. The colour scheme was chosen to accommodate colour-blind patients, while providing an engaging way of sharing information and a powerful tool to support clinicians and patients sharing knowledge.

The application was designed to catalyse conversations between the patient and the clinical team (during dialysis treatment or in the clinic). To meet this requirement, the dashboard was designed for a 10-inch tablet as it has a viable screen size for visualising data. An active internet connection can allow the dietitian to provide more detailed information as needed. The use of the tablet also allows patients to comfortably access data while undergoing dialysis or when in the clinic.

**A working prototype**

The dashboard has three levels for accessing data. Each level is designed to give the user access to more information. *Level One* (Fig.25) provides an overview and is divided into four categories (Diet Results, Bone Results, Anaemia and Clearances). *Level Two* (Fig.26) provides more detailed information in relation to the category selected. *Level Three* (Fig.27) provides the user with access to an overview of the last twelve months of data.

*Level 1*

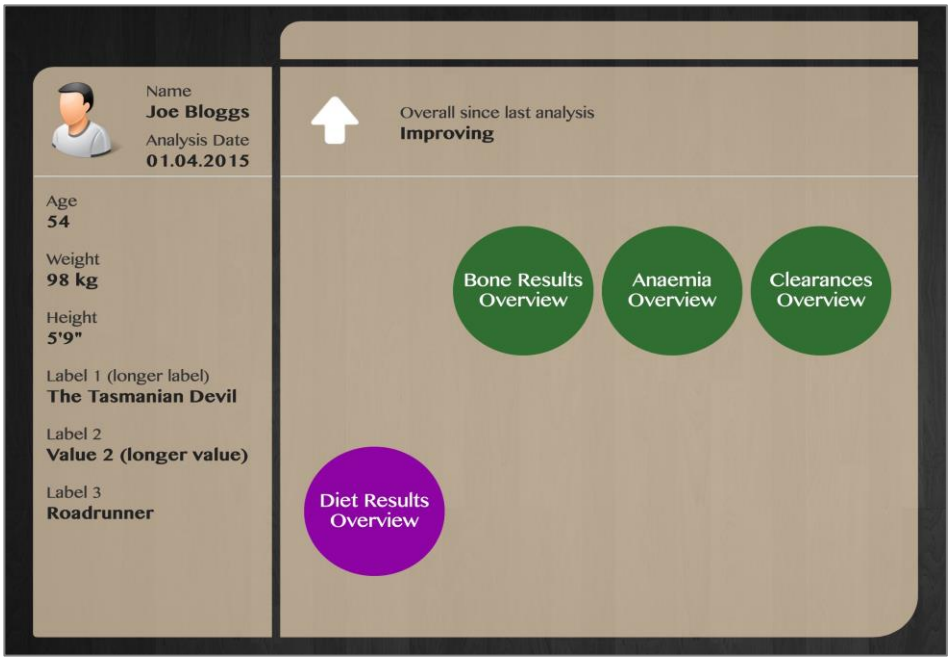



Figure 25 Prototype level 1

The first level allows the user to access a visual representation of data for their last blood test. The view is split into two panels: the left presents a profile of the current user, which gives the clinician context (last analysis date, name, age, height or other patient information identified as being important by the clinician); the right panel presents four blood test categories as circles. Each category contains up to two test parameters relevant to the category. The circle is presented as either green or purple: purple when at least one of the test parameters falls outside the accepted range. The green circle shows that all values in the cluster fall within their accepted ranges.

*Level 2*

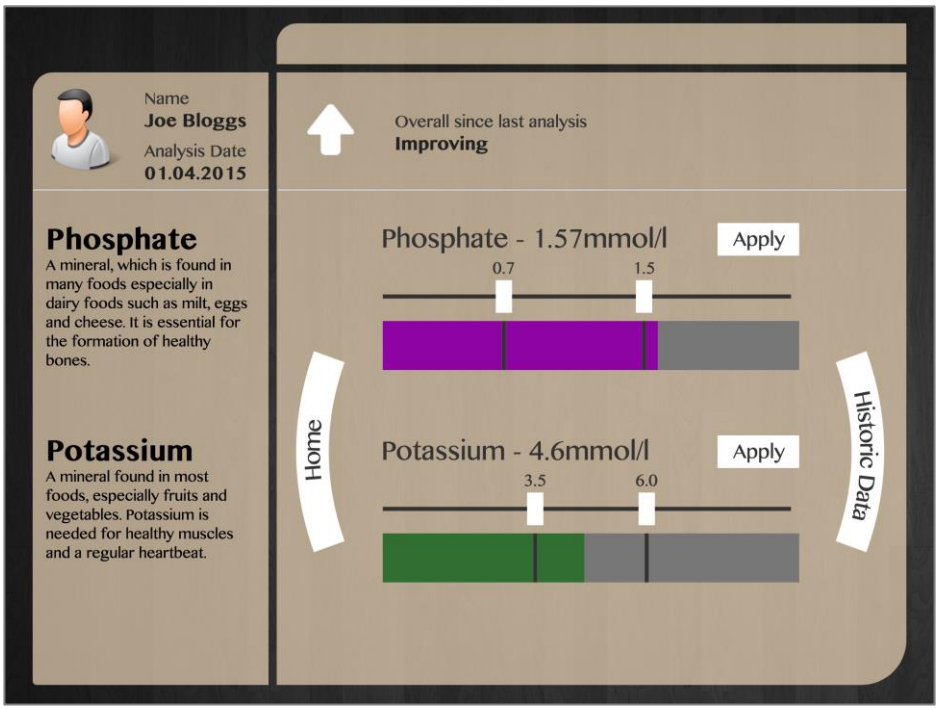



Figure 26 Prototype level 2

If users require more detail, they can tap the desired circle. The second level is then accessed. Here more information is provided for each parameter. The same overall layout is used with the left panel providing a short description for each parameter. The right panel presents the name of the parameter, the current test value and the accepted target range.

The colour scheme is consistent across all levels, purple for values outside the target range, green within the range. A key design feature is the provision for clinicians to adapt the target range for each patient, thus providing a tool for clinicians to adapt to individual circumstances.

*Level 3*

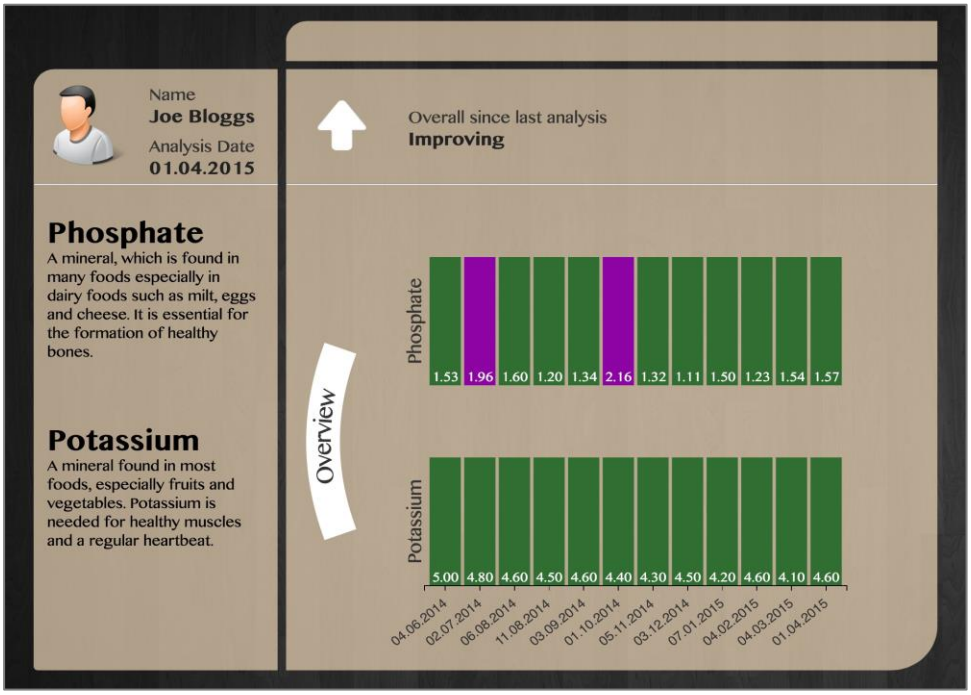



Figure 27 Prototype level 3

Level three is accessed via the '*Historic Data'* button located on the second level. It presents historical data for the patient over the preceding twelve months for the selected metric. The colour scheme is consistent with green signifying a value is within the target range and purple is outside the range.

*Phase 2 Testing and evaluation*

Led by the renal dietitian, the second phase of the project took the form of a twelve-month study as part of her NHS studentship with the University of Central Lancashire (UCLAN). The study evaluated the prototype with a wider group of renal patients and carers. A focus group was selected as the method as the small-group format enabled participants to actively try out the prototype (using tablets) and give their views on the content and layout. Key findings (Hill 2017) included:

- Those consulted noted that the prototype was beneficial in aiding understanding of blood test results and the tool should be used.

- Through co-design with the group, suggestions to modify the home page, display of ideal range of blood results and improvements to the clearances page will be used to shape the final prototype.

- Co-design methodology was effective for evaluating a new digital tool to help patients with CKD understand their blood results.

The report recommends that the prototype should be evaluated with clinicians and a larger group of patients through a focus-group format, to be followed by testing in a clinical context.

**Data Analysis**

The Kendal project provided a unique opportunity for the researcher to explore the collaboration from a research perspective (as observer) and that of a participant (patient and team member). The insights presented on characteristics and the critical enabling themes are based on interview transcripts and key documents associated with the project. The adapted CSF method (see Chapter 3) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* as outlined in Chapter 3 (Kawakita 1991).

*Characteristics of the collaboration*

Insights from interview transcripts and key documents were used to identify characteristics in terms of structure, processes and methodology. Affinity analysis was used to group statements into clusters of shared meaning and intention combined with the authors own reflection on the project.

*Approach (novel):* A novel area of research for clinicians and researchers (epistemology, methodology, application, patient involvement) with central importance given to a shared team understanding of clinical context, user needs and project aims/method.

*Context (emergent and uncertain)*: An exploration of how a design-led methodology can help identify emergent opportunities for the use of digital technologies in developing innovative approaches for supporting knowledge sharing between clinicians and patients in relation to improved patient understanding of renal blood test results and effective CKD management.

*Complexity (high degree of complexity):* Highly complex in terms of team composition, patient involvement and working across disciplinary and organisational cultures.

*Scale (limited resources)*: Temporary collaboration with limited resources and time, and team members involved in other project and roles.

*Team autonomy (highly autonomous)*: The team was autonomous in defining goals, methodology and roles. Senior management (NHS and Lancaster University), provided support as requested.

*Motivation (intrinsic):* A strong emphasis on intrinsic motivation for the researchers and the clinicians. The project did not buy out the clinicians' time with improvements to professional practice being a key motivator. IP was not an issue, reflecting early agreement that the project outcomes would not be used for direct financial gain.

*Outcomes (prototype ready for testing)*: A working prototype to be used for further evaluation with a wider group of users (Phase 2). The project provided a case study for the author's PhD and a related conference paper.

*Methodology (design-led aligned with clinical good practice)*: High priority in reconciling a design-led methodology with clinical good practice. The co-design and development of a working prototype was central in generating value for users and as a catalyst for knowledge sharing.

*Knowledge Exchange (dynamic multiple dimension including co-creation)*: Iterative and dynamic processes related to knowledge transfer (e.g. clinician to researchers/ patient to researchers), knowledge sharing (generating a shared understanding and design brief) and creation (prototype). Of significant importance was the process by which codified and tacit knowledge became synthesised in the creation of the prototype.

*Strategic themes and factors (enablers)*

This section focuses on the identification of enabling themes and factors (enablers) identified as important in facilitating project effectiveness across different dimensions of design and delivery. As outlined in Chapter 3, the themes (and enablers) have been defined following a step-by-step process, drawing on interview transcripts and key documents, with emphasis on the tacit experience and the knowledge of selected participants.

Figure 28 illustrates Kendal case insights in relation to enabling themes and their supporting factors. The diagram provides an overview of the insights that emerged from the case analysis and are aimed to assist the reader navigate the complexity of the narrative. The enabling themes are grouped into three clusters reflecting the meta framework of inputs/processes and emergent states (Chapter 9)

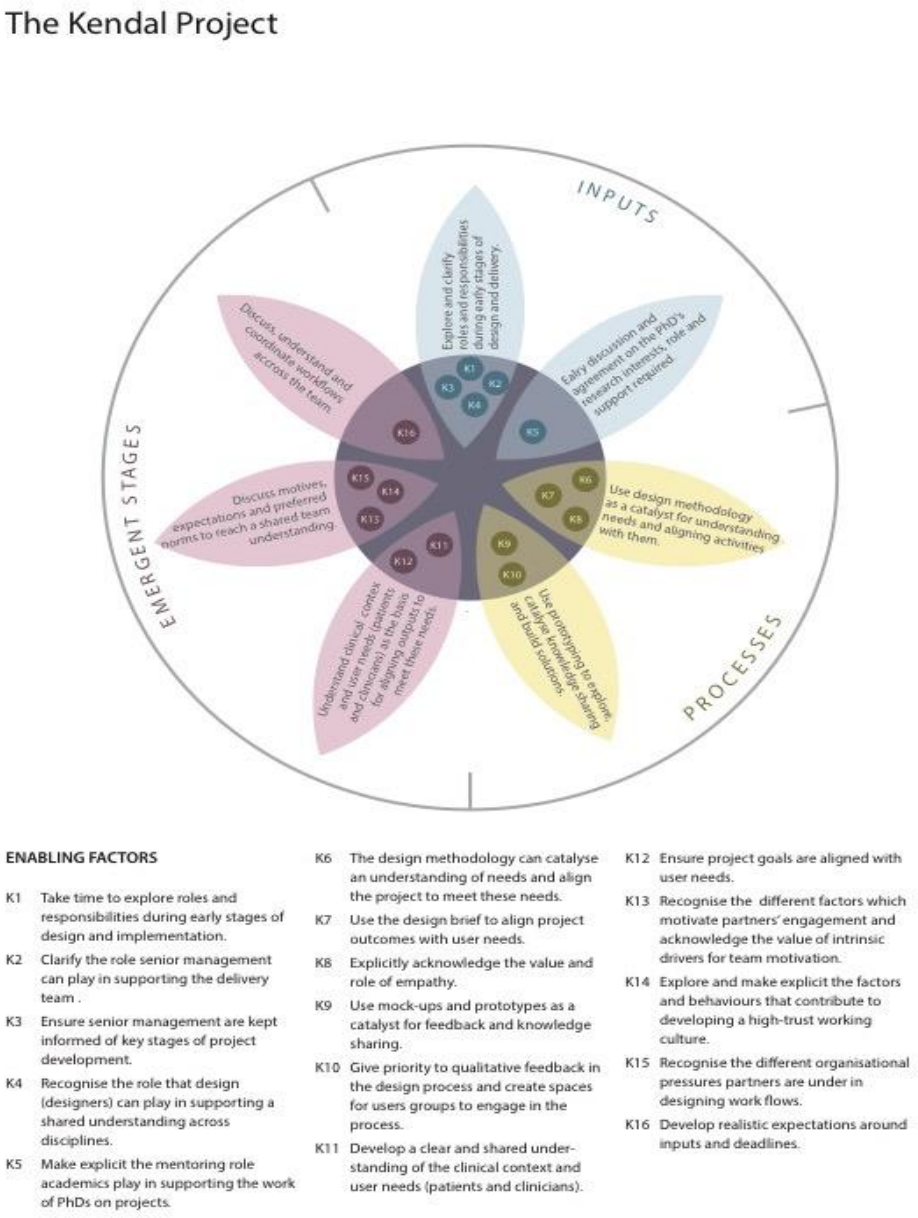



Figure 28 A summary of the Kendal case analysis: enabling themes and factors

Enabling themes of particular significance related to the processes by which the team worked together to create a shared understanding in relation to different dimensions of the project including understanding context and user needs, values, expectations, aims, method and outputs. Of particular importance was the challenge of reconciling a design-led methodology with clinical good practice in generating value for patients and clinicians. The development of a mock-ups and a working prototype provided an important catalyst supporting this process.

Theme 1 Explore and clarify roles and responsibilities during early stages of design and delivery.

*"I think we had the conversation around what we were going to do and I think in essence that defined the roles"* (Interviewee).

Reflecting the process of team building, clarity in the respective roles and responsibilities of team members emerged over the initial phase of the collaboration through a process of discussion. This, in part, reflected the diversity of the team and clear differences in expertise (patient/clinician/academic) combined with a growing appreciation of the value of different perspectives/capabilities that each team member brought to the project and the ways they could contribute to achieving it's goals.

| Enablers | Activity Statements |
|---|---|
| K1. Take time to explore roles and responsibilities during early stages of design and implementation. | A24. Role and responsibilities can be emergent and require iterative discussion and conversations to clarify as the project goals and method become clearer to all team members. |

*"We knew he was there if we needed him"* (Interviewee).

The support and understanding of senior managers (both clinicians and academic) was identified as important for the team members. This was related to the perceived value of their support and guidance to the team in navigating issues that might arise in project design and delivery. A related issue of importance was the need to keep management informed of project progress.

§

| Enablers | Activity Statements |
|---|---|
| K2. Clarify the role senior management can play in supporting the delivery team.<br><br>K3. Ensure senior management are kept informed of key stages of project development. | A25. Senior managers' support and guidance is valued.<br><br>A26. Provide regular updates to senior management on project progress. |

*"I would put the emphasis on design because I think designers have a different view of the world and are much more attuned to working in different ways and with different people and with different processes"* (Interviewee).

Design practice was identified as a skill set that could play a positive role in helping to develop a shared understanding across interdisciplinary teams. This reflects the flexibility and experience of designers working with different disciplines, people and processes and a related ability for them to play the role of facilitators in exploring opportunities and solutions.

| Enablers | Activity Statements |
|---|---|
| K4. Recognise the role that design (designers) can play in supporting a shared understanding across different disciplines. | A27. Explore the potential role that designers can play in all phases of project design and delivery, from supporting the creation of artefacts to their role facilitating engagement between partners and wider stakeholders. |

Theme 2 Early discussion and agreement on the PhD's research interests, role and support required.

*"...the role of the academics in the projects, in some ways we are there to say it's fine, keep calm we can get through this or we can get something good"* (Interviewee).

It was recognised that academics played an important role in providing guidance and giving confidence to the PhDs. A factor identified as having the potential to add value to future KE projects, where PhDs played a central role in their design and delivery, was early training and orientation for PhDs in practice-based research methodologies.

| Enablers | Activity Statements |
|---|---|
| K5. Make explicit the mentoring role academics play in supporting the work of PhDs on projects. | A31. Academics should play the role of project mentors when PhDs are directly involved in delivery.<br><br>A32. For practice-orientated PhDs an initial orientation in method and approach should be provided to support PhD's active role in projects. |

Theme 3 Use design methodology as a catalyst for understanding needs and aligning activities with them.

*"I think, for me, the mock-ups were really powerful because it (design) became manifest and you could see how you could tweak it and change it so easily so that in the end it wasn't fixed, it was very fluid…it (mock-up/prototype) becomes a vehicle then for everybody to contribute to and then you find something that is satisfactory for everybody"* (Interviewee).

The methodology emphasised exploration and the development of an emergent understanding of the clinical context and related opportunities for a visually engaging way of presenting blood test results. The design iterations and development of mock-ups enabled the prototype to provide a framework for discussion and feedback from users and team members, ensuring project outcomes were strongly aligned with user needs and complex operating context.

| Enablers | Activity Statements |
|---|---|
| K6. The design methodology can catalyse an understanding of needs and align the project to meet these needs. | A10. Speculative enquiry and exploration are central to the process of understanding context, opportunities and creative solutions.<br><br>A11. Iterations and feedback on physical mock-ups are central drivers to developing a working prototype that addresses user needs. |

The development of a shared understanding across the team in terms of context and user needs became manifest in the design principles that the prototype needed to address. These principles provided a scaffold within which the mock-ups and prototypes were developed and to evaluate whether it had met the needs of the clinician and patient.

| Enablers | Activity Statements |
|---|---|
| K7. Use the design brief to align project outcomes with user needs. | A12. To ensure alignment with clinical and patients' needs, the prototype needed to:<br>a) Incorporate data that meet national renal standards.<br>b) Use colour rather than numerical values to explain test results.<br>c) Ensure simplicity.<br>d) Reflect the clinical environment within which consultations take place.<br>e) Reflect the IT system and related constraints to ensure a workable solution.<br>f) Be designed to be used by clinicians in consultation with patients. |

*"I think as a designer you have to do it, you have to understand empathy…you have to be empathetic to the people you are interacting with because otherwise you are designing for yourself, not for them"* (Interviewee).

Empathy describes a human capacity to understand and share the feelings of others. In the context of the collaboration, empathy was identified as an important cross cutting theme and a critical factor in enabling both individuals and the group to develop an understanding of the different team members perspectives, user needs and the overall aims and methodology of the project.

| Enablers | Activity Statements |
|---|---|
| K8. Explicitly acknowledge the value and role of empathy**.** | A13. Acknowledge and support the role of empathy in understanding user needs. |

Theme 4 Use prototyping to explore and catalyse knowledge sharing and build solutions.

*"I'm more interested in people telling me what they think rather than they press that button so many times. Things that go beyond the utility and usability into the more subjective"* (Interviewee).

A priority was attached to the qualitative and subjective feedback in relation to lay out and utility as an important element of the design process. Initially only with the project partners, the feedback loop was expanded to include a wider group of clinicians, which had a positive impact on the development of the design.

Consideration was also given to the value of generative workshops to engage and gain feedback on an early stage mock-up of the prototype with a large group of patients, adding to the generation of creative inputs and wider validation of the proposed approach embodied in the artefact.

*"I am not saying that it couldn't turn into co-design, but I think often it's useful to give a provocation of something that might be for people to react against…"* (Interviewee).

A further factor in the development process was the value of using the physical prototype as a provocation for knowledge sharing within the team. This was particularly important given the absence of existing examples of non-numerical ways of visualising renal blood test results and helped develop a shared understanding of goals and anticipated outcomes (both across the team and with stakeholders).

| Enablers | Activity Statements |
|---|---|
| K9. Use mock-ups and prototypes as a catalyst for feedback and knowledge sharing. | A14. Prototypes can help people visualise and understand the concepts being explored and provide a stimulus for understanding and feedback.<br><br>A15. Use mock-ups as catalysts for knowledge sharing. |
| K10. Give priority to qualitative feedback in the design process and create spaces for user groups to engage in the process. | A16. Place priority on generating qualitative feedback which captures subjective feelings in the design process.<br><br>A17. Build into the design iterations spaces for creative ideas to be generated by user groups. |

Theme 5 Understand the clinical context and user needs (patients and clinicians) as the basis for aligning outputs to meet these needs.

*"...a key aim was to facilitate a shared language…Critically the need to develop a shared understanding across an interdisciplinary team"* (Interviewee).

The development of a shared understanding between team members, both of the clinical context and the overall goals and project methodology, was highlighted as being of importance, with particular focus on how monthly blood tests are understood and presented to patients. The participation of both a renal dietitian and a patient in the project team provided insights into the clinical context and process and the factors that impact on a patient's capacity to understood and act upon the test data. The reliance of the current approach on numerical data was recognised as a potential barrier, given that patients learn in different ways. Particularly important for the dietitians are those variables and related metrics which can be influenced through diet, namely phosphate and potassium.

This process of developing this shared understanding was catalysed by a number of different processes and shaped by a variety of factors. Important elements identified included i) the identification of shared questions between the participating patient and clinician as a framework for team discussion; ii) the literature review and related insights; iii) team visit to a dialysis the dialysis unit at Preston Royal hospital. An outcome of this was a growing appreciation by the clinician of the design-led methodology and how a working prototype could provide a useful tool to support the patient/clinician relationship.

| Enablers | Activity Statements |
|---|---|
| K11. Develop a clear and shared understanding of the clinical context and user needs (patients and clinicians). | A1. Two-way flow of information and knowledge between the patient and clinician leads to shared understanding.<br><br>A2. Effective consultation predicated on the assumption that people learn in different ways.<br><br>A3. Trust of the clinician is important for effective consultation and knowledge sharing.<br><br>A4. A growing recognition in the NHS that patients must be more involved in the design and delivery of health services to ensure that services are aligned with their needs.<br><br>A5. Important for the clinician and patient to understand their respective aims and needs as the basis for creating a shared understanding.<br><br>A6. Early face-to-face meetings played an important role in knowledge sharing.<br><br>A7. Other factors that helped to catalyse a greater understanding included desk research, reflective study, conversations and a site visit. |

*"Discussing blood test results can also provide an opportunity for the patient to gain and share knowledge"* (Interviewee).

A growing understanding of the clinical context and a patient's perspective provided the basis for refining the project goals and method through the design process. The alignment of the objective with clinical and patient needs was important in clarifying the value that the prototype could generate for user groups.

| Enablers | Activity Statements |
|---|---|
| K12. Ensure project goals are aligned with user needs. | A8. The project objective and related prototype must be aligned with the needs of patients and clinicians and the wider system of care within which the consultation takes place.<br><br>A9. Creative options for presenting blood test results to patients may catalyse improved knowledge sharing. |

Theme 6 Discuss motives, expectations and preferred norms to reach a shared team understanding.

*"I thought it was interesting (Kendal) and I always like to do interesting things. It's also something I thought was really worthwhile in terms of we all want to make a difference, and this seemed a chance to do this"* (Interviewee).

The comments highlighted the importance of intrinsic motivation for partners in the project. From the desire to improve professional practice and patient care (clinician) to the research interest of the academics and challenges and potential to make a positive difference posed by the project context and objectives.

| Enablers | Activity Statements |
|---|---|
| K13. Recognise the different factors which motivate partners' engagement and acknowledge the value of intrinsic drivers for team motivation. | A18. Intrinsic drivers can be an important factor for partners' engagement with the project.<br><br>A19. Acknowledge and make explicit the non-commercial approach that academics can bring to the collaboration. |

*"I think you actually work towards a goal…Like running, you can't go and run a full marathon when you've never run before…it's something that you have to build upon…The same with dynamics"* (Interviewee).

The theme explored different aspects of trust and respect that developed within the team through an iterative process driven by meetings and conversations with a growing appreciation of the roles people could play and their respective capabilities. A further dimension of developing a shared understanding reflected expectations and normative patterns of behaviour related to listening, respect and openness. A risk factor was identified in terms of working with people for the first time, reinforcing the need for team building.

| Enablers | Activity Statements |
|---|---|
| K14. Explore and make explicit the factors and behaviours that contribute to developing a high-trust working culture. | A20. Building trust takes time and it is easier to work with people you have worked with before. |
| | A21. Diversity of skills and capabilities can contribute to a culture of mutual respect. |
| | A22. Being open and enthusiastic at the beginning of the collaboration and respectful of other people's views. |

*"I know the different tune you dance to as opposed to an academic working in an institution all your life, and I think you have to understand that people have different pressures and different criteria"* (Interviewee).

The complexity of working across organisational boundaries reflects the different pressures, structures and processes that impact on team members. An important factor in developing working relationships is to understand and acknowledge these different organisational drivers. The value of working with academics was also highlighted in terms of their non-commercial interests in collaboration (reflected in the open source approach).

| Enablers | Activity Statements |
|---|---|
| K15. Recognise the different organisational pressures partners are under in designing work flows. | A23. Make explicit the different organisational pressures and drivers that partners are under. |

Theme 7 Discuss, understand and coordinate workflows across the team.

*"…we also respected each other's time which is very, very important"* (Interviewee).

An important dimension of working in collaboration is the need to acknowledge and accommodate the different working patterns and work flows of partners. This requires a degree of transparency and understanding in relation to what is required and when, and to the need to be as flexible as possible when unforeseen events can impact on the capacity of individuals to engage. A further dimension concerned the need to be realistic in terms of what can be achieved in the time available.

| Enablers | Activity Statements |
|---|---|
| K16. Develop realistic expectations around inputs and deadlines. | A28. Develop a clear understanding as to individual inputs and when they can be expected.<br><br>A29. Be flexible in managing different workflows and in adapting to unforeseen events.<br><br>A30. Be realistic (what can be achieved in the time available). |

**Summary**

The Kendal project provided the opportunity to explore a number of themes related to the research question, methodology and context. It reinforced the distinction between knowledge exchange as both policy and as a dynamic process of collaboration, shaping the transfer, sharing and co-creation of knowledge. Sponsored through the Creative Exchange, the project was an example of KE manifesting as a government-sponsored project to catalyse innovation between a university (Lancaster) and an external organisation (the NHS).

The collaboration enabled the NHS to access perspectives, expertise and experience not easily available to work together to achieve mutually agreed goals. From the academic perspective, the project provided an opportunity to explore the value of design methods in a clinical setting and the possibility to generate research outcomes. Within the context of the project, knowledge exchange manifested as a dynamic process by which knowledge was transferred, shared and co-created between project partners and wider stakeholders.

From the author's perspective, it also provided an opportunity to reflect on the concept of knowledge in the context of a personal journey in managing a chronic health condition, using the different stages of recovery to identify points when the transfer, sharing and creation of knowledge became manifest. While not discrete events, they are points on a knowledge continuum that marked milestones on a journey in understanding the impact of CKD. This in turn catalysed a shared understanding between patient and clinicians as the basis for a joint management strategy for the condition.

| Category | Characteristics |
|---|---|
| Approach | Exploratory and iterative approach in identifying opportunities and solutions. |
| Context | Design/digital technology to catalyse patient understanding in a complex clinical context. |
| Complex | Highly complex with multiple disciplines, organisations and paradigms in a complex social context and working culture. |
| Scale | Small project with limited resources, time and a transient team. |
| Autonomy | High degree of autonomy in decision-making and defining roles. |
| Motivation | Strong emphasis on intrinsic motivation. |
| Outputs | A working prototype and research insights. |
| Methodology | Design-led and iterative reconciling research, clinical practice and development of a working prototype. |
| Knowledge Exchange | Dynamic and iterative process of knowledge transfer, sharing and creation through the project life. |

Table 19 Summary of the characteristics of the Kendal case - structure, process and method

The Kendal project reflected a highly novel and emergent collaboration for all those involved. It was a project which was complex in terms of working across organisational and professional paradigms (clinical and design), personal perspectives (clinician, researcher, patient) and which was focused on the co-creation of knowledge in the form of prototype. Of particular importance was the need for a highly autonomous team to generate a shared understanding of both context, opportunities and possible solutions through a dynamic process of knowledge transfer, sharing and creation.

| Domain | Enabling Themes |
|---|---|
| Inputs | 1. Clarify emergent team roles and responsibilities.<br>2. Clarify role of the PhDs and their support. |
| Process | 3. Design and catalyse understanding needs and aligning activitie<br>4. Prototyping to catalyse knowledge sharing and build solutions |
| Emergent | 5. Understand and align with user context and needs.<br>6. Discuss motives, expectations and norms for shared understanding.<br>7. Discuss, understand and coordinate workflows. |

Table 20 Summary of enabling themes for the Kendal project

The *Enabling Themes*, identified in Table 20, are generated from grouping the *Enabling Factors* and their *Activity Statements* by shared meaning and intention identified from transcripts and key documents). The *Domains* used in structuring the findings are derived from existing theory on team effectiveness (inputs/process/ emergent states) and are used to structure all case study insights and providing the basis for a cross-case analysis (Chapter 9).

*Patients as partners*

*"We define involvement as an activity that is done 'with' or 'by' patients or members of the public rather than 'to', 'about' or 'for' them"* (National Institute for Health Research 2016).

On the dialysis unit, patient empowerment acquired a particular meaning for the patient/researcher with reference to the process of a patient learning about CKD and a growing confidence to take responsibility for self-management. This included the confidence and knowledge to ask questions of clinicians. In a clinical context, where the balance of knowledge and authority can be asymmetric, the process of self-management has the potential to make patients true partners in the management of their condition. From observation, this is subject to: i) the desire and capacity of the patient; and ii) commitment from staff to a process of transferring and sharing authority, responsibility and knowledge with the patient.

It is in this context that the prototype was designed to provide an effective tool to support both clinicians and patients in communicating with each other (transferring and sharing knowledge) through presenting a novel approach to visualising data. In their overview of barriers and enablers to user group involvement in health care, Ocloo and Matthews identified factors relevant to both the context and approach reflected in the Kendal project (Ocloo & Matthews 2016). Adapted by the author to the Kendal context, they include:

- *Communication/Information*: A great deal of variability between the ability of clinicians to communicate (and patients to understand) may generate uneven distribution of information and knowledge between patients and carers. This is compounded by a varying capacity of patients to absorb and understand information: factors including patients not being comfortable with numeric data; non-English speakers; patients who lack confidence; possess different disabilities; and may find some clinicians speak in '*clinical English*' (complicated terms/jargon).

- *Poor health literacy*: CKD is a complicated condition and often occurs with co-morbidities. In this context, and despite best efforts by clinicians, it can be very complicated for some patients to understand information presented.

- *Tokenism:* Clinicians talking about engagement and involvement in co-management but not being fully committed to making it happen through the sharing of authority, responsibility and decision-making power.

- *Confidence*: Patients may lack the confidence to ask questions for a variety of reasons including not fully understanding the condition or its impact on their day-to-day live, including blood test results.

In overcoming barriers, the following are identified:

- *Improving access:* Improving access to decision-making processes thorough enhanced understanding of important information (blood test results).

- *Support*: Building confidence/skills to engage as partners in jointly managing a chronic health condition.

- *Health literacy*: Improving communication and understanding with all patients.

- *Development of tools*: Supporting patient empowerment.

A continuum of patient engagement is presented across different dimensions of the clinical context including policy, organisational design/governance, direct care, consultation (addressing *'to/about'* and '*for'* dimension of patient involvement), partnership and shared leadership ('*with'* or '*by'* dimension). Despite a body of evidence on how patients can contribute in the design and delivery of health care, they note that consultation is more *'..the norm than collaboration..'* (Ocloo & Matthews 2016, p.626), this despite the benefits that collaboration can generate in terms of improved service design and delivery, increased patient choice, enhanced self-management, shared decision-making and improved clinical outcomes.

Exploring the divergence between the rhetoric and reality surrounding patient involvement, they note (2016) that even when health care teams (clinicians and administrators) are committed to exploring ways of enhancing engagement:

"*Uncertainty persists about why and how to do involvement well and how to involve and support a diversity of patients and the public, rather than a few selected individuals*" (Ocloo & Matthews, 2016, p.626).

In response to this challenge, they stress a need to explore more effective ways of sharing power between patients and healthcare professionals.

*Co-production of knowledge*

Co-production of knowledge is identified as having the potential to catalyse a more democratic and collaborative approach to working with patients, families and public in the design and delivery of healthcare. Rycroft-Malone and colleagues highlight the different assumptions of co-production (in the context of collaborative research) with reference to traditional modes of knowledge production, transfer and translation, particularly those where the production of knowledge is separated from its use (Rycroft-Malone et al. 2016). They contrast two modes of knowledge production in a clinical context. In the context of the first, the challenge of knowledge transfer is to bridge two communities (producers and users) with emphasis on the packaging and communication of research and its outputs with the aim of making it relevant for potential users (aligned with Mode 1 research and transfer models outlined in Section 2). The second mode places emphasis on the co-production of knowledge in the context of complex collaborations operating within a '*context of use'*. These collaborations involve a variety of stakeholders with different world views who work together to address specific real-world problems (in the clinical context this includes patients and families). In this way the producers and users work together in creating knowledge.

Cooke and colleagues explore the concept of co-production in the context of applied health research where collaborations involve different stakeholders and related culture, norms, values and world views e.g. researchers, clinicians, patients, user groups, funders, policy makers (Cooke et al. 2016). In this context, they emphasise the value of *design, prototyping and making* which reflects an iterative and incremental process of collaboration. In this process the act of making and prototyping reflects and catalyses the co-production of knowledge and:

"*…can create new meaning and knowledge 'through' sketching, simple prototyping, or other creative practices*" (Cooke et al. 2016, p.2).

They note that design methodology and methods address a number of the principles for successful co-production including;

- the need to recognise the issues of power (e.g. language) by adopting a nonverbal form of collaboration (making);

- recognising and leveraging the value that individuals bring to the collaboration;

- blurring the boundaries between different stakeholder groups (e.g. clinicians and patients);

- and moving from command and control to facilitative styles of leadership.

The Kendal project was aligned with these principles of co-production. Its methodology embodied an iterative process of feedback and reflection in identifying opportunities for innovation. It placed mock-ups and prototyping at the centre of the methodology and within a process reflecting elements of participatory design, user-centred design and co-design, with an aspiration to engage a wider group of users in the design process as the project developed to a second phase.

The value of a design based methodology and approach in addressing health and well being challenges is recognised by Louse Valentine and colleagues (Valentine et al, 2016, p.760):

*"With changes and challenges in health care and well-being, a leaning towards more inclusion of patient-centred care and a move away from (an over) reliance on linear models of problem-solving, there is opportunity to consider design as a model for innovation in health care and well-being, especially social innovation"*

*The concept of lead users*

For the project to be successful, an important enabling theme was the alignment between the project deliverable (prototype) and user needs. The design methodology provided important methods and mechanisms that strengthened this alignment. Going beyond the perception of users (patients /clinicians) as passive objects of study to engaging clinicians and patients as partners in the design and research process, it recognises patients and clinicians as '*experts of experience'* (Sanders & Stappers 2008).

*"...lead users often attempt to fill the need they experience, they can provide new product concept and design data as well"* (von Hippel 1986, p.791)

The role of patient and clinician in the Kendal project reflects, in part, the concept of '*lead user'* as developed by Eric von Hippel (von Hippel 1976, 1986). While initially defined with reference to market research, the concept stressed the value of engaging users who have real-world experience of the context and needs in relation to product/service development. It is characterised as:

- Facing needs that will be relevant in the wider market place but in advance of when these needs are made manifest to that wider market.

- Positioned to benefit significantly from obtaining a solution to those needs.

Although faced by the same constraint as all users in that they '*..are constrained by the familiar*' in their ability to imagine what is possible (attributes of any innovation), their unique real-world experience enables them to provide insights into needs, product concepts and design parameters (von Hippel 1986, p.791).

With reference to this case, the characteristics of lead users are reflected in the role of the clinician and the patient. Both have direct experience of CKD and the role that blood tests play in managing the condition (from their different perspectives). Both have insights into the context and the needs of the key stakeholders involved in the consultative process and have provided insights into the attributes that the proposed innovation will need to address. Von Hippel (1986) also reflects on the question of how the insight generated by the lead users can be generalised to the '*market of interest*' or in the case of the wider population of renal patients, families and their medical teams. In this regard, he identifies the prototype as a means of catalysing feedback from a wider group of users. A method adopted in Phase 2 of the Kendal project in generating feedback from a wider group of renal patients.

# Chapter 8 Cases 2-6

The insights presented in relation to project characteristics, enabling themes and factors (enablers) are based on interview transcripts and key project documents. As with the Kendal project, the adapted CSF method (see Chapter 3) has been applied to the analysis of data and provides the basis for identifying characteristics and enabling themes.

An important difference in method between Kendal and the cases included in Chapter 8, is the role of the researcher. In the Kendal project, the researcher was both a team member, patient/user and a research observer.

In the cases below, the researcher was an observer, drawing on insights generated from interviews and key document, combined with an interpretive role in their analysis.

**Case 2 Bretton Buzz**

**Project Profile**

*Objective* To test and develop the potential of the LOCAL nets social media software. An innovative social media analytics application developed to support the design and delivery of measures to catalyse community action and promote community rights.

*CX Cluster* Public Service Innovation and Democracy

*Total Budget* £10,001 and PhD time

*Status* Ongoing at time of interviews

*Project Partners*

- Royal College of Art (Creative Exchange Lead)
- Manchester University
- Table Flip (SME)

*Wider Stakeholders*

- Royal Society for the Encouragement of Arts, Manufacturing and Commerce (RSA)
- University of Central Lancashire (UCLAN)
- Department for Communities and Local Government (DCLG)

*Sources of Data*

*Key Documents*

- Creative Exchange Project Proposal
- Creative Exchange Collaboration Agreement
- Project TOR
- Community Capital: The Value of Connected Communities (Parsfield et al. 2015)

*Three Interviews* (A, B and C) with three team members representing three partner organisations

**Project Description**

*"I think the key thing to understand is whether we can effectively identify groups of individuals who can carry out community action and bring them together and cause that to happen"* (Interviewee).

As part of a wider collaboration supporting community well-being, Bretton Buzz aimed to improve the *LocalNets* analytical software prototype tool created by a CX PhD. This prototype was recognised by project partners as having the potential to provide a useful method in understanding and mapping social networks at the community level. This objective to be achieved by mapping social network activity taking place on web- enabled platforms such as *Twitter* and blog-posts.

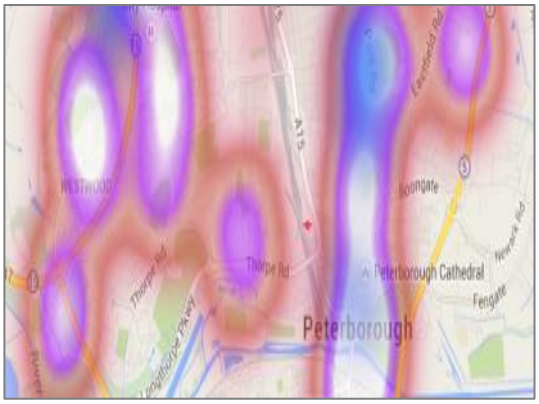



Figure 29 A visualization of the LocalNets app.

LocalNets was originally developed in an earlier project, *The Community Mirror Project*, undertaken with the Royal Society for the Encouragement of Arts, Manufacturing and Commerce (RSA) and NESTA. This project provided the opportunity to develop the LocalNets prototype through comparing the data it produced in mapping social network activity with traditional survey methods used by the RSA in the community of Cranford (Marcus & Tidey 2015). The RSA subsequently used the LocalNets prototype in Bretton, Peterborough as part of its *Mental Wellbeing and Social Inclusion* project (RSA 2015). At the heart of the collaboration is the concept of community well-being. As explored in the project's final report, *Community Capital: The Value of Connected Communities*, community well-being is defined:

*"…the sum of assets including relationships in a community including the value* (to community members) *that accrue from these…*" (Parsfield et al. 2015, p.11).

This project aimed to identify community assets and social networks as the basis for co-designing community-led projects to strengthen social well-being. The Department for Communities and Local Government (DCLG), a wider stakeholder in the CX project, aimed to use the prototype to explore how digital analytics can catalyse community engagement and uptake of the Community Rights Legislation.[45] The core partners of the project (Table Flip and Manchester University) provided CX-funded support for software development while the wider group of stakeholders provided the social context within which to test and evaluate the prototype.

**Data Analysis**

The adapted CSF method (see Section Introduction and Chapter 3 for detail) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* as outlined in Chapter 3 (Kawakita 1991).

*Characteristics of the collaboration: structure, process and methodology*

*Approach* (exploratory and emergent): The project recognised the potential value in digital social network analytics without a clearly defined project outcome. This was noted in the terms of reference, which stated that the prototype and related methodology will evolve on the basis of experience gained through the project. The value associated with this exploratory and emergent approach was recognised by stakeholders noting that this approach would not be possible under traditional commissioning procedures.

[45] The Community Rights legislation falls under the responsibility of the DCLG. This legislation provides a legal framework in support of communities acting on their own behalf to create and sustain community assets.

*Context* (emergent technology and applications): The overarching aim was to deploy a working prototype of a digital analytical tool to support the identification of social networks and related community assets. This digitally focused network analysis to be used alongside, and be evaluated against, traditional forms of network analysis. The insights generated from LocalNets providing a basis for facilitating the identification of possible community project partners.

*Complexity* (multiple organisations and disciplines): The project was characterised by a high degree of complexity as manifested in the number and diversity of project stakeholders (both immediate partners and wider stakeholders) and professional disciplines. The number and diversity of partners creates the potential for a variety of perspectives in design and implementation but also a challenge in terms of aligning interests

*Scale* (limited resources and time): The CX project was small in scale but was working in partnership and leveraging a larger collaboration (RSA - Connected Communities). This synergy created opportunities to further evaluate and develop the prototype, with feedback from a wider group of associated collaborators beyond the immediate partners.

*Team autonomy* (self-organising): An overall structure to the process of collaboration provided a scaffolding which facilitated the development of a shared understanding of the project and how each partner could engage in it. A process of self-selection in roles and responsibilities was demonstrated in both the CX and wider partnerships.

*Outcomes* (varied): A mix of deliverables reflecting the research aims of the PhD and academics involved, policy interests and lesson learning for the civil servants, and project-related outputs and impact in the wider context of the collaboration.

*Methodology* (central role of the prototype)*:* The deployment of an existing prototype catalysed a shared understanding of how partners could engage and generate value. The collaboration provided the basis for further development of the software and its related application, visualisations for data generated and new evidence-based guidance e.g. database.

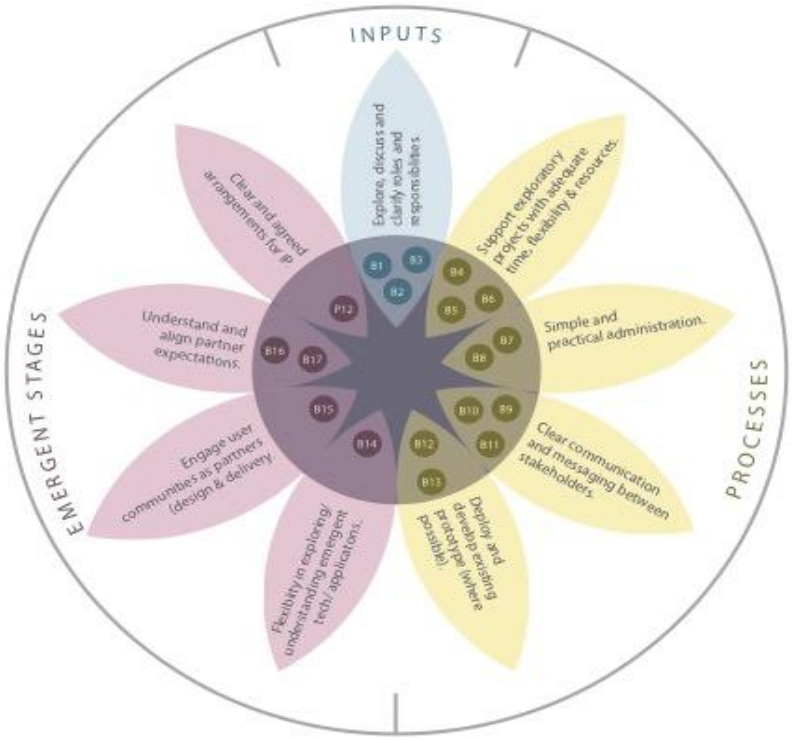
*Knowledge Exchange* (mix of transfer, sharing and creation): Dimensions of knowledge transfer and sharing as part of design and implementation. Co-creation occurred within the CX team (prototype) and in engaging with stakeholders to develop data visualisation in response to feedback from partners. Also, within community-based activities in Bretton as part of the Connected Communities project.

*Strategic themes and enablers (factors)*

This section identifies enabling themes and enablers (factors) in different dimensions of project design and delivery identified as important in facilitating effectiveness.

Figure 30 provides an overview of insights from the Bretton Buzz case analysis with reference to these themes and their supporting factors. The enabling themes are grouped under three clusters reflecting the meta framework of inputs/processes and emergent states, described in detail in Chapter 9.

Bretton Buzz




**ENABLING FACTORS**

B1 Explore and agree roles and responsibilities during the project's early stages.

B2 Identify the lead senior managers within the participating organisations.

B3 Discuss the role of the PhD on the project in relationship to their wider research goals.

B4 Ensure adequate time and resources are committed to developing relationships during early stages of inception and design.

B5 Use flexible management for exploratory projects.

B6 Identify risks and mitigation strategies.

B7 Design simple, efficient and flexible administrative and budgetary procedures.

B8 Pay market rates for service providers (sub contractors).

B9 Budget for regular face-to-face meetings.

B10 Ensure short and regular project updates are circulated.

B11 Place emphasis on developing a high-trust and open working culture.

B12 Use prototypes as a catalyst for knowledge sharing and co-creation between partners and wider stakeholders.

B13 Recognise the value in deploying existing prototypes for lesson learning for future use.

B14 Be flexible in design and implementation when context and outcomes are uncertain.

B15 Prioritise understanding of user context and needs.

B16 Commit time to understanding and aligning partner motives and expectations.

B17 Be realistic about what can be achieved within the resources available.

B18 Discuss and agree a framework for IP at the beginning of the project.

Figure 30 A summary of the Bretton Buzz case analysis: enabling themes and factors

Important themes identified include the emergence and importance of shared understanding between team members and the alignment of expectations e.g. in relation to roles, user context and IP. A further dimension was the need for flexibility in exploring emergent contexts and the importance of enabling processes such as communication, team discussion, resources and simple administration. Further detail is provided below.

Theme 1 Explore, discuss and clarify roles and responsibilities.

*".. it comes down to people, personalities, being able to communicate to provide a positive ethos, to provide a sense of contribution that each stakeholder could make"* (Interviewee).

In the absence of clear lines of hierarchy and authority to shape and dictate project design and management, the Bretton Buzz project developed through discussion and negotiation. This included an element of self-selection by partners in terms of their roles and responsibilities. The principle of self-organisation was also reflected in the work of Community Capital programme through community engagement and co-production of project-based and community-based interventions.

| Enablers | Activity Statements |
|---|---|
| B1. Explore and agree roles and responsibilities during the project's early stages. | A21. Identify clear roles and responsibilities between team members as an important milestone in project development. |
| B2. Identify the lead senior managers within the participating organisations. | A22. Identify individuals within each partner/stakeholder organisation to act as lead contact. |
| B3. Discuss the role of the PhD on the project in relationship to their wider research goals. | A23. Develop a clear understanding between partners of the role and responsibilities of PhDs if they are involved in project design and delivery. |

Theme 2 Support exploratory projects with adequate time, flexibility and resources.

*"...because it's innovative we don't know exactly what it looks like yet and we're still experimenting"* (Interviewee).

The theme reflects the formal process of project design and management. As outlined in project characteristics, Bretton Buzz was focused on exploring the development and application of new software and applications with a related uncertainty in terms of final outcomes. Enabling factors reflect the exploratory nature of the project but also the value of developing relationships at an early stage with both core partners and wider stakeholders. The theme of risk management has been identified as the basis for identifying and mitigating potential risks that can impact on project delivery**.**

| Enablers | Activity Statements |
|---|---|
| B4. Ensure adequate time and resources are committed to developing relationships during early stages of inception and design. | A13. Explore new potential partners at an early stage.<br><br>A14. Ensure sufficient time is allocated to develop the partnerships and design the project e.g. TOR. |
| B5. Use flexible management for exploratory projects. | A15. Recognise the value that exploratory projects can generate. |
| B6. Identify risks and mitigation strategies. | A16. Ensure that risks are identified by project partners and discuss how best to manage. |

Theme 3 Simple and practical administration.

The theme addresses the design of administrative and budgetary procedures impacting on the project. Points arising relate to the development of the initial collaboration and to issues impacting on the downstream delivery of the project and wider collaborations.

| Enablers | Activity Statements |
|---|---|
| B7. Design simple, efficient and flexible administrative and budgetary procedures. | A28. Have simple administrative and budgetary procedures and ensure that resources are available to ensure speedy processing. |
| B8. Pay market rates for service providers (sub-contractors). | A29. Flexibility to allow different types of partners to collaborate. |
| | A30. Pay market rates for services provided. |

Theme 4 Clear communication and messaging between stakeholders.

*"I think it's essential (physical contact) because you can't negotiate patterns of work or projects without that. However, as important would be all of the offline non-face-to-face contact"* (Interviewee).

Communication reflects the importance of face-to-face and online communication between stakeholders, both in the core project partnership and the wider group of community partners.

| Enablers | Activity Statements |
|---|---|
| B9. Budget for regular face-to-face meetings. | A24. Plan and budget for regular face-to-face meetings between partners and stakeholders. |
| B10. Ensure short and regular project updates are circulated. | A25. Keep everybody informed of project progress by short email updates. |
| B11. Place emphasis on developing a high-trust and open working culture. | A26. Make explicit the importance of trust and ethical behaviour in the partnership. |
| | A27. Develop a culture where partners and stakeholders can be open about their role and capacity to deliver. |

Theme 5 Deploy and develop an existing prototype (where possible).

*"My hypothesis is that there is some social value in the data...It could be discovered through some sort of computational process. I narrowed that down to this process of identifying community assets, and we explained that to them and they said we have this very specific need that matches with that"* (Interviewee).

At the heart of the collaboration has been the deployment of the LocalNets prototype. Unlike other CX projects, an existing prototype was deployed in the CX project with the intention of testing and evaluating its performance in mapping and catalysing an understanding of community networks and assets. This is specifically to support: i) uptake of community rights; and ii) the co-production of community-based interventions. The factors that emerged in the context of this theme reflect the value that this prototype brought to the project and issues about the co-design and development of the digital tool.

| Enablers | Activity statements |
|---|---|
| B12. Use prototypes as a catalyst for knowledge sharing and co-creation between partners and wider stakeholders.<br><br>B13. Recognise the value in deploying existing prototypes for lesson learning for future use (proof of concept). | A11. Use the deployment of early stage prototypes to generate relevant guidance and realistic data expectations for its future use.<br><br>A12. Use prototypes to catalyse understanding about overall project direction, and as a tool for co-design. |

Theme 6 Flexibility in exploring and understanding emergent technologies and their applications.

*"...just understanding that unstructured online data that's out there that actually, if structured, could give you new insights into the communities that we're meant to be contacting and making better, is really interesting to us, but I think that not only are we not experts in it, it's an emerging area, so I think we quite near the beginning of understanding what's possible"* (Interviewee).

The project is focused on exploring emergent technology and application areas without being able to draw on extensive experience and knowledge in terms of process or outcomes. Central to the Creative Exchange support for the Bretton Buzz project was the deployment of an early-stage software in support of social network analysis as part of a wider programme of community engagement and rights uptake where both the performance and uptake of the technology were unknown as were project outcomes.

| Enablers | Activity statements |
|---|---|
| B14. Be flexible in design and implementation when context and outcomes are uncertain. | A6. Explore the use of digital analytics as a cost-effective catalyst for offline community activity and related supporting interventions.<br><br>A7. Creative visualisation of data generated by the prototype is critical in supporting stakeholder understanding.<br><br>A8. Social media analytics can provide a new way of connecting to people online.<br><br>A9. Deployment of a digital tool for social network analysis must take into account the non-digital-based networking that takes place in the community.<br><br>A10. Use local knowledge to reality check the results of social network analysis (physical/digital). |

Theme 7 Engage user communities as partners (design and delivery).

*"The tools that you use right at the beginning cannot determine successful or unsuccessful outcomes, but what they can do is determine successful attempts at engaging and making links with communities"* (Interviewee).

Different but related concepts are used to describe the process of working in partnership e.g. co-production, co-creation and co-design. All these phrases share the central concept of engaging with wider groups of stakeholders (service users, community groups, citizens) as partners in the design and implementation of projects. Co-creation was demonstrated in the context of the core CX project and in the wider Community Capital project (RSA) working with communities, specifically Bretton. In the wider projects LocalNets supported a range of community-based initiatives.

| Enablers | Activity Statements |
|---|---|
| B15. Prioritise understanding of user context and needs. | A1. Ensure those involved in community- based projects have access to senior-level support. |
| . | A2. Understand external factors that can impact on the capacity of community-based organisations to effectively engage in community projects. |
| | A3. Identify and understand community assets, networks and connectors. |
| | A4. Understand factors that impact on community organisations' capacity to engage. |
| | A5. Define structure and methodology as the basis for developing partnerships. |

Theme 8 Understand and align partner expectations.

*"I think they're often resolved as you go along. If they don't get resolved then obviously there's team conflict and disparity"* (Interviewee).

The theme of expectations relates to the process by which the respective ambitions and expectations were aligned between partners as the basis for effective collaboration.

| Enablers | Activity Statements |
|---|---|
| B16. Commit time to understanding and aligning partner motives and expectations. | A17. Work to align expectations with reference to overall aims and the process which they will be achieved while mainta flexibility to accommodate partners' inter |
| B17. Be realistic about what can be achieved within the resources available. | A18. Use face-to-face discussion to generate a shared understanding of project aims and objectives. |
| | A19. The prototype can be used to catalyse a shared understanding of project goals. |
| | A20. Be realistic about project timelines and milestones. |

Theme 9 Clear and agreed arrangements for intellectual property (IP).

This theme related the ownership of the different dimensions of knowledge brought into the collaboration by partners and how new creations generated by the collaboration are treated.

| Enablers | Activity Statements |
|---|---|
| B18. Discuss and agree a framework for IP at the beginning of the project. | A31. Explicitly agree a policy for intellectual property (IP) at the beginning of the project.<br><br>A32. Agree how insights and lessons arising from the collaboration will be disseminated and on what basis. |

**Summary**

*"...all the way we are watching what's possible using the methodologies and the application that (LocalNets) is producing. So, we are learning all the time and potentially getting something interesting at the end of it"* (Interviewee).

Bretton Buzz was a small project working within and supporting a wider programme of activities at the community level. These wider activities provided a context in which to evaluate the existing LocalNets software prototype. While small in scale, the project was complex in terms of navigating the interests and needs of this wider group of stakeholders in generating value, both for them and the immediate project team.

| Category | Characteristics |
|---|---|
| Approach | Exploratory and unknown (context and outputs) reflected in a lack of clarity in outcomes and emphasis on iterative prototyping and learning by doing. |
| Context | Emergent technology and applications with emphasis on deploying a working prototype and to learn and refine through its deployment. |
| Complexity | Highly complex in terms of multiple organisations, stakeholders and disciplines reflected in motives and perspective. |
| Scale | Limited resources, although a small project leveraged resources and opportunities through working with partners. |
| Autonomy | High degree of autonomy with emphasis on self-organisation with the context of a larger, clearly defined programme of activity. |
| Motivation | Mixed between community interests, operational objectives of programme staff and sponsors, academic interests and wider policy goals of stakeholders. |
| Outputs | Mixed deliverables with emphasis on research, practical value added to the larger programme/policies and the potential for proof of concept. |

| | |
|---|---|
| Methodology | The prototype as a catalyst for knowledge sharing and creation through iterative process of lesson learning and refinement. |
| Knowledge Exchange | Dynamic continuum[46] of knowledge transfer, sharing and creation within an iterative journey. |

Table 21 Characteristics of the Bretton Buzz collaboration - structure, process and method

Characteristics illustrate the emergent and exploratory nature of the process by which the project developed, both in terms of its design in the wider community context and in terms of its technology and areas of application. This development process reflected a dynamic process of knowledge sharing and creation – both within the immediate project team and among the wider stakeholders, including at the community level in Bretton. The prototype was central to the process of catalysing knowledge sharing and learning through the collaboration and its deployment in the wider context of the Connected Communities programme.

| **Domain** | **Summary of Enabling Themes** |
|---|---|
| Inputs | 1. Explore, discuss and clarify roles and responsibilities.<br>2. Flexibility, adequate resources and proactive management. |
| Process | 3. Simple and practical administration.<br>4. Clear communication and messaging.<br>5. Flexibility in exploring. |
| Emergent | 6. Engage and understand communities as partners.<br>7. Understanding and aligning partner expectations.<br>8. Clear and agreed arrangements for Intellectual Property. |

Table 22 Summary of enabling themes for Bretton Buzz

[46] Continuum: "*A continuous sequence in which adjacent elements are not perceptibly different from each other, but the extremes are quite distinct*" (Oxford English Dictionary 2012c)

In identifying the themes and their enablers, insights emerged across different a number of dimensions. At the team level, the emergent nature of team roles and responsibilities was acknowledged with a need to commit time during early stages of project development to exploring/resolving how parties will work together. This included both the role of the PhD and senior managers within the stakeholder organisations. Related themes included the need for effective communication, simple administration and the imperative to understand and align partner expectations (inputs/project design and IP arrangements).

These were particularly important with reference to a project context focused on exploring emergent technology and applications where outcomes and process were uncertain. This context led to the need for flexible management combined with a discussion between team members of risks that might impact on the project and their mitigation. An important cross-cutting process, related to these different dimensions of collaboration, was the value of developing a shared understanding between team members (and wider stakeholders) in relation to different dimensions of project design and delivery.

**Case 3 Hybrid Lives**

**Project Profile**

*Objective* To explore the impact of digital technology on working life through the design and delivery of a digitally augmented public facing installation with free access to co-working space at FACT, Liverpool.

| | |
|---|---|
| *CX Cluster* | Rethinking Working Life |
| *Budget (cash cost)* | £14,920 and PhD time |
| *Status* | Completed at time of interviews |

*Project Partners*

| | |
|---|---|
| • Unwork | SME work place design |
| • Bossons Group | SME architect and product design |
| • Swansea Metropolitan | University |
| • Royal College of Art | CX PhD and lead University |

*Wider stakeholders*

- FACT[1] (Foundation for Art and Creative Technology)
- Public engaging with Hybrid Lives installation

*Sources of Data*

Key Documents

- Creative Exchange Project Proposal (Bosson 2012)
- Creative Exchange Collaboration Agreement (RCA 2013)
- Project blogs (RCA, accessed 2016)

*Two Interviews* (A and B) were completed with two team members representing two project partner organisations. Other team members were contacted but were unavailable.

**Project Description**

*"We propose to design a digitally augmented installation that reveals how the spaces we inhabit reflect patterns of personal online behaviour and how they relate to physical and virtual environments"* (Bosson 2012, p.3).

Hybrid Lives was designed to explore the impact of digital technologies on working life, with particular focus on how technologies are enabling new digitally mediated ways of communication, sharing and collaboration. It explicitly investigated how these new patterns of behaviour are likely to impact on a changing demarcation between work and home and the emergence of hybrid patterns of living.

The project objectives focused on the design and implementation of a public co-working installation delivered in partnership with FACT[47] in Liverpool. This installation was delivered as part of the Time and Motion exhibition at FACT (FACT 2014).

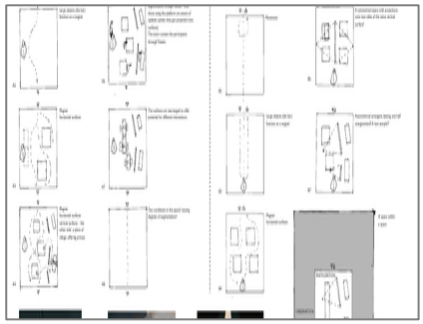


Figure 31 Hybrid Lives exhibition plan

The space was designed to create a digitally augmented physical space providing free access to the public. The space was principally focused on catalysing pubic engagement and providing a research framework to explore how people use and interact physically and digitally within it. The collaboration brought together a range of expertise spanning academia, design and different areas of creative practice. The project included designers from two companies, a lead academic from Swansea Metropolitan University and PhDs from the CX at the Royal College of Art. Although not formally named in the collaboration agreement, FACT was a key partner in the production and delivery of the installation.

[47] *Foundation for Art and Creative Technology (FACT)*: FACT is an arts-media centre based in Liverpool. Its activities are focused on exploring the convergence of creative practice and technology. FACT curates and produces a programme of public-facing events. Although not named as a formal partner in the collaboration, it was a strategic stakeholder and made a significant contribution in the design and production of the showcase event.

The anticipated impact of the project emphasised non-commercial outcomes in the form of a successful exhibition, insights and lessons for individual practice and research outcomes. Commercial benefits from the collaboration were identified as possible in the longer term.

**Data Analysis**

The adapted CSF method (see Section 3 Introduction and Chapter 3 for detail) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* as outlined in Chapter 3 (Kawakita 1991).

*Characteristics of the collaboration: structure, process and methodology*

*Approach (exploratory and emergent*): The project was exploratory, both in understanding context and in the design of the installation. A process of iteration around ideas, mock-ups and prototypes provided the basis for agreeing a workable exhibition that addressed the needs for engaging the public and providing a framework to host diverse research projects.

*Context (emergent technology and applications*): The context was social behaviour associated with the impact of digital technologies in mediating the balance between home-and work-life and their impact on how space is used. The project explored emergent patterns of behaviour through the design and delivery of a temporary, digitally augmented public-facing space for visitors to use. This space provided a framework and context within which research projects could be designed and implemented.

*Complexity* (*multiple organisations and disciplines)*: The project structure reflected the multiple organisations and professional disciplines involved in the collaboration.

*Scale (limited resources):* The team had limited time and cash resources. A key resource was the time provided by the lead PhD in the roles of project manager, researcher and creative practitioner.

*Team autonomy (self-organising*): There were no external requirements in terms of who would lead the team or how decisions would be made by the team, but instead a high degree of autonomy in decision-making and role-setting. Reference was made to the open and high-trust culture that developed within the collaboration, this despite the geographic separation of the partners which made it difficult for regular face-to-face meetings.

*Motivation* (*A high degree of intrinsic motivation):* Team members demonstrated a high degree of intrinsic motivation focused on both research aims and a desire to explore and improve professional practice. This was complemented by FACT in its role of producing and curating content to inform and engage the public at large.

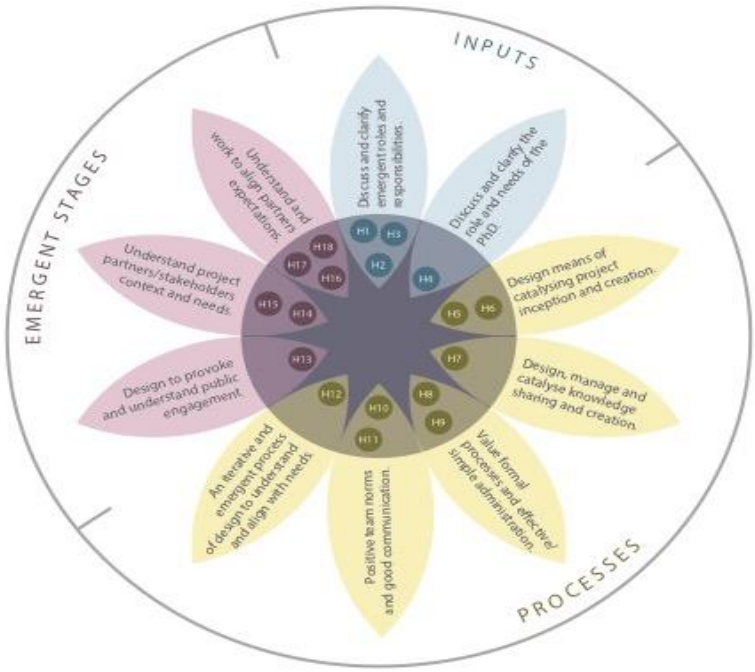
*Methodology (design-led):* The emergent process of project design and delivery focused on exploring context and developing early stage mock-ups and prototypes leading to the delivery of the installation. Reference was made to the value of a shared background of the core partners in terms of design practice.

*Knowledge Exchange* (*a dynamic process*): A multi-faceted dynamic process by which knowledge was transferred, shared and created, within the team and with the public who engaged with the installation space. Conversation and discussion were enabling mechanisms, both formally and in relation to serendipitous encounters.

*Strategic themes and enablers (factors)*

This section identifies enabling themes and enablers (factors) in different dimensions of project design and delivery identified as important in facilitating effectiveness. Figure 32 provides an overview of insights from the Hybrid Lives case analysis with reference to these themes and their supporting factors. The enabling themes are grouped under three clusters reflecting the meta framework of inputs/processes and emergent states, described in detail in Chapter 9.

Hybrid Lives




**ENABLING FACTORS**

H1 Adequate time to discuss the design of the collaboration together.

H2 Self-selection as a mechanism for defining roles and responsibilities.

H3 When clarifying responsibilities include senior management and their roles in supporting the project.

H4 PhD(s) to be made aware of their possible role as project managers and provided with support to enable them to fulfil this role alongside their research.

H5 Allow sufficient time for informal and formal discussion.

H6 Consider designing workshops around challenges and design briefs to catalyse collaboration and project building.

H7 Explore how knowledge sharing will be facilitated during design and delivery.

H8 Use formal process of approval to support the development of a shared understanding as to aims, method and IP.

H9 Design administrative procedures to be as simple as possible and ensure that adequate support is available.

H10 Resource the project to ensure regular conversations are undertaken.

H11 Recognise and discuss values and behaviours that the collaboration aspires to.

H12 Use iteration around ideas and mock -ups to explore emergent concepts and align to user needs.

H13 Design provocations as the catalyst for engaging the public.

H14 Design collaborations to leverage diverse expertise and experience of partners and wider stakeholders.

H15 Discuss and understand the diversity of partners' expertise and clarify the contribution from each.

H16 Discuss and understand each partners' motives and expectations for the collaboration.

H17 Recognise the need to develop a shared and realistic understanding of goals, approach and achievable outcomes within time and resource constraints.

H18 Recognise the importance of enjoyment as a motive for working together.

Figure 32 A summary of the Hybrid Lives case analysis: enabling themes and factors

The autonomous nature of the teams decision-making processes combined with self-selection, enabled roles and responsibilities in project design and delivery to emerge, reflecting competencies and interests. A further dimension and emergent aspect of this process was the development of mutual understanding as to areas of expertise, motives and expectations about project methodology and outcomes.

Theme 1 Discuss and clarify emergent roles and responsibilities.

*"It's quite natural, I think because their expertise was as artists and researchers, and our expertise was as curators and producers working on the deliverables"* (Interviewee).

Insights related to team structure emphasised the emergence of clear roles and responsibilities, both for core partners and for FACT. Reflecting the highly autonomous nature of the team, these roles were not prescribed but rather emerged through a process of iterative discussion and negotiation among team members. The definition of roles in large part reflected the mix of expertise the individual team members brought to the collaboration. A further dimension or role definition related to the value attached to the support of senior managers and other non-project staff.

| Enablers | Activity Statements |
|---|---|
| H1. Adequate time to discuss the design of the collaboration together. | A30. The PhD self-selected to the role of project manager and overall facilitator. |
| H2. Self-selection as a mechanism for defining roles and responsibilities. | A31. The diversity of expertise provided the basis for people to self-select into their respective roles in the collaboration. |
| H3. When clarifying responsibilities include senior management and their roles in supporting the project. | A32. An important area of competence in curating and producing a public facing event is the ability to negotiate across different interests. |
| | A33. A strong support network provides confidence for team members and a mechanism for problem-solving. |

Theme 2 Discuss and clarify the role and needs of the PhD.

*"... it would be really stupid of not to fit (not fitting) a case study into this"* (Interviewee).

In the absence of an alternative, the PhD self-selected into the project-manager role which initially appeared unconnected to their primary purpose of undertaking the research. A key challenge for the PhD was the need to reconcile their roles as project manager, creative practitioner and PhD researcher, as they provided important co-ordination and administrative support to the team. However, during the design process, potentially competing domains and demands were reconciled by using the project as the basis for a PhD case study.

| Enablers | Activity Statements |
|---|---|
| H4. PhD(s) to be made aware of their possible role as project managers and provided with support to enable them to fulfil this role alongside their research. | A34. Important for the PhD to be aware of their expected role as project manager and provided with initial guidance and mentoring in support of this role.<br><br>A35. PhDs to recognise the value and the opportunity to use the project context in support of their research outcomes.<br><br>A36. Project partners should be made aware at an early stage of the needs of the PhD to reconcile research aims with project role and responsibilities. |

Theme 3 Design means of catalysing project inception and creation.

*"...the development of the idea for the project came from these methods, which is discussion, meetings and conversation"* (Interviewee).

The theme reflected insights related to the earliest phases of emergent collaborations. Of particular importance was the value in explicitly designing the early interaction and networking to reflect the iterative process of building ideas and relationships. In this context, value was identified in relation to informal networking and a more formal process such as challenge and/or design brief-led collaborations. A related insight was that it was necessary to allow sufficient time for this process to take place.

| Enablers | Activity Statements |
|---|---|
| H5. Allow sufficient time for informal and formal discussion. | A4. The process of designing initial exploratory networking and workshops should allow sufficient time to provide space for informal and formal conversations around themes of interest. |
| H6. Consider designing workshops around challenges and design briefs to catalyse collaboration and project building. | A5. The development of concepts and ideas is iterative with views changing and evolving through discussion. |
| | A6. Responding to a challenge or design brief can catalyse the process of building collaborations. |
| | A7. Meetings, conversation and discussion are important methods in exploring possible collaboration. |
| | A8. Physical proximity of partners is a positive factor in support of the development of ideas and projects. |
| | A9. The experience and personalities of the partners has an impact on the ability of the team to work together. |

Theme 4 Design, manage and catalyse knowledge sharing and creation.

*"Having the idea of a shared voice and a shared language. So equipping people and almost empowering people to take part in those conversations on the same level as an eye-to-eye level"* (Interviewee).

Three contexts within which knowledge exchange (sharing/transfer/creation) occurred within the context of Hybrid Lives: i) public users engaging with the installation space; ii) between researchers and the public engaging with the exhibition; and iii) between project partners. The project identified knowledge exchange and sharing as a dynamic process, principally built around different forms of conversation. Physical space was identified as having a significant impact on catalysing conversations and enabling knowledge sharing to take place.

| Enablers | Activity Statements |
|---|---|
| H7. Explore how knowledge sharing will be facilitated during design and delivery. | A37. Conversations are central defining characteristic of knowledge exchange in its different forms. |
| | A38. Exchange and sharing in collaboration involve more than just knowledge. |
| | A39. Physical space can impact on the sharing of knowledge and catalysing conversations. |
| | A40. Serendipity is an important factor in catalysing knowledge exchange. |

Theme 5 Value formal processes and effective, simple administration.

*"I suppose what I've learned about collaboration here is that there are two sides to it: i) openness and ii) production and efficiency*" (Interviewee).

The value of the formal processes associated with project approval were identified as providing a catalyst for clarifying project aims, methods and overall structure. However, delays in finalising the collaboration agreement were identified as a disruptive factor which required good will from all the partners to overcome with a contributing factor to the administrative bottlenecks being staff turnover. An issue of particular note was the absence of IP being identified as a significant issue, which largely reflected the motives of the partners and the nature of the collaboration.

| Enablers | Activity Statements |
|---|---|
| H8. Use formal approval to support the development of a shared understanding as to aims, method and IP. | A22. The process of preparing a formal project proposal, budget and related documentation provided a stimulus to clarifying and formalising the design of the project. |
| H9. Design administrative procedures to be as simple as possible and ensure that adequate support is available. | A23. Adequate resources and management support need to be committed to ensuring the collaboration agreement is agreed and signed as early as possible. |
| | A24. Unforeseen staff turnover should be identified as a risk factor with agreement on how to manage this risk. |
| | A25. Delays in finalising the collaboration agreement between partners delayed payments being made. |
| | A26. IP did not manifest as a significant issue reflecting the non-commercial aims of the project partners. |

Theme 6 Positive team norms and good communication.

*"Too little time, I would say so, yes. I think the fact, for example, one of the main collaborators was based in a different city…that was a problem"* (Interviewee).

An important element of team dynamics was related to the value of face-to-face meetings during the early phases of project design. This in part appears to be related to building the team culture as reflected in areas such as trust and openness. Time, in relation to conversations and meeting each other, was also a factor in providing the opportunity for the iterative process of developing a shared understanding between team members of the project's context and of goals and approach in delivery (including the process of iteratively designing the installation). The value of face-to-face discussion was also recognised in the context of the use of web enabled tools such as Skype, which provided the opportunity for real-time interactions between team members and stakeholders who were not co-located.

| Enablers | Activity Statements |
|---|---|
| H10. Resource the project to ensure regular conversations are undertaken. | A27. Adequate resources should be made available to ensure that regular face-to-face meetings can be held, particularly during the early design phases. |
| H11. Recognise and discuss values and behaviours that the collaboration aspires to. | A28. Regular Skype and other internet-enabled conversations are important in supporting the iterative process of design and delivery. |
| | A29. A culture of mutual respect and tolerance is important in enabling honest discussion between partners e.g. around project aims and methods. |

Theme 7 An iterative and emergent process of design to understand and align with needs.

*"By designing and making an environment that provokes conscious reflective engagement, we hope to elicit an understanding of how digital technologies have brought about a form of working life that is characterised by hybridisation"* (Interviewee).

Exploring and developing a project concept provided the basis for generating the design of a complex, public facing exhibition. The process reflected repeated iterations in the form of discussion and exchange of information, ideas and knowledge (blueprints, mock-ups and prototypes). Central to the development process was the need to reconcile the exhibition with the research aims of the collaboration.

| Enablers | Activity Statements |
|---|---|
| H12. Use iteration around ideas and mock-ups to explore emergent concepts and align to user needs. | A19. The design and production of a public-facing installation was strongly aligned with research and curatorial aims of partners.<br><br>A20. Central driver for the design of the installation was the need to engage the general public in terms of their use of the space provided.<br><br>A21. The development and production of the public installation reflected a process of iteration and consultation around mock-ups. |

Theme 8 Design to provoke and understand public engagement.

*"The opportunities here are to expose the mechanism by which people construct new social realities, social persona through new work structures and digital technologies"* (Interviewee)

Through the design and production of a public-facing installation, Hybrid Lives created a research framework to explore emergent patterns of social behaviour associated with the convergence of digital and physical spaces, a key theme being how digitally augmented space can generate insights into the changing boundaries between home and work. The design challenge was to create a space that was engaging for the public while providing a framework within which different research projects could be undertaken.

| Enablers | Activity Statements |
|---|---|
| H13. Design provocations as the catalyst for engaging the public. | A1. The opportunities are to explore and expose the mechanism by which people construct new social realities and persona.<br><br>A2. By designing and making an environment that provokes reflective engagement, the project aimed to elicit an understanding of how digital technologies have brought about a hybrid form of working life.<br><br>A3. Important to show that the space was designed to provoke thinking about work and working life. |

Theme 9 Understand project partners' and stakeholders' context and needs.[48]

*"By collaborating across disciplines and looking outside our area of expertise for acknowledged authorities we will find a range of voices and skills"* (Interviewee).

The theme highlights the potential value of team diversity and related challenges associated with generating a shared understanding of aims and objectives. The different professional languages were cited as a particular challenge to team-building (in turn reflecting the differences in expertise experience and professional world views).

| Enablers | Activity Statements |
|---|---|
| H14. Design collaborations to leverage diverse expertise and experience of partners and wider stakeholders. | A10. Collaboration across disciplines provides access to skills, professional expertise and life experiences. |
| H15. Discuss and understand the diversity of partners' expertise and clarify the contribution from each. | A11. Informal partners (space, expertise and networks) can be important in design and delivery of project objectives. |
| | A12. Professional language can inhibit knowledge sharing. |
| | A13. The delivery of time- and resource-bound objectives can provide a challenge for partners who are not experienced in working within those constraints. |

[48] Multiple disciplines, Professional perspectives and organisations.

Theme 10 Understand and work to align partners expectations.

*"One of the main problems that always comes up is when people have different expectations of the same project"* (Interviewee).

Partners bring to the collaboration a mix of expectations, both in terms of their inputs and the value they expect to gain from their engagement with the project. The insights outlined are principally focused on the value of making explicit each partner's motives and expectations as the basis for generating a shared understanding and expectation about project aims, approach and deliverables. This shared mental model was developed through iterative discussions between team members. Within this context, enjoyment of working together was an important motivating factor.

| Enablers | Activity Statements |
|---|---|
| H16. Discuss and understand each partner's motives and expectations for the collaboration. | A14. Recognise the potential for partners and their respective organisations to have different ideas about aims, approach and inputs. |
| H17. Recognise the need to develop a shared and realistic understanding of goals, approach and achievable outcomes within time and resource constraints. | A15. Discuss partners' aims and expectations with the aim of generating shared expectations. |
| | A16. The creation of a shared understanding of goals, approach and inputs reflects an iterative process of discussion and negotiation. |
| | A17. Work to ensure that the collaboration is enjoyable for all. |
| H18. Recognise the importance of enjoyment as a motive for working together. | A18. Risk of underestimating delivery. |

**Summary**

The Hybrid Lives installation was successfully designed and delivered with over 5,000 members of the public using the space during a three-month period. A number of research projects were undertaken within the framework of the installation which in turn generated research outcomes including publications and PhD case studies. Although not focused upon generating commercial outcomes, the lessons learnt and insights generated were recognised as being relevant for the future commercial practice of those involved. Moreover, although constrained by geographical distances and a limited travel budget, the team liaised intensively on the development of concepts and prototypes in the design and delivery of the installation. During the early stages of the project Unwork decided to leave the collaboration with additional supporting inputs provided through short-term inputs (mainly by CX PhD).

| Category | Characteristics |
|---|---|
| Approach | Exploratory and iterative in design, method and learning. |
| Context | Emergent technology, applications and social behaviour. |
| Complexity | Highly complex with multiple organisations, professions and perspectives combined with an imperative to engage the wider public. |
| Scale | Small project with limited resources in terms of cash and time. |
| Autonomy | A high degree of autonomy with emphasis upon self-organisation. |
| Motivation | Strong emphasis on intrinsic motivation and improving professional practice. |
| Outputs | Successful public installation that provided a framework for research and related outputs. |
| Methodology | Strong emphasis on design method and prototyping as a tool of exploration and concept development and delivery. |
| Knowledge Exchange | Dynamic process with multiple dimensions of knowledge transfer, sharing and creation. |

Table 23 Characteristics of Hybrid Lives- structure, process and method

The team itself was small, highly autonomous and worked across organisational and professional boundaries in exploring a wider context characterised by emergent technology, applications and uncertainty about how users would engage with the space and with the technology. The processes by which the team acquired an understanding about the project's context and designed an installation which would meet the needs of all the key stakeholders (including the public at large) were design-led and iterative, with a reliance on mock-ups and prototypes to catalyse knowledge sharing and the development of a shared understanding about how to deliver project objectives.

A high degree of intrinsic motivation was demonstrated by team members, reflecting the research interests of the academics, the mission of FACT in terms of public engagement and a desire to explore the development of professional practice. Knowledge exchange was identified a dynamic process catalysed by discussion and the development/delivery of the installation, both between team members and with the wider public (through the installation).

| **Domain** | **Summary of Enabling Themes** |
|---|---|
| Inputs | 1. Discuss and clarify emergent roles and responsibilities.<br>2. Discuss and clarify the role and needs of the PhD. |
| Process | 3. Design means of catalysing project inception and creation.<br>4. Design, manage and catalyse knowledge sharing and creation.<br>5. Value of formal processes and simple administration.<br>6. Positive team norms and good communication. |
| Emergent | 7. Iterative process of design to understand and align with needs.<br>8. Designing to provoke and understand public engagement.<br>9. Understanding partners' and stakeholders' needs.<br>10. Understanding and working to align partners' expectations. |

Table 24 Summary of enabling themes for Hybrid Lives

Adequate time (both formal and informal) for team discussion (ideally face-to-face) during early phases of the project's inception and design was identified as being of critical importance in catalysing discussion and the iterative process by which the project developed; particularly in supporting the development of a shared understanding across the team. Positive team behaviour and norms (openness and mutual respect) were important for team performance. The design-led method, characterised by iterations and prototyping, was considered of particular value in exploring emergent areas of technology and reconciling the different interests of stakeholders. This included the need to explore and deliver innovative ways of engaging the public.

The PhD played a critical role in project coordination, management and as a creative practitioner, with a key challenge (and opportunity) being the need to reconcile project demands with his research interests and objectives. Simple (and proportionate) administration combined with adequate support for the team in navigating administration hurdles (e.g. budget) were considered important in supporting a small and exploratory project.

**Case 4 Open Planning**

**Project Profile**

*Objective* To identify new ways of engaging the public in the planning process and develop digital prototype to support citizens to better understand and provide feedback on planning proposals.

*Cluster* Democracy and Innovation

*Budget (phase 1 and 2)* £8,000 and PhD time

*Status* Completed

*Project Partners*

- Red Ninja
- Stardotstar
- Engage Liverpool
- Liverpool City Council
- University of Liverpool
- University of Lancaster (Creative Exchange PhDs)

*Wider stakeholders*

- Liverpool Vision

*Sources of Data*

Key documents

- CX Project Proposal Phase 1 (Koeck 2014)
- Partner Collaboration Agreement Phase (Koeck & Walsh 2013)

- Open Planning Impact Statement (Salinas 2015)
- Open Planning Blogs (Salinas & Porter 2015)
- Transforming the Planning Process (Koeck & Walsh 2013)

*Three Interviews* (A, B, C) with team members representing three partner organisations.

**Project Description**

The Open Planning (OP) project was focused on exploring the connection between urban planning, space, people and digital technology in the city of Liverpool. The overall aim of the project was to improve the transparency, effectiveness and two-way communication between planning authorities and the public in relation to planning decisions.

Approved in February 2013 and started in March 2013, *Phase 1* of the project had a three-month duration. The insights generated through project-based desk research and working with user groups provided the basis for the development of a digital prototype to support communities to better understand and provide feedback on planning proposals. The *second phase* included co-design workshops with local user groups using live data to demonstrate the methodology and tools developed under the first phase.

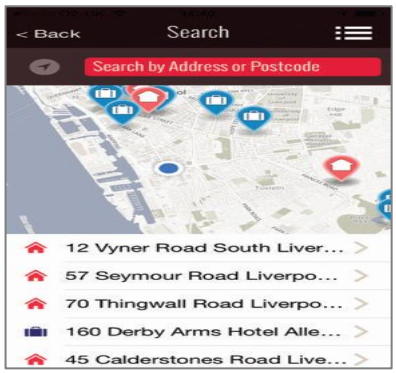


Fig. 33 Open Planning application

A key priority for the project was to understand the planning process and wider context of the project as the basis for identifying opportunities for innovation to improve the processes in relation to public engagement. On the basis of insights from desk research and workshops, a wireframe mock-up of an OP application (Figure 33) was developed (for use on iPhone, iPad and Android) and for an improved lamppost notification (the standard means of communicating planning applications in the community). Project activities included desk research and two focus group discussions; the first with Liverpool City Planning and GIS Team and a mock-up of the second with citizens organised through Engage Liverpool (bringing city-centre residents together). The prototypes developed by the project had the aim of exploring how citizens could be empowered in the local planning process through improved digitally facilitated communication and feedback channels (Salinas 2015). Working prototypes were developed but at the time of the interviews had not gone live, reflecting difficulties in gaining access to the necessary council data.

**Data Analysis**

The adapted CSF method (see Section 3 Introduction and Chapter 3 for detail) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* as outlined in Chapter 3 (Kawakita 1991).

*Characteristics of the collaboration: structure, process and methodology*

*Approach (design-led exploration):* Exploration of context and user needs with local government and community. Emphasis on developing bespoke methods to engage community groups in understanding needs and prototyping solutions.

*Context (emergent):* Technology/applications providing new opportunities and challenges for engaging communities in the planning process with limited understanding of user needs and expectations.

*Complexity* (*multiple stakeholders, disciplines and social contexts):* Team working across multiple organisations and contexts, disciplines and user groups. Characterised by multidisciplinary expertise and experience. Significant role for design and creative practice.

*Scale (limited resources):* Limited resources in relation to time and cash with significant non-costed inputs provided by the PhDs in terms of research, coordination and creative practice.

*Team autonomy* (a *high degree of autonomy):* In terms of team decision-making and with reference to overall design, methodology and approach and emergent roles and responsibilities. Key role for team discussion for reaching a shared understanding over time and providing a framework for delivery.

*Motivation* (*a mix of motives and interests):* From the academic interest (lead academic and PhDs) and the interests of an SME to engage with new networks for commercial and professional interests. This combined with the potential value to the work of the local planning authorities and ultimate value to the communities.

*Outcomes (varied)*: Tangible outcomes in terms of working prototype, operational insights and research deliverables (publications). A key constraint in further development of the prototype was limited access to public data.

*Methodology* (*iterative design and delivery*): Project delivery was characterised by iterative processes by which the project concept, approach and outcomes were generated. The interaction between explicit and tacit knowledge was a central aspect of knowledge exchange and creation.

*Use of physical mock-ups and prototypes:* Mock-ups and prototypes played an integral role in project design and delivery both as a deliverable and for co-creation with end users where mock-ups and prototypes acted as a catalyst for discussion, feedback and further design.

*Knowledge Exchange* (*a dynamic process):* Knowledge sharing and feedback are a central aspect of the dynamic and emergent research process; knowledge exchange as a dynamic, iterative process of the transfer, and sharing and co-creation occurred at different stages throughout the project cycle. Engagement with end users was a central element in the project and provided insights into user needs.

*Strategic themes and enablers (factors)*

Figure 34 provides an overview of insights from the Open Planning case analysis with reference to these themes and their supporting factors. The enabling themes are grouped under three clusters reflecting the meta framework of inputs/processes and emergent states, described in detail in Chapter 9.

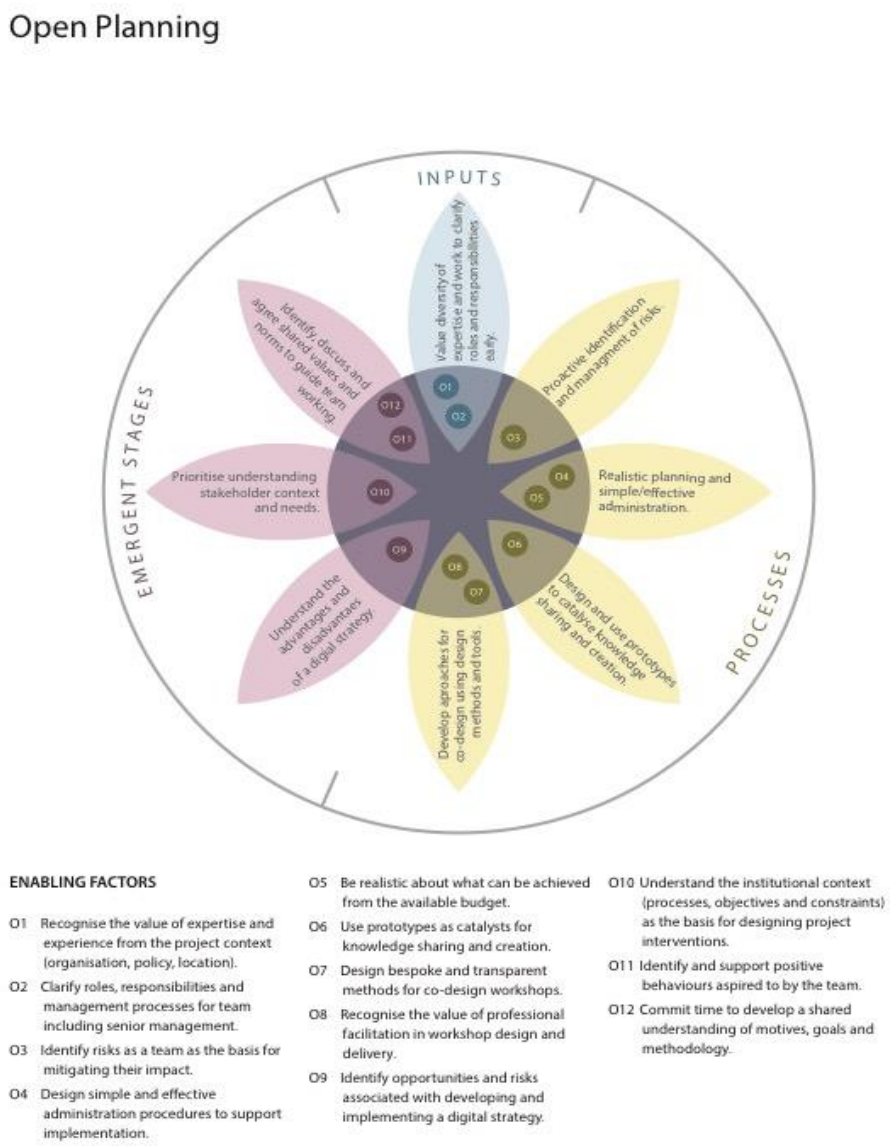



Figure 34 A summary of open planning case analysis: enabling themes and factors

Open Planning demonstrated the value of diversity in terms of the team's skills, expertise and motives; diversity that was aligned with the challenges of an uncertain and emergent context, where technology offered potential but unknown benefits. Key enabling themes and processes included the important role of prototyping as a catalyst for knowledge sharing, supported by proactive planning and related enabling behaviours and processes, including effective communication.

Theme 1 Value diversity of expertise and work to clarify roles and responsibilities (early).

*"...somebody on board who was a former planning officer in that very office who had years of experience, who knew the processes inside out, who knew exactly who to talk to and also how to talk and what peoples agendas are"* (Interviewee).

The value in incorporating experience and expertise from the context/organisation /system of the project was as an important enabler and a catalyst for building high-trust relationships with wider stakeholders. In the case of Open Planning, the context was the planning system, processes and wider communities associated with Liverpool City Council.

| Enablers | Activity Statements |
|---|---|
| O1. Recognise the value of expertise and experience from the project context (organisation, policy, location). | A15. Design the delivery team to incorporate direct expertise and experience of the institutional domain within which project interventions will be focused. |

*"It's really important to have a shared understanding of what is the policy framework of how we are conducting this research, who's leading what, who is responsible for what? Honestly that was not clear, I found out by doing"* (Interviewee).

A further enabler is associated with the importance of clarifying roles, responsibilities and decision-making processes within the team and between the team and partner organisations at an early stage in the collaboration. The absence of clarity emerged as an issue that could cause misunderstanding during project delivery. A further aspect was the importance of securing senior decision-makers to buy in to project aims and method.

| Enablers | Activity Statements |
|---|---|
| O2. Clarify roles, responsibilities and management processes for the team including senior management. | A15. Securing the commitment and support of senior decision-makers is essential for successful project delivery and impact.<br><br>A16. Clearly define roles, responsibilities and related decision-making procedures during project conception and design. |

Theme 2 Proactive identification and management of risks.

*"...said have the data, have the data but then the company don't want to give you the data"* (Interviewee).

The need to identify and mitigate risks emerged as an important area of planning that should be addressed in future projects. Of particular importance was the risk associated with the movement of key personnel in partner organisations and access to digital data required to develop a viable prototype. The practical implication arising from this theme was the need to incorporate a project risk analysis (identification of important risks and how they could be managed) at an early stage in the collaborative process.

| Enablers | Activity Statements |
|---|---|
| O3. Identify risks, as a team, as the basis for mitigating their impact. | A24. Project risk analysis should be undertaken by all members of the team at an early stage in project implementation.<br><br>A25. Measures to mitigate the impact of risk should be identified as part of the risk analysis. |

Theme 3 Realistic planning and simple/effective administration.

*"...it is very complicated to operate for a relatively short period of time on a shoestring budget, then after three quarters of the project need to reapply for another small amount of money, and just to keep everybody involved and happy in the process is very, very difficult"* (Interviewee).

Key issues emerged in relation to the design and delivery of the administrative systems that supported the collaboration and project delivery. Of importance was the need to develop simple and efficient procedures that are proportionate to the scale of the project being implemented (specifically with reference to overall budget). Concern was noted about the time and energy committed to supporting project administration and the need to scale the budget to secure project objectives.

| Enablers | Activity Statements |
|---|---|
| O4. Design simple and effective administrative procedures to support implementation. | A21. Adequate resources must be made available to achieve successful project outcomes. |
| O5. Be realistic about what can be achieved from the available budget. | A22. The planning of project phasing and related procedures should be proportionate to the scale of funding available |
| | A23. Simple and efficient administrative procedures must be agreed between partners before project implementation**.** |

Theme 4 Design and use prototypes to catalyse knowledge sharing and creation.

*"We identified an opportunity to increase citizen empowerment by developing a digital tool that complements the public consultation stage of the planning system. Building on the preliminary findings, a digital tool will be co-designed and developed during the second stage"* (Interviewee).

The creation of mock-ups and a prototype was highlighted as an outcome and also a catalyst for knowledge sharing and creation.

| Enablers | Activity Statements |
|---|---|
| O6. Use prototypes as catalysts for knowledge sharing and creation. | A11. Integrate co-design of prototypes into project design as a catalyst for knowledge sharing and creation.<br><br>A12. Evaluate prototype performance before roll out. |

Theme 5 Develop approaches for co-design using design method and tools (including facilitation).

*"So, I find that just being really honest and open and reinforcing the fact that people you're asking are the experts, we wouldn't be able to do this without you, and then painting a picture of how this will then benefit them and other people. It sounds really naff but just being honest with people basically and not having a hidden agenda"* (Interviewee).

Co-design workshops and methods emerged as a powerful catalyst for knowledge sharing between stakeholder groups. In this regard, the role of workshop facilitator was identified as important in terms of successful outcomes. Key factors for success included; i) the value and need for inputs from local citizens; ii) the value of using local networks to identify and engage local representatives; iii) emphasis on the honesty of the facilitator in interactions with the group; and iv) the need to ensure facilitators have expertise/training relevant to their role.

| Enablers | Activity Statements |
|---|---|
| O7. Design bespoke and transparent methods for co-design workshops. | A7. Co-creation workshops are a catalyst for knowledge sharing. |
| O8. Recognise the value of professional facilitation in workshop design and delivery. | A8. Facilitators must be honest about the role of the end users and the expertise they bring to the design process. |
| | A9. Local networks should be used in attracting end users into workshops. |
| | A10. Team members who are playing the role of facilitators should have expertise/training relevant to this role. |

Theme 6 Understand the advantages and disadvantages of a digital strategy.

*"Open planning…aims to enhance the quality of planning applications in intervening in public consultations with a tool for active engagement and citizen empowerment"* (Interviewee).

This theme highlights factors that shape technology and use of digital data. Key issues focus on the opportunities and risks of using data and tools to empower citizens in their engagement with the planning (information and feedback). Specifically, i) the potential for digital technology to act as a catalyst for citizen engagement; ii) the digital divide and how it needs to be recognised and managed (the proportion of the local population not engaged with the digital data or tools) and; iii) the need for early agreement on how public data will be accessed as the project develops.

| Enablers | Activity Statements |
|---|---|
| O9. Identify opportunities and risks associated with developing and implementing a digital strategy. | A1. Explore the use of digital data and tools to strengthen citizen engagement with the planning process.<br><br>A2. Access to the relevant digital data should be agreed at an early stage in project design.<br><br>A3. The design of digital strategies and prototypes in supporting the planning process must acknowledge the digital divide. |

Theme 7 Prioritise understanding stakeholder context and needs.

*"A key challenge is to spend sufficient time to understand the existing institutional set up and actors' interactions, but also to clarify one's own assumptions, expectations and perceptual biases"* (Interviewee).

A recognition of the importance of developing a shared understanding of key stakeholders' institutional systems, culture and objectives. These insights then provide the basis for developing a strategy and related prototypes aligned with context and need (generated through experience, meetings and desk research).

*"Constraints in time, team resources and institutional inertia (inflexibility of changing the current system quickly) lead us to approach the current system through an 'acupuncture approach': we focused upon small targeted interventions…"* (Interviewee).

A feature of the project strategy, informed by background understanding and acquired during orientation, was the need to target interventions to achieve maximum impact in the context of a complex organisations, risk-averse culture and a project constrained by limited resources.

| Enablers | Activity Statements |
|---|---|
| O10. Understand the institutional context (processes, objectives and constraints) as the basis for designing project interventions. | A4. Understand the institutional systems and stakeholder objectives as the basis for designing project interventions that will generate value for partners.<br><br>A5. Project interventions must take into account resource constraint and institutional inertia.<br><br>A6. Project interventions must be targeted to have maximum impact. |

Theme 8 Identify, discuss and agree shared values and norms to guide team working.

*"The culture was very nice, it was very open, everyone was encouraged to say their points"* (Interviewee).

A related dimension of team design that was identified as important concerned working norms and values which developed within the collaboration. Of major importance was the development of a culture that enabled and facilitated contributions from all partners in shaping project design and delivery. This was an integral process and factor supporting the development of a shared understanding and commitment across the team as to project aims and methods.

*"There would be some obvious things to say to make such a relationship work and that is to be quite open and frank, to be open about everybody's agenda is, what does everybody wants to get out of the collaboration like, what are the limits of the engagement, what is everybody willing to bring in by way of the limits. So, we have to be clear on these things"* (Interviewee).

One key aspect in developing an open project culture was a need for partners to be honest and realistic in identifying their own personal expectations and aims for the collaboration, their inputs and when they can deliver outputs.

| Enablers | Activity Statements |
|---|---|
| O11. Identify and support positive behaviours aspired to by the team. | A17. Action should be taken to enable behaviours that support the creation of trust between team members. |
| O12. Commit time to develop a shared understanding of motives, goals and methodology. | A18. All partners need to reach agreement on overall project goals.<br><br>A19. All partners need to be honest and transparent about what they wish to get out of the collaboration.<br><br>A20. Partners must be realistic about inputs they can deliver and relate to timeframes for their deliverables. |

**Summary**

Open Planning was a small, complex and dynamic collaboration focused on using design and prototyping to catalyse knowledge sharing between partners, stakeholders and representative of the wider community of users. The aim of this process being to facilitate an understanding of context and needs. The development of shared understanding provided the basis for defining and developing potential solutions to enhance community engagement in the planning process in the form of digital applications manifest in a working prototype. The emergent nature of the project was also reflected in the process by which the team generated shared aims, approaches and roles/responsibilities, through iterative discussion and learning.

| Category | Characteristics |
|---|---|
| Approach | A design-led exploration of context, user needs and possible solutions with emphasis on the use of facilitated workshops. |
| Context | Emergent technologies/applications generating new opportunities to facilitate greater public engagement in the planning process. |
| Complexity | Multiple organisations and expertise with complex network of stakeholders including community groups. |
| Scale | Limited resources (cash and time). Significant PhD input. |
| Autonomy | A high degree of autonomy in decision-making. Emphasis on the team to self-organise in methodology and delivery including roles and responsibilities. |
| Motivation | A diverse range of motives and interests from academic, professional practice, commercial and networking through to community interests. |
| Outputs | Working prototype with insights from research and the experience gained from delivery, as well as networking opportunities. |
| Methodology | Design-led with strong role for prototyping and use of mock-ups as the basis for producing a working prototype. |
| Knowledge Exchange | A dynamic process of knowledge transfer, sharing and co-creation. |

Table 25 Characteristics of Open Planning- structure, process and method

Through a design-led process, opportunities and solutions were identified and framed in the form of mock-ups and a working prototype. The journey highlighted issues in relation to the viability of a digitally enhanced planning process. Two key points:

i) The digital divide with reference to those people in the community who have no access or interest in digital technologies.

ii) Access to critically important data required for the application to work in practice (access which had not been resolved at the time of the interviews).

| Domain | Summary of Enabling Themes |
|---|---|
| Inputs | 1. Value diversity and work to clarify roles and responsibilities. |
| | 2. Proactive identification and management of risks. |
| Process | 3. Realistic planning and simple/effective administration. |
| Emergent | 4. Design/prototypes to catalyse knowledge sharing and creation. |
| | 5. Bespoke co-design methods using design methods and tools. |
| | 6. Understand the advantages and disadvantages of a digital strategy |
| | 7. Prioritise understanding of stakeholder context and needs. |
| | 8. Identify, discuss, agree shared values/norms to guide team. |

Table 26 Summary of enabling themes for Open Planning

The iterative and design-led methodology to project implementation offered an effective method to explore and understand needs and identify potential solutions through prototyping. A key challenge that emerged during implementation was access to digital planning data. This issue had not been resolved at the time of the interviews and reinforced the value of risk analysis and mitigation. Bespoke approaches were developed to the design and delivery of workshops, working with user groups to share knowledge to gain a deeper understanding context and needs. The themes illustrated interrelated factors that supported effective team working. These processes included team discussion, communication and values supporting an enabling culture within which an iterative process catalysed a shared understanding of norms, user needs, solutions and method.

## Case 5 Participatory Production Technologies

### Project Profile

*Objective* To explore and identify differences and synergies in methodology and method between professional and grassroots video production. To use research insights to define and test possible enabling methods and technologies for user generated video content.

*Cluster* Performance, Liveness and Participation

*Budget* £15,195 and PhD time

**S***tatus* Completed

*Partners*

- BBC R&D
- University of Hull — Lead academic
- Newcastle University — Lead CX PhD; Technology support; Technology support
- Co-Opera Co. — Senior Management
- RHMedia — Film production (sub-contractor)

*Wider Stakeholders*

- Cast and crew of the Mikado Operetta (Co-Opera Co.)

*Sources of data*

Key Documents

- Participatory Production Technologies web page/blogs (Green 2015; Creative Exchange 2013a)
- CX Project Proposal (Newell 2013)
- PPT Collaboration Agreement (Creative Exchange 2013a)
- Beyond Participatory Production (Green et al. 2015)

*Three Interviews* (A, B, C) of team members representing three partner organisations.

**Project Description**

*"Can we leverage our understanding of documentary production processes to help overcome the organisational and social challenges facing User Generated Video Content (UGVC) producers and support motivated communities to organise their collaborative UGVC production activities around a kind of grassroots production model"* (Green et al. 2015, p.3157).


Figure 35 Co-Opera Co. logo

The project supported the creation of two film documentaries. The first (Pro film) was a documentary of the Mikado operetta performed by the cast and crew of Co-Opera Co. This film was produced by a professional film company (RHMedia) and strongly aligned with the norms and standards of the BBC's documentary production processes.

The second production (Pop film) was a documentary to be to created and edited by cast and crew of The Mikado (Co-Opera Co.), following the principles of a grassroots film documentary. Specifically, their preparations for, and the public performance of, the Mikado operetta in the summer of 2013. The term '*User Generated Content* (UGC)' describes the creation of video content by non-professionals, often members of an activist group or community of practice. Content generated in this manner can be distinguished on the basis of criteria including: i) intention ; ii) collaborative nature; iii) a lack of significant investment; iv) and absence of coherence and consistency (Green et al. 2015). Central to the project design was a research study to explore and understand the differences between the two documentaries in terms of process and values. The different production and editing processes were studied through observation, interviews, evaluating the films created and a reflective workshop at the end of the project. Findings highlighted differences between the two processes in terms of production and editing with the insights providing a basis for designing future structures and technologies reflecting the qualities and values of grassroots film production.

At the time of the interviews neither documentary was publicly available. The collaboration included academic researchers including a PhD from the CX Newcastle University and related technical support for the development of the prototype. A professional film crew (RHMedia) was commissioned to produce and edit an opera-focused documentary. The cast and crew of the Mikado operetta (Co-Opera Co) were expected to produce and edit a documentary. A Research Assistant was recruited from that community to support the project. While BBC R&D were partners in the collaboration they did not play an active role although supporting a PhD internship.

**Data Analysis**

The adapted CSF method (see Chapter 3) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* (Kawakita 1991- Ch.3).

*Characteristics of the collaboration: structure, process and methodology*

*Approach (An exploration of user-generated content):* Characterised as being a '*collaborative, iterative, and user-led production of content by participants in a hybrid user-producer role'* (Green et al. 2015 p.3159).

*Context (emergent):* Pop film (grassroots documentary) is associated with user-generated content. Catalysed by the emergence of technologies associated with the production and distribution of film by non-professionals, the research focused on the possibility of developing production and editing tools for non-professionals.

*Complexity (multiple organisations and multiple disciplines)*: A complex collaboration working across organisational and professional boundaries and cultures including members of the opera company as partners.

*Structure:* Pop film reflected an unstructured approach to management and the process of content creation and editing (in marked contrast to Pro film). This was manifest in the lack of clearly defined roles and responsibilities associated with the production and editing of content generated.

*Autonomy (self-organising and self-selecting):* The initial project partner opted out, leaving the opportunity to invite Co-Opera Co to participate and roles and responsibilities were not agreed in advance. The lead PhD took on the role of project manager, supported by the recruitment of a research assistant and film director. The Pop film was dependent on individual cast and crew becoming actively involved.

*Scale (limited resources and time):* Reflected in the budget and the time available from core team partners, with the wider stakeholders engaged in the production and editing process using their own time.

*Motivation (complex motivation and aims of partners):* Multiple aims and objectives among partners and stakeholders. The research aim was the key driver in the project design, specifically to compare the production models of Pro/Pop film.

*Methodology (central role of the prototype and co-design):* An emphasis on co-design was central to the academic research study and informed the selection of the Co-Opera Co. community to participate. A theme in the original proposal was the design, delivery and evaluation of prototypes to support grassroots production.

Knowledge Exchange: KE as a dynamic process of collaboration manifest in different dimensions of the project. In terms of the user group (cast and crew of the opera company), between the core project partners and with the commercial documentary film crew. Each dimension provided different context and issues related to the success/failure of the KE process.

*Strategic themes and enablers (factors)*

Figure 36 provides an overview of insights from the PPT case analysis with reference to these themes and their supporting factors. The enabling themes are grouped under three clusters reflecting the meta framework of inputs/processes and emergent states, described in detail in Chapter 9.

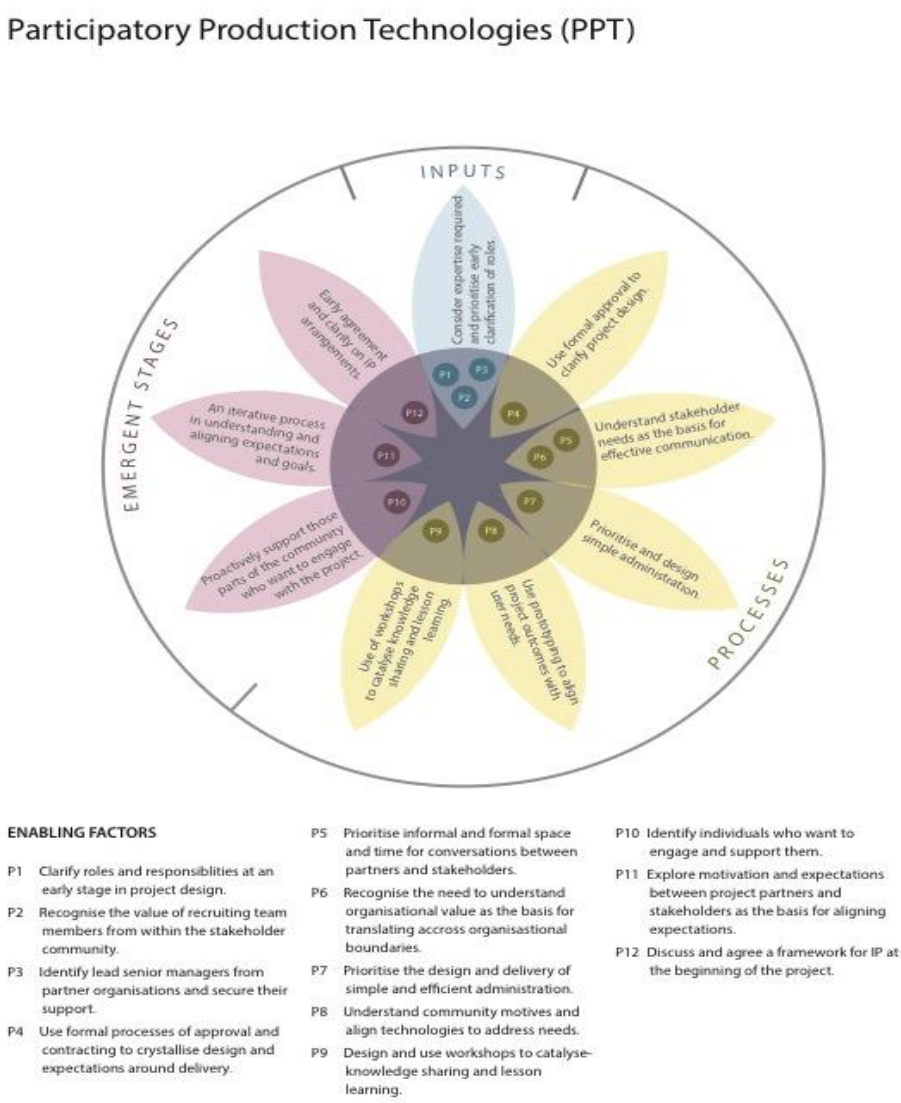



Figure 36 A summary of the PPT case analysis: enabling themes and factors

The collaboration was complex, reflecting a convergence of a different factors including those associated with stakeholder backgrounds, motives, roles and expectations. The enabling themes reflect and acknowledge this complexity and a related need for both senior management support and effective communication as the basis for securing a shared understanding. This across a range of issues associated with process, engagement and project outcomes. A theme of central importance was both communication and understanding between key stakeholders during design and implementation.

Theme 1 Consider expertise required and prioritise early clarification of roles.

*"I would be liaison, partly because of the physical distance but also because I am an opera singer so I know the environment. I know, I guess, what the rehearsal situation is like and what people are expecting, when it's appropriate to talk to people and when it's not appropriate"* (Interviewee).

Roles and responsibilities were defined and/or emerged in relation to the three discrete workflows: i) the overall research study, ii) Pro film, and iii) Pop film. The CX PhD self-selected into the overall role of project manager, supporting and coordinating overall workflows with a lead academic. A critical role (defined and funded by CX) was that of Project Assistant. The role, recruited from within the Co Opera Co community, provided a point of coordination between the three work streams and supported the grassroots film project (Pop film). The position provided knowledge and insights into the working culture of the opera company and the social context of opera.

The commissioning and delivery of Pro film (RH Media) had the clearest definition of roles and responsibilities reflecting the explicit relationship between Pro film with industry standards and processes. The delivery of Pop film, by contrast, was characterised by a lack of clear roles and responsibilities. One factor noted was a lack of engagement by senior management who were engaged in preparing for the production (Co Opera Co) and self-selection by cast and crew in terms of their involvement (or not) in production and editing.

| Enablers | Activity Statements |
|---|---|
| P1. Clarify roles and responsibilities at an early stage in project design. | A9. Clear roles and responsibilities are important in ensuring successful delivery. |
| P2. Recognise the value of recruiting team members from within the stakeholder community. | A10. Clarifying roles and responsibilities should be an explicit point of reference in the design and delivery of project workflows. |
| | A11. The recruitment of a team member (e.g. project assistant) from the stakeholder community can provide a valuable point of co-ordination and provide valuable insider knowledge. |

*"If those people (senior mgt.) were really excited about making the documentary from the beginning, then I think that was extremely important"* (Interviewee).

An important dimension emerged in relation to the role of senior management in supporting (or not) the design and delivery of the project in general and specifically the production of the films. The importance and value of senior management involvement was also reflected in the support provided by the supervisors of the PhD student managing the project.

| Enablers | Activity Statements |
|---|---|
| P3. Identify lead senior managers from partner organisations and secure their support. | A12. Ensure senior managers from partner organisations support project aims and communicate to their communities throughout project design and delivery. |

Theme 2 Use formal approval to clarify project design.

*"We batted around a lot of ideas but it was in the CX proposal that we actually decided on what we were going to do…So it crystallised all the ideas that we'd had to date"* (Interviewee).

The PPT incorporated three main workflows; i) the overall design implementation of the research study; ii) the commissioning and delivery of a professionally commissioned documentary (Pro film); and iii) catalysing and supporting a grassroots film documentary (Pop film). In terms of work-flows, two processes emerged as important in crystallising the project design; i) the CX proposal and ii) the commissioning briefs for Pro film and Pop film.

| Enablers | Activity Statements |
|---|---|
| P4. Use formal processes of approval and contracting to crystallise design and expectations around delivery. | A7. Preparation of project documentation (proposal and collaboration agreement) catalyses ideas being brought together into an overall project design.<br><br>A8. Preparation of brief should provide sufficient information to guide the design/delivery of related workflows. |

Theme 3 Understand stakeholder needs as the basis for effective communication.

*"I think it all came down to miscommunication or lack of communication"* (Interviewee).

Communication, in the form of conversations, meetings workshops and emails between stakeholders and cast and crew of the Mikado, emerged as a critically important driving force, impacting both positively and negatively on the design and delivery of both Pro and Pop film.

| Enablers | Activity Statements |
|---|---|
| P5. Prioritise informal and formal space and time for conversation between partners and stakeholders. | A15. Team members who have experience across relevant organisational and professional boundaries can play a valuable role in translating. |
| P6. Recognise the need to understand organisational values as the basis for translating across organisational boundaries. | A16. Senior management of project partners and stakeholders must effectively communicate their support to their internal communities. |
| | A17. Explicit recognition must be given in the project design to the important role that conversations, meetings and workshops play in supporting the creation of shared understanding of aims and objectives across professional and organisational boundaries. |

Theme 4 Prioritise and design simple administration.

*"The administration of the project was invisible so it worked really effectively"* (Interviewee).

The overall project budget and related administration was considered very good in supporting project activities, including the recruitment and payment of subcontractors. A pragmatic approach was adopted in managing delays in finalising the project's collaboration agreement.

| Enablers | Activity Statements |
|---|---|
| P7. Prioritise the design and delivery of simple and efficient administration. | A18. Clarify budget and administration processes supporting work stream activities in advance of project delivery.<br><br>A19. Identify how to mitigate the impact of delays in agreeing formal project agreements. |

Theme 5 Use prototyping to align project outcomes with user needs.

*"The project aims to produce prototypes based on the specific requirements of two different production scenarios (Pro film and Pop film) in order to identify common requirements which might contribute to design recommendations for a more robust and extensible or more widely applicable system to support user generated production"* (Newell 2013).

The development and deployment of prototype technologies to support the production and editing of content was a central aspect of the project design. The creation of the two films using different methodologies provided a complex social context within which to work. Within these contexts, it was expected that prototypes would be tested and evaluated to inform the design of future technologies supporting user generated production.

Within the context of Pop film, using the prototype technology deployed by the project, was identified as a barrier by users to the production and particularly in the editing of user generated content. As such, it was identified as factor in explaining why the final edited Pop film documentary was not produced.

| Enablers | Activity Statements |
|---|---|
| P8. Understand community motives and align technologies to address needs. | A4. The design of technologies to support user-generated video content must be aligned with the needs of participating users.<br><br>A5. The motivation, time available and stress levels of a performance-focused community of practice must be taken into account before the deployment of technologies aimed at supporting their workflow. |

Theme 6 Use workshops to catalyse knowledge sharing and lesson learning.

*"At the end of the three-month production period, after the opera performance run, a four-hour workshop featured three activities, designed to explore questions of values, qualities and limitations respectively"* (Green et al. 2015, p.3160).

A single workshop was held towards the end of the project, bringing those involved in Pro film and Pop film together with academics to reflect on the two films and related processes in production and editing. The workshop was structured around three activities exploring processes and the content generated and included critical reflection by the group. The workshop was attended by eleven participants including seven members of the Pop film including two co-directors, two cast members and the research assistant.

| Enablers | Activity Statements |
|---|---|
| P9. Design and use workshops to catalyse knowledge sharing and lesson learning. | A6. Workshops can catalyse knowledge sharing at different stages in project implementation (beginning, middle, end). |

Theme 7 Proactively support those parts of the community who want to engage with the project.

*"...it takes a certain kind of person to do this. One person could make a really interesting documentary by themselves, but if you want to get a group of people to do it then I feel like it could have been really good idea to have everyone come together and brainstorm about it"* (Interviewee).

A key element of the grassroots film production (Pop film) was engaging with the cast and crew who were expected to play the main role in generating and editing content. This created a contradiction in project design given that grassroots initiatives are usually defined as being generated by the community themselves without outside intervention. In the context of the CX project, a limited number of interventions were undertaken to catalyse and support engagement from the cast and crew. In practice, the level of engagement from the target community was variable in generating content and non-existent in terms of editing, ultimately impeding the production of a final, edited documentary.

| Enablers | Activity Statements |
|---|---|
| P10. Identify individuals who want to engage and support them. | A1. Recognise that not everyone will be motivated or have the time and energy to engage.<br><br>A2. Identify and introduce to each other those who will actively engage in the grassroots project (via email, workshop etc.).<br><br>A3. Provide support and get feedback on project design from those members of the community who are happy to engage. |

Theme 8 An iterative process in understanding and aligning expectations and goals.

*"…ultimately the performance is the most important thing. Whereas we've said before, from an academic perspective that's not necessarily the case, so that's where I felt frustrated in this because I felt like a failure"* (Interviewee).

This theme explores the degree of alignment of motivations and goals between the key project stakeholders: academics, contractors and the cast and crew of the Mikado. The degree of alignment of motivations and goals emerges as an important factor influencing the project from conception to delivery. Cross-cutting factors shaping the degree of alignment included; i) the mechanism of self-selection in and out of project activities e.g. the cast and crew of the Mikado in the making of Pop film; ii) existing relationships and related levels of trust; iii) support or lack of support provided by senior management to project aims; and iv) the central role communication can play in supporting or undermining a shared understanding and buy in to project aims (conversations, meetings and emails).

| Enablers | Activity Statements |
|---|---|
| P11. Explore motivation and expectations between project partners and stakeholders as the basis for aligning expectations. | A13. Recognise the different motivations between academics and other stakeholders as the basis for exploring how project aims and objectives can be more closely aligned.<br><br>A14. Self-selection into or out of project activities is important for testing the degree of alignment between motivations and goals between project partners and stakeholders. |

Theme 9 Early agreement and clarity on IP arrangements.

*"Unfortunately, the reason the professional video isn't online at the moment is because there was some uncertainty about who had ownership of it"* (Interviewee).

The absence of a mutually agreed approach to intellectual property (Pro film) was cited as a factor in the lack of the final edit being made publicly available.

| Enablers | Activity Statements |
|---|---|
| P12. Discuss and agree a framework for IP at the beginning of the project. | A20. Reach early agreement on IP arrangements between partners.<br><br>A21. Ensure that arrangements are reflected in contracts. |

**Summary**

A complex project incorporating different partners, motives and professional cultures. The relative ease of Pro Film (implemented by a professional film crew) was in marked contrast to the challenges of working with opera singers expected to play a lead role in self-organising to create a documentary about an upcoming opera production.

| Category | Characteristics |
|---|---|
| Approach | A novel and unstructured approach was introduced into a community which did not have prior experience of UGC. Pop film was characterised by unstructured and emergent management in contrast to Pro film. |
| Context | An exploration of user-generated content (UGC) in relation to professional film documentary production as the basis for identifying key features and emergent opportunities for supporting UGC. |
| Complexity | Multiple organisations and multiple disciplines working in a complex collaboration across organisational and professional boundaries and cultures. |
| Scale | Limited resources reflected in the budget and the time available from core team and partners. Users engaged in the project without compensation. |
| Autonomy | Self-organising and self-selecting with the initial partners opting out of the project, leaving the opportunity to invite Co Opera Co. The roles and responsibilities were emergent with the PhD taking a lead role in coordination. |
| Motivation | Complex motivation and aims of partners with multiple and varied aims and objectives among partners and stakeholders. |
| Outputs | The research aim was the key driver in project design, specifically to compare the production models of two documentaries, Pro film and Pop film. |
| Methodology | The emphasis on co-design of a participatory production model was central to the academic research study. A key theme in the CX proposal was the design, delivery and evaluation of prototypes. |
| Knowledge Exchange | Dynamic and unstructured process of knowledge sharing and creation with a central role in a reflective workshop at the end of the project process. |

Table 27 Characteristics of the PPT collaboration- structure, process and method

The collaboration reflected academic research interests, professional and commercial approaches adopted for Pro film and the many different personal and individual motives of the members of the Co Opera Co. This manifested in the different methodologies adopted for Pro film and Pop film and wide variety of attitudes and levels of engagement between the senior management of Co Opera Co and members of the cast and crew.

| Domain | Summary of Enabling Themes |
|---|---|
| Inputs | 1. Consider expertise required and clarify roles. |
| Process | 2. Use formal approval to clarify project design.<br>3. Understand stakeholder needs for effective communication.<br>4. Prioritise and design simple administration.<br>5. Use prototyping to align project outcomes with user needs. |
| Emergent | 6. Workshops to catalyse knowledge sharing and lesson learning.<br>7. Support (by understanding motives) those who want to engage.<br>8. Iterative process of understanding/aligning expectations/goals.<br>9. Early agreement and clarity in IP arrangements. |

Table 28 Summary of enabling themes for Participatory Production Technologies

The collaboration reflected a complex set of processes and influences associated with the design and implementation of project work streams. This complexity emerges in a continuum by which process and understanding (or lack of it) emerged during delivery. Of critical importance was the importance of management buy in to project aims and approach and effective communication across organisational cultures and between different stakeholders involved in programme delivery. This in turn reflected a need to understand complex motives, interests and constraints facing the different partners and stakeholders (from private contractors to opera singers).

## Case 6 Tuning in to T. Dan Smith

### Project Profile

*Objective* To explore the role that digital technology can play in the interpretation of urban spaces and urban regeneration and how locative digital content can affect the way a place is experienced and understood.

*CX Cluster* Stories, Archives, Living Heritage

*Total Budget* £14,185 and PhD time

*Status at time of interviews* Completed

*Project Partners*

- Newcastle University
- Amblr[1] (SME)
- Amber[1]
- Northern Architecture[1]

*Wider Stakeholders*

- Members of the public identified to take part in the city walks

*Sources of Data*

Key Documents

- CX Collaboration Agreement (Creative Exchange 2013b)
- CX Project Proposal (Robertson 2012)
- CX Blog posts (Crivellaro 2014)
- Contesting the City: Enacting the Political Through Digitally Supported Urban Walks (Crivellaro et al. 2015)

*Three Interviews* (A, B, C) completed of team members representing three partner organisations.

**Project Description**

*"…to explore the role that digital technology can play in the interpretation of urban spaces and urban regeneration and how locative digital content can affect the way a place is experienced and understood. This will be achieved through prototyping a locative media application to access different layers of media content, comprising a selection of audio archives of T. Dan Smith.."* (Robertson 2012, p.1).

Figure 37 T. Dan Smith-city walk

The original project concept was focused on prototyping a *locative media application* enabling digital content to be accessed around the city of Newcastle. This content was to include audio archives associated with T. Dan Smith[49] as well as newly created content exploring the development of Newcastle's urban landscape.

The aim of the project was to catalyse a greater public understanding of the forces that shaped Newcastle's urban development as a prompt for public reflection on the city's future development. After an initial series of informal conversations and further discussion at a CX workshop a project proposal was developed, reflecting an initial consensus on broad aims and objectives by some, but not all, of the project's final team members. This provided the basis for CX approval. Following approval, the project aims, methodology and outcomes were critically reflected on by some team members and sponsors.

This process resulted in a breakdown in the initial consensus and changing perspective on the project emerged with a redesign undertaken and agreement reached on a revised approach. This process enabled an accommodation to be reached on how PhD research interests could be addressed within the project.

[49] Thomas Daniel Smith (T. Dan Smith) was Leader of Newcastle City Council from 1960 to 1965. A driving force in the post-war regeneration of Newcastle, his vision included the clearing of slums and creating a modernist blueprint for the city's development.

As a result of this redesign, focus moved from the locative media app. to developing innovative methods that could be used to catalyse public engagement with Newcastle's urban landscape and future planning decisions. This aim was to be achieved through *curated city walks* and use of related methods and content. Knowledge exchange was recognised as an important element of the collaboration. A clear difference was identified between exchange, sharing and the process of creating common structures of understanding throughout the collaboration, among core team members, organisational partners and wider stakeholders (including participants in the walks).

**Data Analysis**

The adapted CSF method (see Chapter 3) has been applied to the analysis and provides the basis for identifying key characteristics and important enabling themes. The approach also draws on *Affinity Analysis* (Kawakita 1991- Ch.3).

*Characteristics of the collaboration - structure, process and methodology*

*Approach (emergent):* As the project design evolved and incorporated different interests, emphasis shifted from technology and content associated with locative media to the design and testing of methods for catalysing public engagement (curated city walks).

*Context (uncertain):* The dominant theme emerged as the role that curated city walks could play in catalysing public engagement and an understanding of the urban environment, explicitly those forces that shape that landscape as the basis for political engagement and action.

*Complexity (multiple and diverse perspectives)*: Multiple partners and professional/research disciplines including PhD researcher. These diverse interests were reflected in differences in aims, motives and expectations about the collaboration and its overall direction in approach, method and outcomes.

*Scale (limited resources)*: The most significant resource available was PhD time with limited time budgeted for collaborative partners. Reference was made to the lack of adequate resources for prototype development, although this was less relevant in the context of shifting the priority away from locative media.

*Autonomy (*high degree of autonomy): Autonomy in team decision-making, with a strong interest and influence from the lead organisation manifest in supporting project partners to explore ways of accommodating the PhD's research interests.

*Outputs (emphasis on research outcomes)*: The project outcomes included a range of tools and approaches for supporting city walks as a method for engaging, and empowering participants. The locative media app was not fully developed nor deployed as part of the project. Principal outputs were academic in the form of lessons learnt for future practice, published papers and curriculum content.

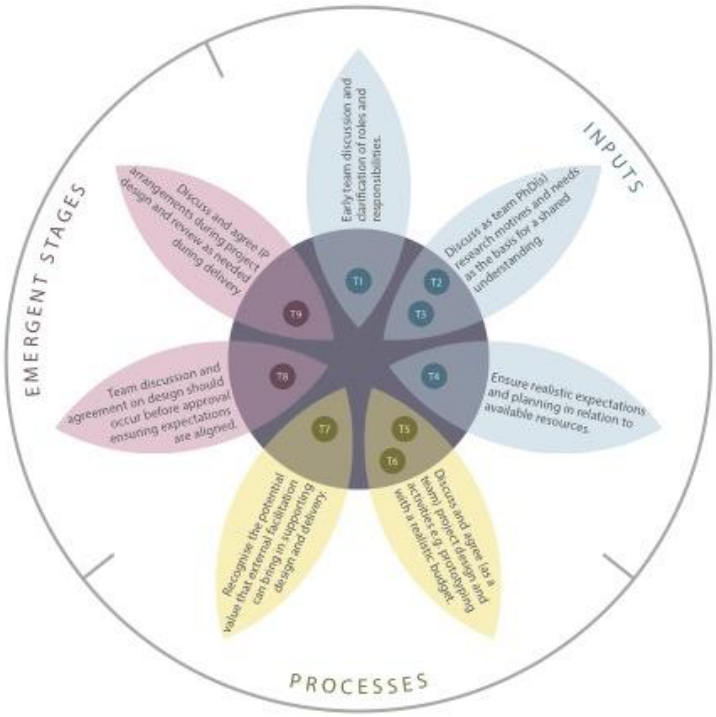
*Methodology (design-led with central role for prototyping)*: The development and testing of prototypes was the central driver in project design. Although the type of prototype changed from technology-based to method-based, this remained central to the methodology. Co-design, as principle and method, was an explicit point of reference throughout the collaboration, both in the context of the core team and with participants involved in pilot urban walks.

*Knowledge Exchange*: Recognition that the sharing of knowledge and the creation of shared structures of understanding happens throughout the collaboration. Different processes and mechanisms were associated with an active process of sharing and creating knowledge

*Strategic themes and enablers (factors)*

Figure 38 provides an overview of insights from the T.Dan Smith case analysis with reference to these themes and their supporting factors. The enabling themes are grouped under three clusters reflecting the meta framework of inputs/processes and emergent states, described in detail in Chapter 9.

T. Dan Smith




**ENABLING FACTORS**

T1 Ensure all team members (and sponsor as required) are involved in discussion and decisions regarding design and roles.

T2 Ensure PhD(s) are involved in early stage discussions about goals and approach.

T3 PhD(s) must make their research interests clear at early stages in project design.

T4 Ensure that project expectations are realistic in terms of the budget.

T5 Reach early agreement on the role of prototype development in overall project design.

T6 Ensure adequate resources are committed to prototype development.

T7 Consider external facilitation to support project design and delivery.

T8 Ensure that all key partners are involved in exploring and agreeing project methodology before approval.

T9 Discuss and agree IP arrangements at the beginning of the project.

Figure 38 A summary of the T. Dan Smith case analysis: enabling themes and factors

A project that went through an iterative process of re-design after approval. A process which was reflected in the enabling behaviours and processes identified and that had, as their focus, the development of shared understanding between team members with reference to aims, methods and expectations, providing a basis for success. An issue of central importance being the recognition of the need for transparency and honesty in discussion between team members as to their aims and expectations in relation to the collaboration.

Theme 1 Early team discussion and clarification of roles and responsibilities.

*"No. I don't think anybody ever really understood exactly what their role was"* (Interviewee).

Roles and responsibilities were often unclear and emergent. The respective roles and related inputs largely responded to the evolving nature of the project design and expectations around methodology and aims.

| Enablers | Activity Statements |
|---|---|
| T1. Ensure all team members (and sponsor as required) are involved in discussion and decisions regarding design and roles. | A8. The sponsor and partners should be clear and open to all parties about their role and expectations concerning project and methodology during initial design and approval processes.<br><br>A9. Collectively agree and review the design of the initial collaboration (partners, capabilities and sponsors) as the basis for aim, methodology and related roles and responsibilities.<br><br>A10. Make sure all collaborative partners are involved in discussion and decisions prior to formal approval. |

Theme 2 Discuss, as a team, the PhD's research motives and needs as the basis for a shared understanding.

*"If ( ) had said for example right at the beginning, I'm interested in activism, we're going to do something around activism and these are the communities we are going to work with, it would have moved things on really, really quickly…Some people would have left the process and not been interested but at least then you have the kind of clarity of purpose…"* (Interviewee).

The role and interests of the Creative Exchange PhD(s) was an important factor that actively shaped the overall direction and methodology during implementation. This was influential given the major role the PhD was expected to play in terms of research and management inputs into the project. An initial lack of clarity and understanding across the partnership as to the research interests of the PhD resulted in an original project design (approved proposal) not accurately reflecting these interests. This subsequently resulted in a significant redesign. This redesign occurred in the form of three discrete work packages, which took into account these and the sponsors' wider interests including a reduced emphasis on the creation of a locative media digital prototype.

| Enablers | Activity Statements |
|---|---|
| T2. Ensure PhD(s) are involved in early stage discussions about goals and approach.<br><br>T3. PhD(s) must make their research interests clear at early stages in project design**.** | A11. Ensure the role of the PhD(s) is made clear during the early stages of project inception and are actively involved in project design at an early stage to ensure that their interests and aims are explored and addressed from the beginning. |

Theme 3 Ensure realistic expectations and planning in relation to available resources.

*"It seemed that the entire budget was split three ways and that the entire budget would only have enough, assuming a prior existing platform, to do a small prototype intervention"* (Interviewee).

The issue of the limited budget emerged specifically in relation to the development and deployment of a digital prototype as a central part of the project's methodology. The implicit assumptions surrounding the development of this new technology, based on an existing platform brought to the project by one of the partners, was an area of ambiguity in the project design, i.e. who was to lead in the development of the platform. The wider principle appears to be the need to correlate the budget (and related resources) with the realistic expectations about project aims and outcomes.

| Enablers | Activity Statements |
|---|---|
| T4. Ensure that project expectations are realistic in terms of the budget. | A13. Ensure that the budget outlined for the project is a realistic reflection of the resources required to successfully deliver the aims and outputs of the project.<br><br>A14. Ensure that the assumptions concerning inputs and outputs related to the project are transparent and agreed by all parties as the basis for the budget. |

Theme 4 Discuss and agree (as a team) project design and activities e.g. prototyping with a realistic budget.

*"...the design of a method for the situated and co-located discovery and articulation of issues and debates in and about the city"* (Interviewee).

The changing emphasis on the role and development of prototypes within the project reflected the broader process by which the initial vision of method evolved away from digital technology toward the development of prototypes as method. Specifically, these were methods and tools for supporting curated city walks with the explicit purpose of catalysing knowledge sharing and public awareness of the forces that have shaped and are shaping the city's physical development.

| Enablers | Activity Statements |
|---|---|
| T5. Reach early agreement on the role of prototype development in overall project design. | A6. Agreement should be reached during project design between potential partners and the project sponsor as to the type of prototype to be developed and their place in overall project strategy and methodology. |
| T6. Ensure adequate resources are committed to prototype development. | A7. Adequate resources and skills should be committed to prototype design and development during early stages of project design and in the context of formal approval and related documentation |

Theme 5 Recognise the potential value that external facilitation can bring in supporting design and delivery.

*"There's a particular skill around that I don't think is recognised necessarily…. I think facilitation is important…"* (Interviewee).

This theme is related to the potential role of external facilitation at different points during project inception and implementation, with a particular focus on supporting the development of a shared understanding of the different partners' motives and expectations concerning project aims and outcomes. Discussion also explored the role of methods, such as different ways of visualisation in the context of conversations and meetings to catalyse planning.

| Enablers | Activity Statements |
|---|---|
| T7. Consider external facilitation to support project design and delivery. | A5. Consideration should be given by project sponsors to provide access to external facilitation to support the process of project design and planning. |

Theme 6 Team discussion and agreement on design should occur before approval, ensuring expectations are aligned (inputs/method/outputs).

*" It has to be an incremental process where there is a seed/preparatory work but actually that doesn't suit all the projects. Some projects are just ready to go and will lose the impetus if they don't have that"* (Interviewee).

The theme of alignment of expectations explores the process by which the core partners (and sponsor) in the collaboration interacted to develop a shared understanding of aims, methodology and what the project was fundamentally focused on in terms of output. The journey of T. Dan Smith highlights the challenges encountered in reconciling different objectives and expectations about the purpose of the collaboration, but also more profound differences in terms of perspectives on methodology and the relative roles of technology, content and curated urban walks in catalysing a public discourse.

| Enablers | Activity Statements |
|---|---|
| T8. Ensure that all key partners are involved in exploring and agreeing project methodology before approval. | A1. The sponsor should not approve a given project proposal unless a broad consensus is achieved and demonstrated by all core partners in terms of project direction, aims, inputs/partners and outputs.<br><br>A2. Project inception and design may require a series of meetings/events for all potential partners (including PhD) and sponsor to explore and achieve an understanding of motivations and expectations as the basis for developing a shared vision in terms of goals, approach, roles and outcomes.<br><br>A3. Self-selection is an important mechanism for identifying core partners.<br><br>A4. Project partners should agree protocols regarding how meetings will be organised and outcomes of meetings disseminated to ensure transparency and build trust in developing the vision. |

The process of incorporating different expectations around the project's purpose occurred in discrete stages from initial project conception and related conversations between partners (including a CX Lab), leading to a project proposal and collaboration agreement. Beyond this initial consensus, the project design evolved and changed to accommodate the perspective and needs of the PhD and sponsors. The three discrete work packages were a key milestone in accommodating divergent views regarding the relative emphasis on digital prototypes (downplayed during delivery) relative to content-focused methods e.g. curated city walks and tools focused on engaging the public in a political discourse around city development.

Theme 7 Discuss and agree IP arrangements during project design and review as needed during delivery.

*"I think that the question of IP around that felt sufficiently vague, that it was slightly concerning. Not so much from the position of IP ownership as the fact that IP ownership wasn't sufficiently addressed…"* (Interviewee).

IP emerged as an issue for a partner focused on the use of his existing technology platform. A general comment was that different dimensions of IP creation and ownership were not adequately explored nor agreed in discussion and formal documentation. Given the evolution of project aims, the development of prototypes and deployment of technologies became a less important area of activity.

| Enablers | Activity Statements |
|---|---|
| T9. Discuss and agree IP arrangements at the beginning of the project**.** | A12. IP issues should be explicitly explored and reviewed as part of project design (in the project proposal/collaboration agreement) and during implementation and closure. |

**Summary**

This was a complex project, both in terms of reflecting different motives and interests in the delivery team and in the iterative process by which tensions were resolved, principally through flexibility in approach and project design. As with other cases, the project was exploratory in relation to developing and testing new approaches to engage the public in the physical and political urban landscape. While initially emphasising the potential role of technology, it replaced this with an emphasis on method and curation of content and experience as the principal focus of the project's activities.

| Category | Characteristics (structure, process, method) |
|---|---|
| Approach | Emergent aims and methodology evolved through a series of iterations where tensions between different interests were resolved through flexibility in design. Co-design was a central tool in exploring context with emphasis changing from technology to methods. |
| Context | The role that curated city walks could play in catalysing public engagement and understanding of the city's physical and political environment. |
| Complexity | Multiple partners and professional/research disciplines including PhD researcher reflected in different aims and expectations. |
| Scale | Small scale with limited resources in terms of time and cash. The most significant resource for the project was the time of the PhD with limited time budgeted for collaborative partners. |
| Autonomy | High degree of autonomy reflected in self-organising behaviour with autonomy in decision-making combined with support interest from the lead organisation as requested. |
| Motivation | Diverse personal and academic interests with strong and different motivations and interests were resolved through different stages in project development post-approval. Initial focus on technology was replaced with methods reflecting different interests in the team. |
| Outputs | Principally academic in the form of journal articles and a case study. Outcomes included a range of tools and approaches to supporting city walks. |
| Methodology | Development and testing of prototypes was central in project design. Co-design was an explicit point of reference as principle and method. |
| Knowledge Exchange | A dynamic process of sharing and creating knowledge through a range of mechanisms from conversation, prototyping and curation/feedback. |

Table 29 Characteristics of T. Dan Smith - structure, process and method

Following approval of the initial proposal, the consensus on aims and approach broke down with a compromise being explored and reached on how PhD interests could be addressed within the project. As a result of the reformulated work plan, a greater emphasis was placed on piloting the method and the curation of content. The enabling themes and factors appear to reflect a deep and shared desire by the team to find solutions through flexibility in approach and design. There is also a recognition that design issues need to be discussed and agreed during the early stages of project development. A key factor in this process being the inclusive nature of the process with an imperative to include all team members in these formative discussions and that individuals need to be open and honest about their aims and interest in the collaboration.

| **Domain** | **Summary of Enabling Themes** |
|---|---|
| Inputs | 1. Early discussion and clarification of roles and responsibilities.<br>2. Team discussion of PhD's research motives and needs.<br>3. Realistic expectations/planning in relation to available resources. |
| Process | 4. Discuss and agree project design as a team.<br>5. Recognise the potential value of external facilitation. |
| Emergent | 6. Agreement (on design) before approval - ensuring expectations aligned.<br>7. Agree IP arrangements during design and review during delivery. |

Table 30 Summary of enabling themes for T. Dan Smith

# Chapter 9 A Cross-case Analysis

This chapter presents a cross-case analysis of the selected Creative Exchange (CX) projects included as part of the case study. The analysis provides the basis for exploring common enabling themes (Themes) and factors (Enablers) in the design and delivery of these projects, from the perspective of team members. The analysis focuses on factors that impact on the effectiveness of teams as they work collaboratively towards achieving mutually agreed goals. An ex-post analysis of performance and impact has not been undertaken as part of this analysis given that some of case projects were ongoing at the time of the interviews[50] and for the reasons identified in Chapter 3. Emphasis in the enquiry was placed on the perceptions of the selected team members of the important influences that shaped team performance in relation to the stated and approved objectives for the projects. The author's intention being to use these insights as the basis for generating a possible enabling scaffolding of measures that could support future knowledge exchange projects.

**Existing theory as a point of reference**

The definition of *team* by Cannon-Bowers and colleagues[51], provides a starting point for the analysis (Cannon-Bowers et al. 1993, p.222):

"*A group of two or more individuals who must interact co-operatively and adaptively in pursuit of shared valued objectives. Further team members have clearly defined, differentiated roles and responsibilities, hold task relevant knowledge and are interdependent (i.e. must rely on one another in order to accomplish goals*".

[50] This emphasis is also considered to be i) aligned with the research strategy and ii) the need to create a high trust relationship between the author and interviewees.

[51] In reflecting on this definition, the authors note that historical research into team performance has often lacked clarity and consistency in the concept of team and how the word is used.

They also attempt to provide clarity in relation to further important dimension of team performance, namely team decision making which they refer to as:

*"... a team process that involves gathering, processing integrating and communicating information in support of arriving at task relevant decision(s)"*

While the definitions provide clarity and a starting point as to what is meant by team and decision-making, an important characteristic of the CX mode of knowledge exchange teams (Section 4) is their high degree of autonomy and non-hierarchical structures as they explored uncertain and emergent contexts. These characteristics re-enforces the importance of both team dynamics and decision-making processes that enable these types of complex teams to work effectively.

Academic research undertaken into team effectiveness[52] has focused on identifying and understanding the mechanisms and forces that influence how teams function as individual team member work together to achieve mutually agreed goals. Early models exploring effectiveness assumed a time-bound and linear process by which inputs were transformed into deliverable outputs through a step-by-step process as presented in the *Input-Process-Output models IPO* (Fig.39) (Ilgen et al. 2005).

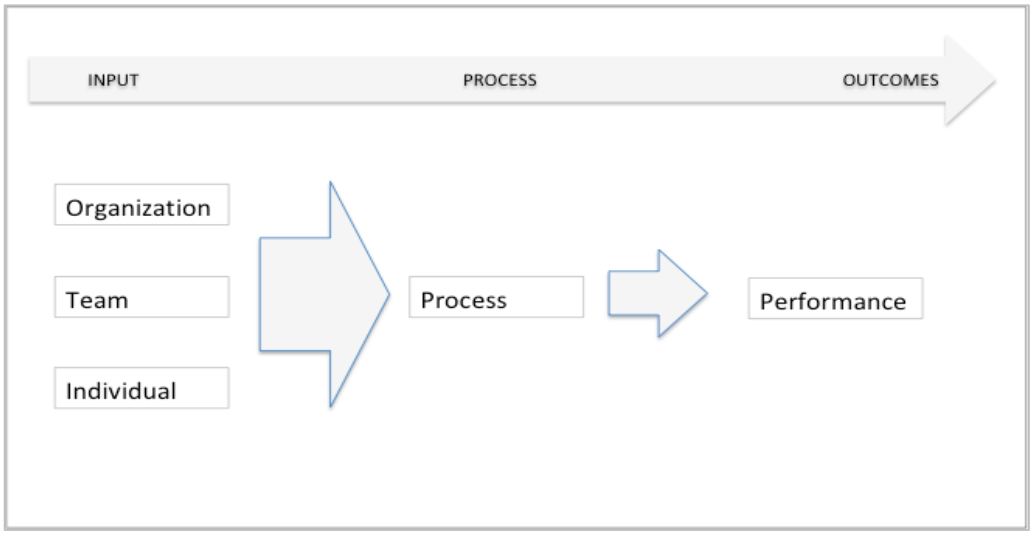



Figure 39 Input-Process-Output Framework (adapted from Mathieu et al., 2008, p.413)

[52] Situated in, and drawing on, different academic disciplines including organisational psychology, management theory and practice.

Of particular relevance for the CX cases were models developed to explore the effectiveness of *Self-Managed Work Teams* (SMWT), i.e. multidisciplinary teams that were granted a high degree of autonomy in objective setting, decision-making and organising resources to achieve project outcomes (Yeatts & Hyten 1998; Ilgen et al. 2005; Attaran et al.1999; Mathieu et al. 2008; Yeatts et al. 2013). This type of autonomous team is also referred to as self-directed work, self-managing teams, self-maintaining teams, self-leading teams, semi-autonomous workgroups, self-regulating groups etc. A notable feature of the much of the existing theory into team effectiveness (as with other areas of the literature review) is relative priority attached to teams working within large organisations i.e. corporate rather than SMEs and often teams working across internal boundaries rather than beyond. Attaran and colleagues note that the origins of the concept (self-managing work teams) lie in management theory and practice associated with Total Quality Management[53] (TQM) and its focus on the benefits arising from employee participation and empowerment to make decisions (Attaran et al. 1999).

The emphasis in the literature on decision-making autonomy in a corporate context is in marked contrast to the CX project teams that were working across one or more organisational boundaries (in relation to hierarchies, culture, operational priorities, administrative systems etc.), where internal project structures and methodologies were contingent on objectives and context.

In their review of research exploring team effectiveness, Mathieu and colleagues identified a growing appreciation among many researchers of a more complex set of factors and processes impacting on team performance (Mathieu et al. 2008). Other models (Sundstrom et al. 1990; Ilgen et al. 2005; Cohen & Bailey 1997; Kozlowski & Klein 2000) acknowledge collaborative team working as a dynamic, iterative and cyclical process of interaction between team's members and contextual factors over the life of a project.

---

[53] Total Quality Management: *"... an integrated management philosophy and set of practices that emphasises, among other things, continuous improvement, meeting customers' requirements, reducing rework, long-range thinking, increased employee involvement and teamwork, process redesign, competitive benchmarking, team-based problem-solving, constant measurement of results, and closer relationships with suppliers.."* (Powell, 1995, p.16)

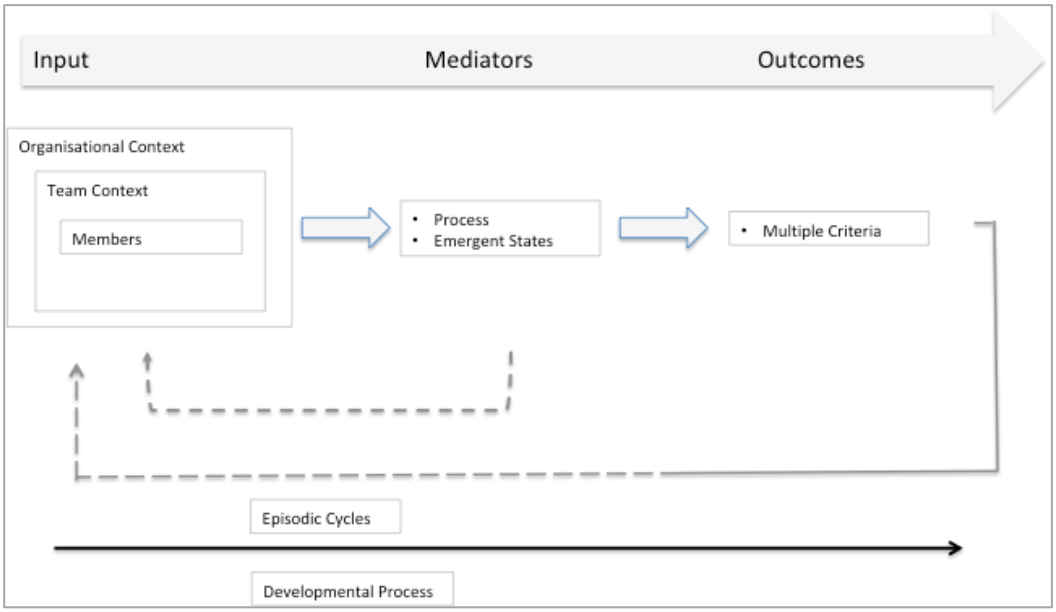



Figure 40 Input/Mediator/Output/Input model of team effectiveness (adapted from Mathieu et al. 2008, p.413)

The more nuanced insights into exploring how teams turn inputs into outcomes are reflected in the *Input-Mediator-Output-Input* model illustrated in Figure 40 (Ilgen et al. 2005; Mathieu et al. 2008). These models illustrate a complex and dynamic process through which teams work and learn together. Adaptations to the IPO model included an appreciation of iterative feedback loops throughout the team's life (episodic and developmental). A clear distinction was noted between processes' mediators (individual and team tasks) and emergent states (cognitive, motivational and affective) which act to transform inputs into outputs and which in turn can generate new inputs into a cyclical, iterative and developmental process of team and project development.

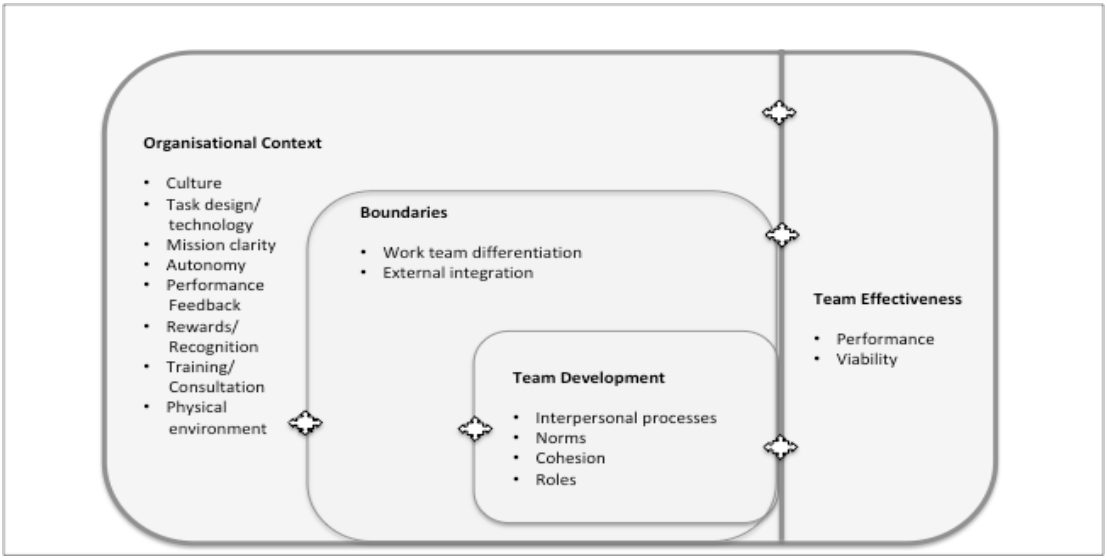



Figure 41 An ecological framework for analysing team effectiveness (Sundstrom et al. 1990, p.122)

The *Ecological Framework* (Figure 41) provides an alternative, non-linear perspective on effectiveness. Exploring team-based interactions across four dimensions (organisation/boundaries/team development/team effectiveness). This perspective embeds teams into their wider operating context, placing emphasis on internal interactions, and between the team and its wider environment (Sundstrom et al. 1990). Central to the model is the role that boundaries and their management play in successfully mediating the relationship between the team and its context. These boundaries act to;

- differentiate one work unit from another;
- present real or symbolic barriers to the access or transfer of information, goods or people;
- a point of external exchange with other teams, customers (users), peers, competitors or other entities;
- define what constitutes effectiveness for the team within its specific organisational context.

Other elements include team development (interpersonal processes, roles, norms, cohesion) and team effectiveness (in terms of performance/viability).

*Cross-case analysis*

The analysis is based on a comparison of the *Themes* and *Enablers* identified from each project cases which are grouped into clusters of shared meaning (*Categorie*s). Illustrative figures are presented for each category within which the themes identified from the different cases are visualised as petals grouped into clusters (defined in a category description).

The associated Enablers (enabling factors), identified from the different case projects, are listed below the illustrative figures. Both strategic themes (*Themes)* and enabling factors (*Enablers)* are coded to identify their source case, with explanatory text accompanying each figure. The Themes and Enablers identified in the analysis reflect the areas of importance from the perspective of the selected team members and related project documentation.

*Coding (illustrative figures)*

The following are the codes used to identify the source for Themes and Enablers.
H - Hybrid Lives
K - Kendal Project
T - T. Dan Smith
O - Open Planning
B - Bretton Buzz
P - Participatory Production Technologies

A meta framework (*Inputs/ Mediators-Processes /Mediators- Emergent States*) has been included to support the cross-case analysis. The concepts are used to structure case insights and provide a consistent framework to explore themes across the portfolio of case projects. The concepts are derived from the *Input-Mediator-Output-Input* framework (Figure 40) where they are defined as (adapted from Mathieu et al. 2008, pp.412-415):

> *Inputs*: Reflects the factors and contextual conditions that exist at the beginning of the collaboration including individual team members' expertise, capabilities and other inputs. Defined as *'... antecedent factors that enable and constrain members' interactions. These include individual team member characteristics (e.g. competencies, personalities), team-level factors (e.g. task structure, external leader influences), and organisational and contextual factors (e.g. organisational design features, environmental complexity)'* (Mathieu et al. 2008, p.412).

*Process (Mediators)*: This concept emphasis the role that different processes, mechanisms and social interactions play in catalysing inputs being transformed into project deliverables with reference to the project achieving its stated aims.

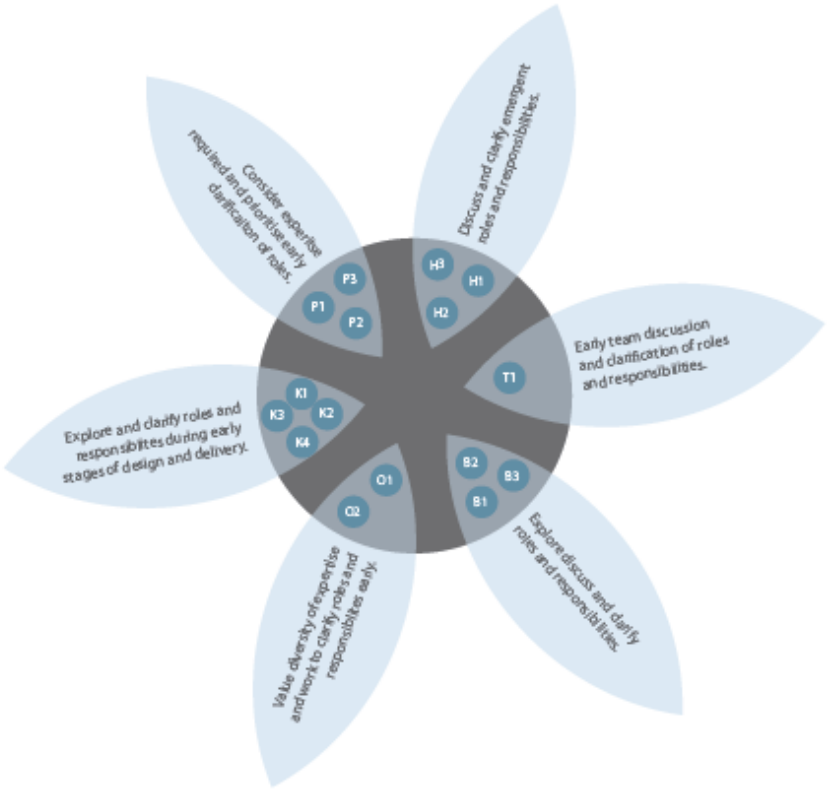
*Emergent State (Mediators):* Emergent states are conditions that emerge within the context of team working that can have a positive and enabling influence on a team's capacity to work together in delivering project goals. The are identified as *'..cognitive, motivational and affective states of teams…'* (Marks 2001 cited in Mathieu et al. 2008, p.425). This includes the development of a shared understanding and collective cognition across the team, dimensions including trust, confidence, empowerment, norms, attitudes and expectations.

The *Categories/Themes* and *Enablers* presented below are those that emerged from the case analysis and were identified as significant from the perspective of team members. The insights generated from the cross-case analysis are presented in relation to the three headings (Inputs/Processes/Emergent States).

## Identification of cross-cutting enabling themes

*Inputs*

*Clarify emergent team roles and responsibilities (category)*




**ENABLING FACTORS**

- B1 Explore and agree roles and responsibilities during the project's early stages.
- B2 Identify the lead senior managers within the participating organisations.
- B3 Discuss the role of the PhD on the project in relationship to their wider research goals.
- H1 Adequate time to discuss the design of the collaboration together.
- H2 Self-selection as a mechanism for defining roles and responsibilities.
- H3 When clarifying responsibilities include senior management and their roles in supporting the project.
- K1 Take time to explore roles and responsibilities during early stages of design and implementation.
- K2 Clarify the role senior management can play in supporting the delivery team.
- K3 Ensure senior management are kept informed of key stages of project development.
- K4 Recognise the role that designers can play in supporting a shared understanding across different disciplines.
- O1 Recognise the value of expertise and experience from the project context (organisation, policy, location)
- O2 Clarify roles, responsibilities and management processes for team including senior management.
- P1 Clarify roles and responsiblities at an early stage in project design.
- P2 Recognise the value of recruiting team members from within the stakeholder community.
- P3 Identify lead senior managers from partner organisations and secure their support.
- T1 Ensure all team members (and sponsor as required) are involved in discussion and decisions regarding design and roles.

Figure 42 Cross-cutting enabling category: team roles and responsibilities

This category reflects the importance associated with clarifying the respective roles and responsibilities between team members in the wider context of project aims and objectives. As reflected from the data, this process was particularly challenging in the context of highly autonomous teams operating across organisational cultures and lines of authority.

This was a particular issue where there had been no pre-existing agreement or instruction as to the allocation of responsibilities, tasks and levels of authority of individual team members. The Themes and their associated Enablers highlight a range of insights into the processes through which emergent roles and responsibilities are clarified. They reflect a complex and iterative process by which discussion (ideally face-to-face) provides the catalyst for reaching a shared understanding between team members as to expertise, skills and interests, and how they can be used to achieve desired and agreed outcomes (both individually and collectively).

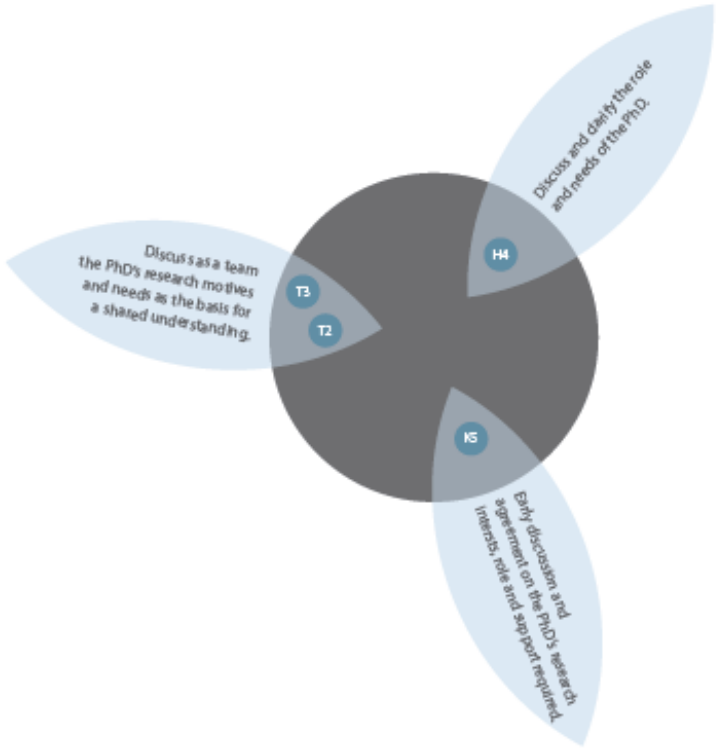
In these highly autonomous teams, roles and responsibilities are emergent and not fully defined at the beginning of the project. It is considered highly probable (although not explored within the case studies) that this emergent understanding of roles is related to a wider development of a shared understanding of project context, user needs, aims and an approach to delivery. Key points included:

- The value of **expertise and experience** from the project's context (organisational, policy, location, potential users). This principle was clearly demonstrated in Kendal (partner clinician), Participatory Production Technologies (member of Co Opera Co.), Open Planning (consultant with direct experience of local planning in Liverpool), Bretton Buzz (local user groups), and Hybrid Lives (role of FACT).

- The role of **self-selection** in the clarification process. In this context, the importance of **diversity** in expertise was seen as a means of facilitating a division of labour and also the value of partners/stakeholders self-selecting in and out of the collaboration at early stages.

- The value in identifying **lead senior managers** within the respective partner organisations with a shared understanding of their role and support they can provide. This was clearly demonstrated by the lead organisations but was also identified as important for all partners.

*Discuss, understand and agree the PhD's role*




**ENABLING FACTORS**

- H4 PhD's to be made aware of their possible role as project managers and provided with support to enable them to fulfil this role alongside their research.
- K5 Make explicit the mentoring role academics play in supporting the work of PhDs on projects.
- T2 Ensure PhD's are involved in early stage discussions about goals and approach.
- T3 PhD's must make their research interests clear at early stages in project design.

Figure 43 Cross-cutting enabling category: role of the PhD

*"If ( ) had said for example right at the beginning I'm interested in activism, we're going to do something around activism and these are the communities we are going to work with, it would have moved things on really quick. Some people would have left the process and not been interested but at least then you have the kind of clarity of purpose"* (interviewee).

Reflecting the structure and priorities of the Creative Exchange programme (Chapter 1), CX PhDs were expected to play, and performed, important roles in the design and delivery of the CX projects. While their roles varied across the collaborations, they invariably included a strong if not a leading role in coordination, management and delivering various elements of creative and technical practice (project-related research, software development, workshop facilitation, co-design methods, prototyping etc.).

The cases highlighted the challenges of reconciling the research needs of the PhD with project aims and methods, as well as in taking advantage of the opportunities afforded to the PhDs by working with a variety of non-academic partners and social contexts. In three of the six cases, issues relating to the role of the PhD were identified across Themes and in a further case study at the level of Enablers (factors). In three of the cases (Hybrid Lives, Kendal and T. Dan Smith) the role of the PhD was of strategic importance. In further case studies, the issue was identified at the level of Activity Statements.

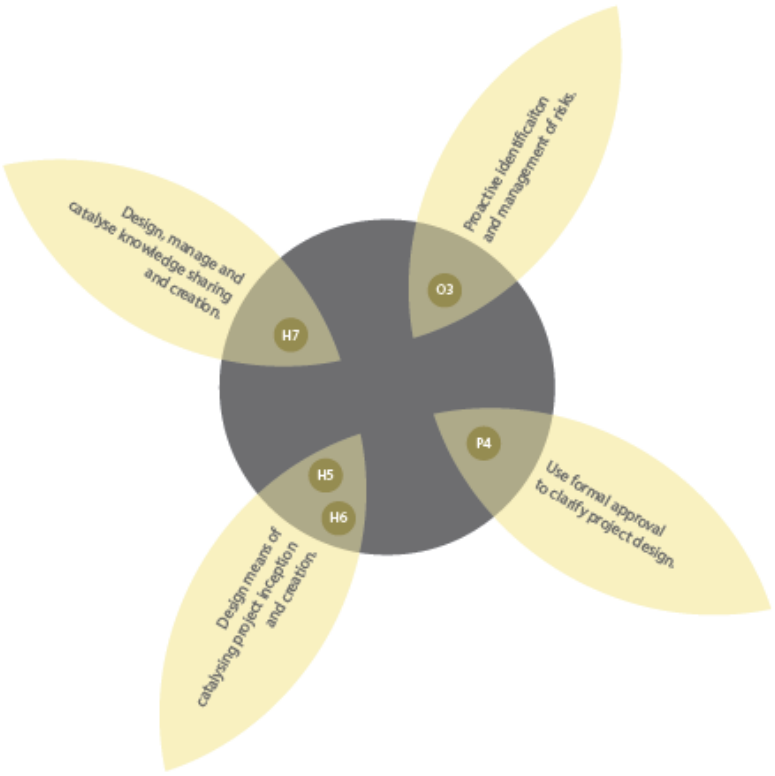
Associated Enablers highlight the importance of early discussions within the team about the role of the PhD in project design and delivery. This is closely associated with the need for the PhD to present their area of research interests to support the development of a shared understanding across the team and where these interests can fit into the overall design and delivery. A further dimension of the enabling environment includes the value of mentoring and guidance through formal supervision and from lead academics active in the collaboration (highlighted in Kendal). Also important is the possibility of access to training for the PhD (and possibly other team members) in relation to specific skill sets required by the collaboration e.g. facilitation.

*Additional insights related to inputs*

The cash budgets were considered relatively small (on average £12,000) with the most significant input being the uncosted time (at project level) of PhDs in project design and delivery. Key issues included a need to ensure adequate resources for developing and sustaining relationships and a need for flexibility when there is uncertainly around processes and outcomes. A further issue was the importance of realistic assumptions about what can be achieved from available resources (budgets and time).

*Process*

*Proactive management (inception to delivery)*




**ENABLING FACTORS**

O3 Identify risks (as a team) as the basis for mitigating their impact.

H5 Allow sufficient time for informal and formal discussion.

H6 Consider designing workshops around challenges and design briefs to catalyse collaboration and project building.

H7 Explore how knowledge sharing will be facilitated during design and delivery.

P4 Use formal processes of approval and contracting to crystalise design and expectations around delivery.

Figure 44 Cross-cutting enabling category: proactive project management

*" The purpose of project management is to plan, organise and control all activities so that the project is completed as successfully as possible. The buzzwords here are deliverables (the expected project benefits) and stakeholders (organisations and people with any significant interest in the project and its deliverables). Frances Hatton (2010) believed that a successful project is one that makes all stakeholders happy"* (Lock 2014, p.1).

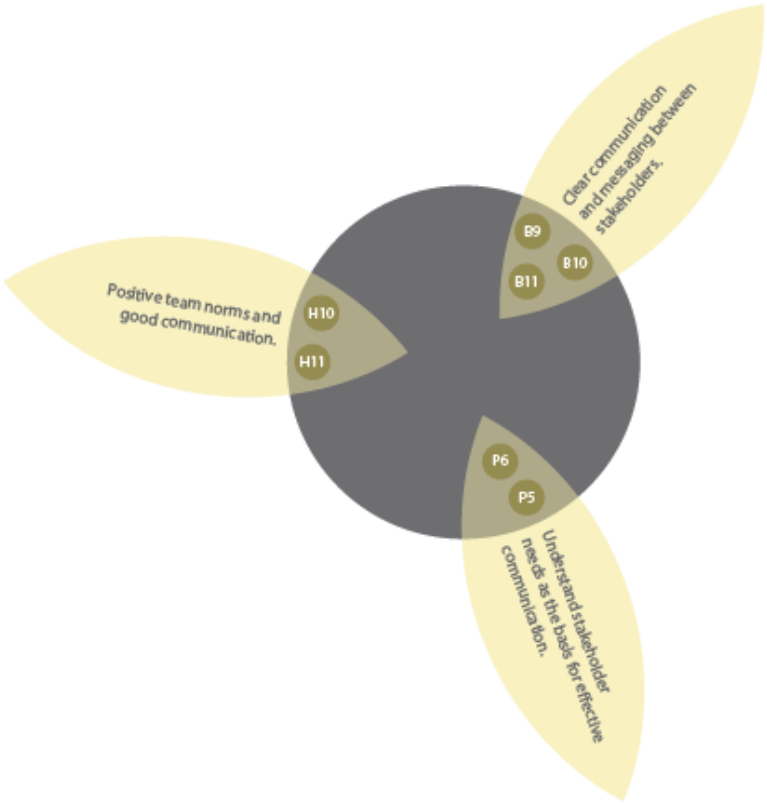
Under the category of project management, the Themes and Enablers are associated with the proactive decisions made within the collaboration to shape project development and delivery. As noted in other categories, the themes and factors reflect the dynamic and iterative process by which teams interact with each other and with the wider project context to shape processes and develop a shared understanding around the approach to design and delivery. Of particular importance was the value in explicitly designing the early phases of interaction and networking to reflect a creative and iterative process by which ideas and relationships are explored and built.

During the early phases of conception, design and delivery, the importance of informal networking combined with more formal processes were identified as potential catalysts for sharing knowledge and developing relationships and ideas; challenges and design briefs were tools that could be used in this context (e.g. Hybrid Lives). A related insight was the need to allow sufficient time and resources for this process to take place, while also a recognition that individual personalities and experience can play an important role (positive/ negative) in building and shaping collaborations.

Knowledge exchange was identified as a dynamic process by which knowledge is transferred, shared and created between partners and a wider group of project stakeholders, principally through conversation and discussion. While included in the management category, given the value of proactive decisions to facilitate this process, it is in practice a cross-cutting theme that impacts during the different stages of inception through to delivery. Of central importance is the assumption that effective knowledge exchange can be enabled by factors such as resources, time and physical proximity. While these insights emerged in the context of one case study (Hybrid Lives), they are reflected across a range of other projects and themes at the level of activity statements (e.g. Kendal, Bretton Buzz, Hybrid Lives).

The need to identify and mitigate project risks was identified as part of the collaborative process (OP). However, risks emerged across a number of case studies and included: the movement of key personnel in partner organisations (OP); buy-in of user groups (PPT); access to digital data required to develop a viable prototype (Open Planning, Bretton Buzz, Kendal); and the digital divide (Bretton Buzz). The operational implication arising from these risks is a need to incorporate a project risk analysis (identification of important risks and how they could be managed) at an early stage in the collaborative process as the basis for their management.

*Effective communication*




**ENABLING FACTORS**

B9 Budget for regular face-to-face meetings.

B10 Ensure short and regular project updates are circulated.

B11 Place emphasis on developing a high -trust and open working culture.

H10 Resource the project to ensure regular conversations are undertaken.

H11 Recognise and discuss values and behaviours that the collaboration aspires to.

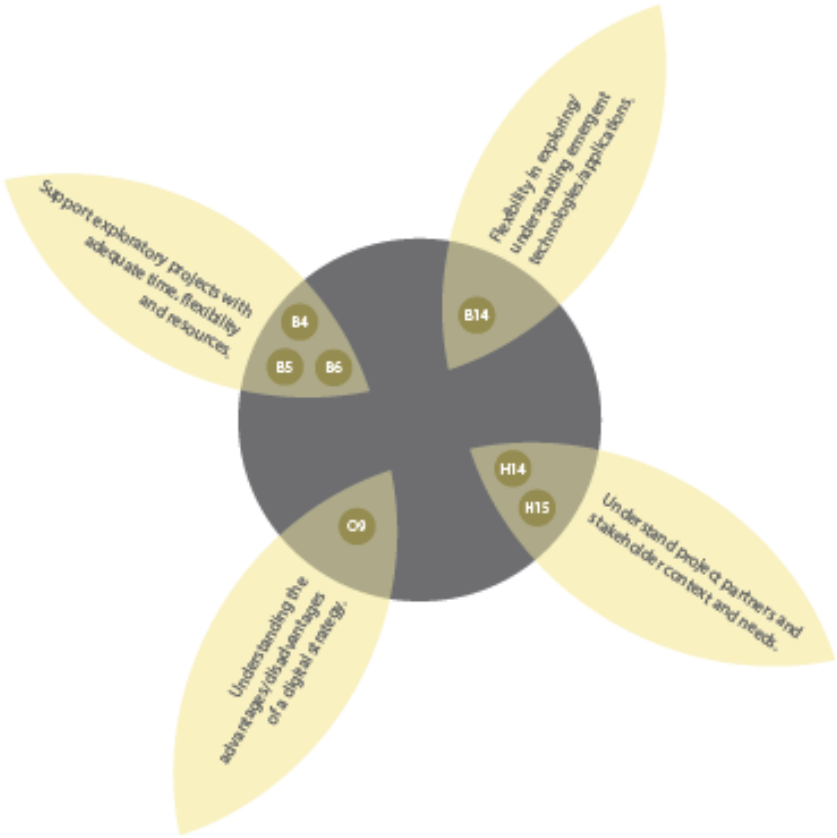
P5 Prioritise informal and formal space and time for conversation between partners and stakeholders.

P6 Recognise the need to understand organisational values as the basis for translating (messages) accross organisational boundaries.

Figure 45 Cross-cutting enabling category: effective communication

Clear communication and messaging between team members and stakeholders was identified as a critically important Enabler and one that was reflected at the level of Themes in three case studies. The topic also arose at the level of Activity Statements in other cases and in relation to other topics (project management, roles and responsibilities, role of the PhD, and shared expectations). The importance of effective communication was facilitated by team discussions, face-to-face meetings and team norms and behaviours that facilitated openness. It was identified as a central driver of successful knowledge sharing and the development of a shared understanding across team members and wider stakeholders. An important factor in facilitating communication was the provision of adequate resources to enable regular meetings and discussion to take place (both formal and informal). A particular challenge if team members are not in close geographical proximity.

*Explore and understand organisational and user context*




**ENABLING FACTORS**

H14 Design collaborations to leverage diverse expertise and experience of partners and wider stakeholders.

H15 Discuss and understand the diversity of partners' expertise and clarify the contribution from each.

O9 Identify opportunities and risks associated with developing and implementing a digital strategy.

B4 Ensure adequate time and resources are committed to developing relationships during early stages of inception and design.

B5 Use flexible management for exploratory projects.

B6 Identify risk and mitigation strategies.

B14 Be flexible in design and implementation when context and outcomes are uncertain.

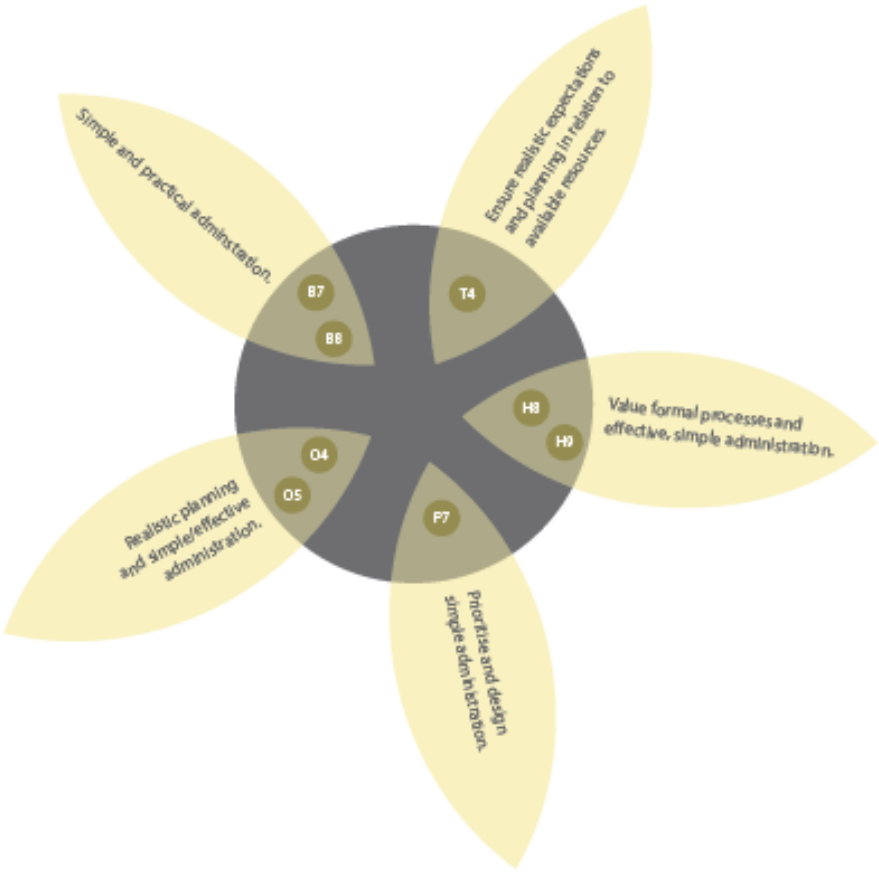
Figure 46 Cross-cutting enabling category: understanding context

*Context: The social, economic and technological environment within which the project is designed and implemented. It addresses a number of different and interrelated dimensions related to project partners, stakeholders and the wider social and economic environment, including organisational and professional cultures, administrative processes, stakeholders and user needs and interests.*

Exploring context and needs is a dimension of project management associated with developing a shared understanding of emergent technology and applications in relation to user needs. While this theme emerged at a strategic level in three case projects (Bretton Buzz, Hybrid Lives, Open Planning), insights are relevant to all projects where emergent aims, method and outcomes are characterised by uncertainty.

Key insights from the case analysis included the value of flexibility in project design and management to accommodate the emergence of understanding between partners and stakeholders. This included the definition of methodology and outcomes in relation to context (opportunities, challenges and user needs). A related point being the value of leveraging diverse expertise from partners and wider stakeholders in supporting project aims and ensuring adequate resources are available to support the development of relationships during early development stages. Risk management was identified as important in the context of uncertainties arising from emergent areas of technology and application e.g. possible digital divide and access to data necessary for scaling up prototypes (Kendal, Open Planning).

*Simple, efficient and enabling administration*




**ENABLING FACTORS**

B7 Design simple, efficient and flexible administrative and budgetary procedures.

B8 Pay market rates for service providers (subcontractors).

H8 Use formal approval to support the development of a shared understanding as to aims, method and IP.

H9 Design administrative procedures to be as simple as possible and ensure adequate support is available.

O4 Design simple and effective administrative procedures to support implementation.

O5 Be realistic about what can be achieved from the available budget.

P7 Prioritise the design and delivery of simple and efficient administration.

T4 Ensure that project expectations are realistic in terms of the budget.

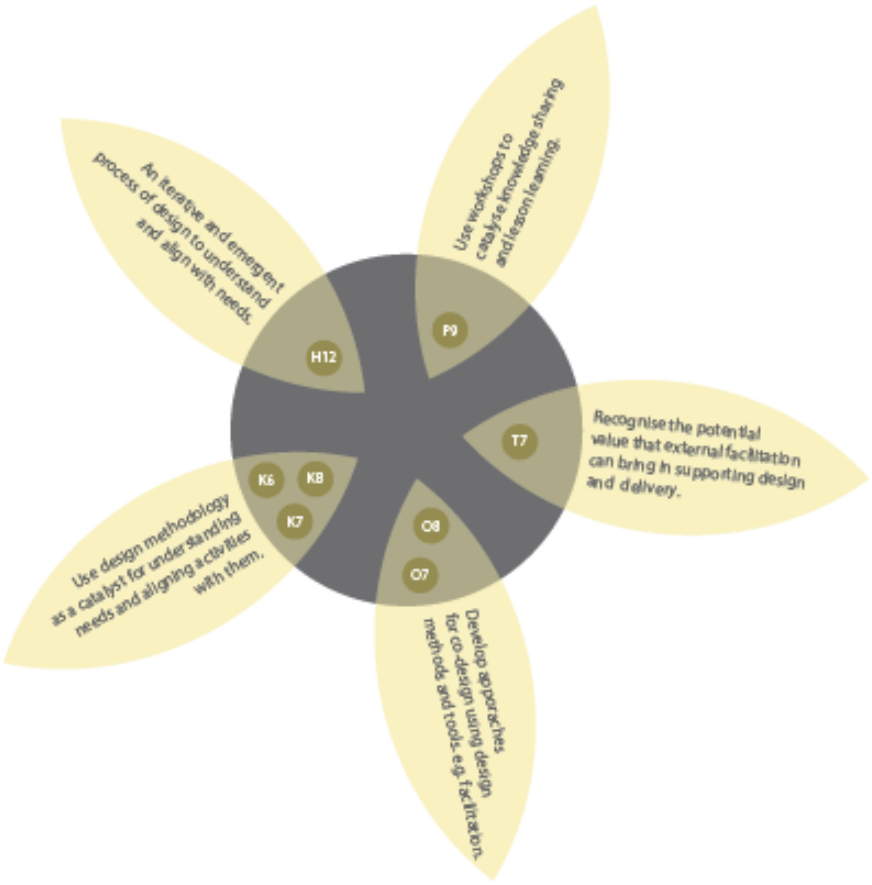
Figure 47 Cross-cutting enabling category: effective administration

"*Administration…involves the efficient organisation of people, information, and other resources to achieve organisational objectives*" (IAM, 2018).

This category reflects the importance and impact of formal systems by which organisations fund, manage, shape and support project-based collaborations. A central driver to the design, delivery and management of administrative systems is the principle of accountability in ensuring that the policies of the sponsor, partner organisations and collaborators are adhered to, explicitly that funds committed to the project(s) are used and accounted for in relation to the purposes intended. Of particular value (and a milestone in project development) was the positive effect that formal processes (approval and collaboration agreements) could play in crystallising ideas around process and outcomes. It is worth noting that insights on administration have been from the perspective of team members interviewed (not a wider group of stakeholders).

Insights captured include the value of effective and enabling administration to support project delivery. Of particular importance were simplicity and efficiency in the design of systems and procedures that are proportionate to the scale of the projects undertaken. It was equally important for teams to plan realistically in relation to available resources and what can be achieved (e.g. individual work streams such as prototype development). A detailed point arising was the value of flexibility in how and on what rate subcontractors/partners are employed i.e. the need to pay market rates to be applied (PPT) or flexibility to pay small amounts for community support projects (Bretton Buzz).

*Use design (methodology and tools) to align activities with needs*




**ENABLING FACTORS**

H12 Use iteration around ideas and mock-ups to explore emegent concepts and to align to user needs.

T7 Consider external facilitation to support project design and delivery.

O7 Design bespoke and transparent methods for co-design workshops.

O8 Recognise the value of professional facilitation in workshop design and delivery.

P9 Design and use workshops to catalyse knowledge sharing and lesson learning.

K6 The design methodology can catalyse an understanding of needs and align the project to meet these needs

K7 Use the design brief to align project outcomes with user needs.

K8 Explicitly acknowledge the value and role of empathy.

Figure 48 Cross-cutting enabling category: the design-led methodology

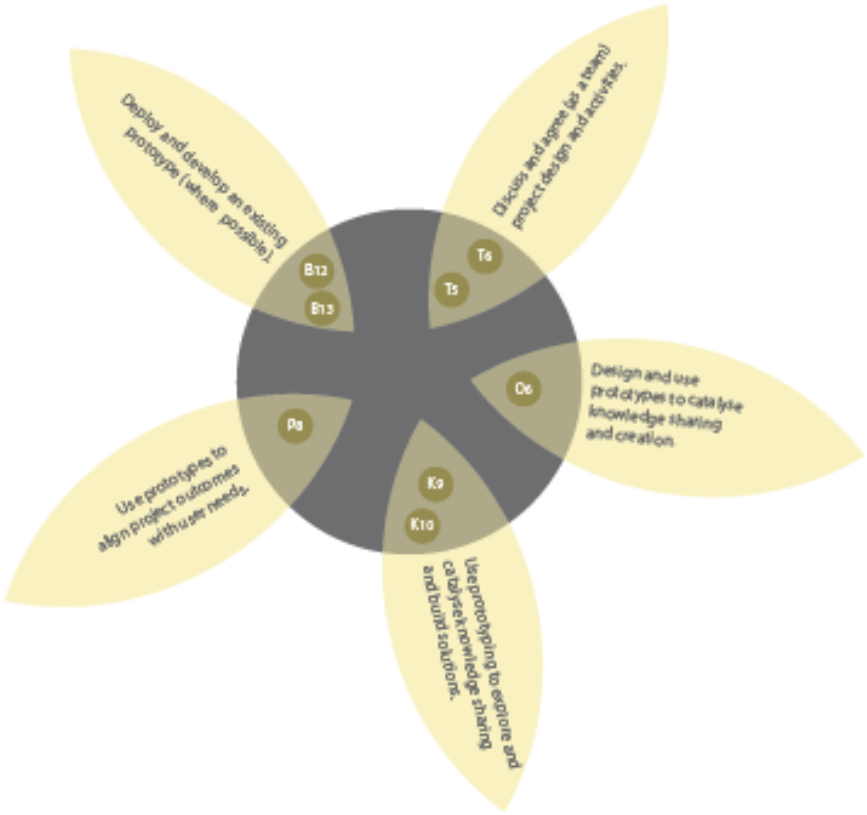
*"Methodology: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes"* (Crotty 1998, p.3).

Design emerged as a driving force to project methodologies across all the case studies. This was supported by creative practitioners in the delivery team and strongly related to the role of the prototype development. The theme reflected a number of different facets of design as an iterative process by which context is explored and as the basis by which ideas are transformed into new services or products. The value of design appears to be strongly aligned with model of agile KE explored in Section 4 and where the wider project contexts are characterised by a high degree of uncertainty.

An important cross-cutting theme focused on the role of design (reinforced by the role of prototypes) as a catalyst for knowledge sharing, creation, engagement among team members and wider stakeholders (e.g. potential users). Specifically, this role of design is a process that is manifested in a non-linear approach to exploring context and developing possible solutions in the form of prototypes to the challenges identified, in the context of working across professional (and epistemological boundaries). A related operational point was the value of the design brief as a tool to facilitate a shared understanding of user requirements and a framework for prototype development (Kendal).

Co-design workshops and related methods emerged as a powerful catalyst for knowledge sharing between the different stakeholder groups. In this regard, the role of workshop facilitator was identified as important in terms of successful outcomes. In addition to the value of workshops as a potential tool for engaging with stakeholders (users), their role in supporting knowledge sharing at different stages in project implementation was also acknowledged. In this context, a potential role for external facilitation was identified as a possible supporting measure support the development of a shared understanding between team members.

*Use prototyping to catalyse knowledge sharing and creation*




**ENABLING FACTORS**

- T5 Reach early agreement on the role of the prototype development in overal project design.
- T6 Ensure adequate resources are committed to prototype development.
- O6 Use prototypes as catalysts for knowledge sharing and creation.
- K9 Use mock-ups and prototypes as a catalyst for feedback and knowledge sharing.
- K10 Give priority to qualitative feedback in the design process and create spaces for user groups to engage in the process.
- P8 Understand community motives and align technologies to address needs.
- B12 Use prototypes as a catalyst for knowledge sharing and co-creation between partners and wider stakeholders.
- B13 Recognise the value of deploying existing prototypes as the basis for lesson learning for future use.

Figure 49 Cross-cutting enabling category: the value of prototyping

*"Prototypes are physical manifestations of ideas or concepts. They range from rough (giving the overall idea only) to finished (resembling the actual end result). Their purpose is to give form to an idea and to explore technical and social feasibility"* (Sanders & Stappers 2014, p.9).

A further dimension of the methodology was the development and deployment of prototypes as an integral part of the project design and outcomes. Prototyping was embedded into different approaches to participatory design methods used to catalyse knowledge sharing and creation with wider stakeholders and potential end users (both through making, storytelling and sharing insight and knowledge). Ranging from the prototype as a probe to catalyse user feedback (Bretton Buzz, Kendal) to creating generative tools which facilitate user groups becoming active partners in the design process itself (Open Planning, Participatory Production Technologies, T. Dan Smith).

| **Cases** | **Prototype** |
|---|---|
| Bretton Buzz | Analytical software tool supporting community engagement. |
| Kendal | Blood test visualisation app. supporting patient engagement. |
| Participatory Production Tech. | Formats and enabling technologies for supporting user-generated content. |
| Open Planning | Application to support public engagement in planning processes. |
| Hybrid Lives | Formats, visualisation, mock-ups and delivery of public-facing interactive event. |
| T. Dan Smith | City walks (method) designed to deliver content and catalyse public engagement. |

Table 31 Creative Exchange case project prototypes

Summarised by Stappers in the context of research through design (Stappers 2010 cited in Sanders & Stappers 2014, p.6), prototyping is framed as a process where context and ideas are explored, solutions identified, developed and tested on an iterative journey with team members and stakeholders. He identifies the following in relation to the role of prototyping, to:

- evoke a focused discussion in a team, because the phenomenon is '*on the table*';
- allow testing of a hypothesis;
- confront theories, because instantiating one typically forces those involved to consider several overlapping perspectives/ theories/ frames;
- confront the world, because the theory is not hidden in abstraction;
- change the world, because in interventions it allows people to experience a situation that did not exist before.

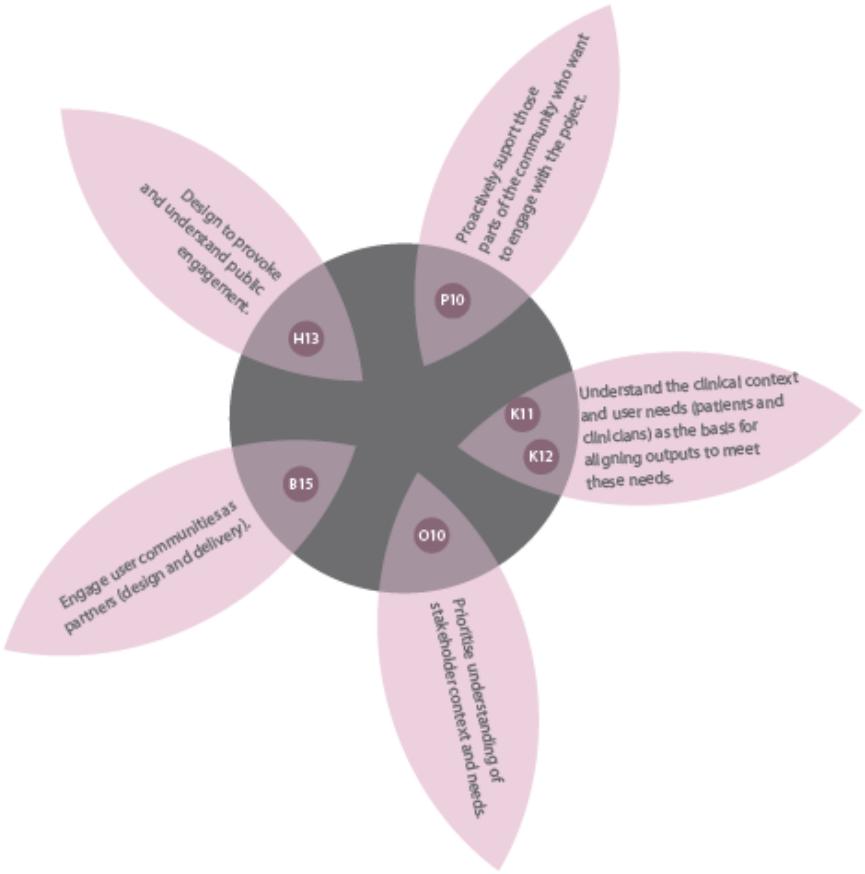
These insights from Stappers are reflected in the insights gained from the case study where prototype design, development and deployment played a central role in catalysing knowledge sharing and creation in support of project goals (Table 31). Tool kits, probes and prototypes took different forms, from physical and digital artefacts (Open Planning, Kendal, Participatory Production Technologies) to new and innovative methods and ways of working (T. Dan Smith, Open Planning). The creation of physical and/or digital artefacts reflected varying degrees of participatory design, bringing together both project partners and representative of potential user communities, providing a catalyst for knowledge sharing and creation.

The insights arising relate to both the management and processes associated with developing the prototype and the wider role that prototype development plays in catalysing knowledge sharing and creation. Importance was attached to reaching an early agreement between project partners and project stakeholders on the role prototypes will play in overall project methodology and deliverables combined with adequate resourcing (Open Planning, T. Dan Smith, Bretton Buzz).

Reflecting an iterative process of design and development, prototypes (and early-stage mock-ups) facilitate the exploration of the emergent areas of technology and application, thus providing catalysts for knowledge sharing and supporting the development of a shared understanding among project partners and stakeholders of context, opportunities and possible solutions. In this context, the importance of using the prototype to understand and address user needs with the importance of qualitative feedback was recognised; a related management issue was the need to identify the risks associated with prototype deployment e.g. access to data.

*Emergent States*

*Prioritise development of a shared understanding (context and user needs)*




**ENABLING FACTORS**

P10 Identify individuals who want to engage and support them.

K11 Develop a clear and shared understanding of the clinical context and user needs (patients and clinicians).

K12 Ensure project goals are aligned with user needs.

O10 Understand the institutional context (processes, objectives and constraints) as the basis for designing project interventions.

B15 Prioritise understanding user-context and needs.

H13 Design provocations as the catalyst for engaging the public.

Figure 50 Cross-cutting enabling category: shared understanding of context and user needs

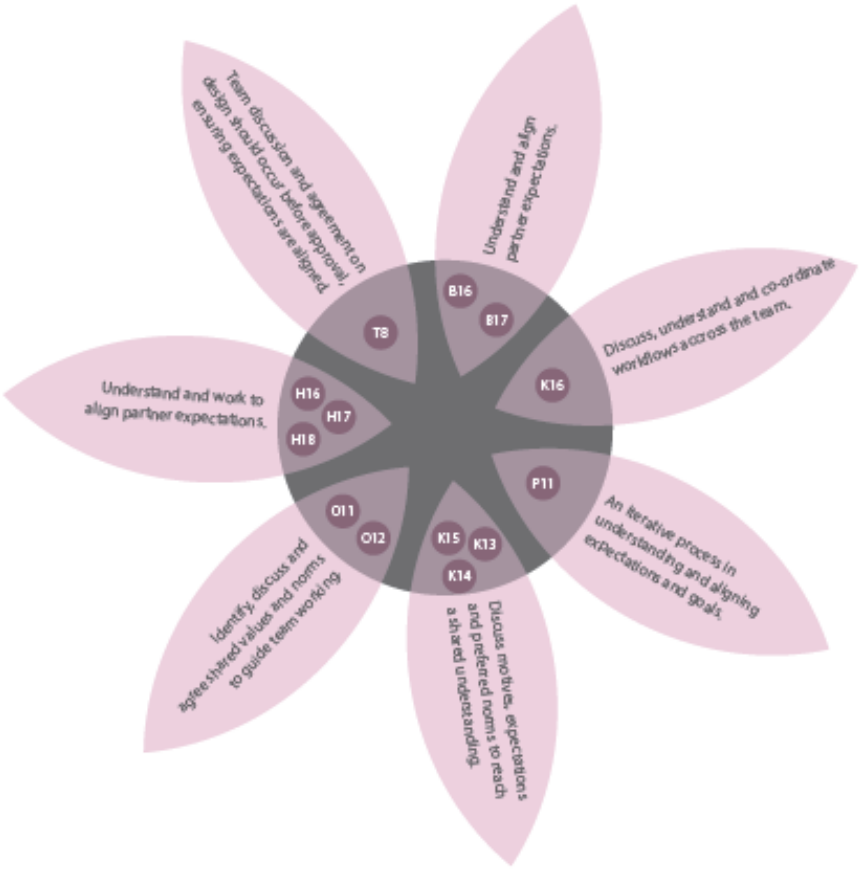
The development of a shared understanding between project partners in relation to context (individual and organisational) and user needs, was a cross-cutting theme for all cases. It is a developmental process that takes place over time between team members and wider stakeholders, which leads to a shared understanding of the wider project context and user needs, and an understanding of key structures, factors and motivators which in turn provide realistic assumptions about what can be achieved through project interventions.

*"A key challenge is to spend sufficient time to understand the existing institutional set up and actors' interactions, but also to clarify one's own assumptions, expectations and perceptual biases"* (Interviewee).

Given the importance of design methodology and its emphasis on aligning project outputs with end user needs, the emergence of this category is not surprising. The associated Enablers reflect a range of forces shaping process and outcomes by which shared understanding was generated.

Although contexts (technical, social and organisational) varied significantly, participatory design in different forms was a central process in catalysing knowledge sharing and co-production leading to an understanding of user needs. Such factors reflect a need to engage user groups as partners in the design and delivery of projects. In this context, support for key individuals and groups to engage as active participants in a process of knowledge sharing/creation is an important priority (norms, resources, space etc.).

*Invest in aligning team and stakeholder expectations (inputs/method/ outputs)*




**ENABLING FACTORS**

K16 Develop realistic expectations around inputs and deadlines.

P11 Explore motivation and expectations between project partners and stakeholders as the basis for aligning expectations.

K13 Recognise the different factors which motivate partner engagement and acknowledge the value of intrinsic drivers for team motivation.

K14 Explore and make explicit the factors and behaviors that contribute to developing a high-trust working culture.

K15 Recognise the different organisational pressures partners are under in designing workflows.

H16 Discuss and understand each partner's motives and expectations for the collaboration.

H17 Recognsie the need to develop a shared and realistic understanding of goals, approach and achievable outcomes within time and resource constraints.

H18 Recognise the importance of enjoyment as a motive for working together.

T8 Ensure that all key partners are involved in exploring and agreeing project methodology before approval.

B16 Commit time to understanding and aligning partner motives and expectations.

B17 Be realistic about what can be achieved within the resources available.

O11 Identify and support positive behaviouprs aspired to by the team.

O12 Commit time to develop a shared understanding of motives, goals and methodology.

Figure 51 Cross-cutting enabling category: understanding and aligning expectations

This category captures the importance of group cognition and the development of a shared understanding of individual motives, project context, goals and an approach to project delivery. The associated Themes and Enablers reflect an iterative process of interaction between team members, with stakeholders, and the wider project context facilitating a process of individual and collective learning stimulated by knowledge sharing and creation. Rather than a discrete moment in time, the process of alignment approximates a continuum through the project's life characterised by key milestones such as project approval, workshops, mock-ups, working prototypes etc. Key dimensions in the development process include:

- A *discussion of partner motives and expectations* enabling an iterative process of knowledge sharing. It is important for all team members to meet together to discuss their motivation for engaging in the project and a realistic assessment of what and when they can contribute.

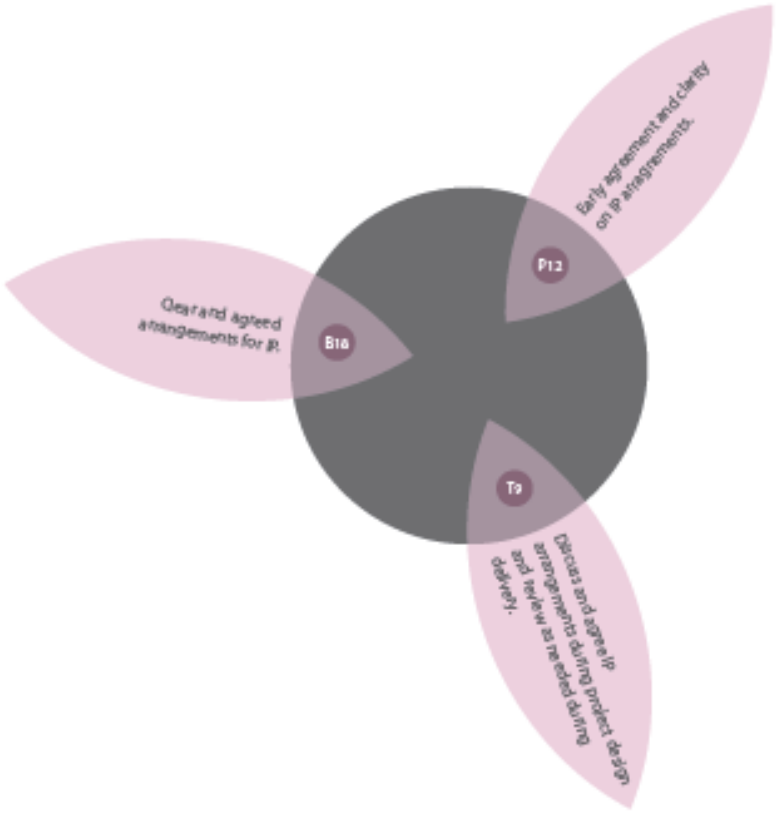
- The *value of time, effort and enabling norms* and values *(*openness/trust*)* to facilitate an understanding and a process of alignment to take place. This is an iterative process driven by meetings and conversations that build on a growing appreciation of the different perspectives and roles that team members could play in the project and the respective capabilities that they contributed (see Roles and Responsibilities).

- *Realism* about what can be expected from team members and what can be achieved is important in creating an enabling team culture.

- *The value and importance of intrinsic motivators* such as enjoyment from the collaboration and professional and personal interest in process and outcomes.

*" There would be some obvious things to say to make such a relationship work and that is to be quite open and frank, to be open about everybody's agenda, what does everybody want to get out of the collaboration like, what are the limits of the engagement, what is everybody willing to bring in by way of the limits. So, we have to be clear on these things"* (Interviewee).

*Develop a shared strategy for Intellectual Property (IP)*




**ENABLING FACTORS**

P12 Discuss and agree a framework for IP at the beginning of the project.

T9 Discuss and agree IP arrangements at the beginning of the project.

B18 Discuss and agree a framework for IP at the beginning of the project.

Figure 52 Cross-cutting enabling category: shared strategy for Intellectual Property (IP)

*"I think they're often resolved as you go along. If they don't get resolved then obviously there's team conflict and disparity"* (Interviewee).

While Intellectual Property (IP) was addressed in the collaboration agreements signed for all projects, in three out of the six case studies it emerged as a strategic theme of importance. While the insights reflect in large part the process by which IP arrangements are discussed, agreed and implemented, it has been included as a discrete category given the central importance and value of securing a shared and early understanding between all parties as to the arrangements to be adopted for the deployment of products, services and knowledge created within the context of the collaboration.

As with all categories, the Enablers reflect the interaction between processes and outcomes:

- Partners/team members should discuss and agree principles for their IP agreement during early stages of the collaboration and review arrangements during implementation and closure.

- The principles of the agreed IP policy for each project should be clearly stated in all project documentation (proposal/collaboration agreement) and contracts for service providers.

- Agree a policy and protocol for the dissemination of results arising from the project, e.g. publications.

**Summary**

While teams reflect a unique set of personalities, characteristics and factors associated with each project (Mathieu et al. 2008), they:

"*… all reflect the underlying notion that teams are complex, dynamic systems, existing in larger systemic contexts of people, tasks, technologies, and settings…"* (Ilgen et al. 2005, p.519).

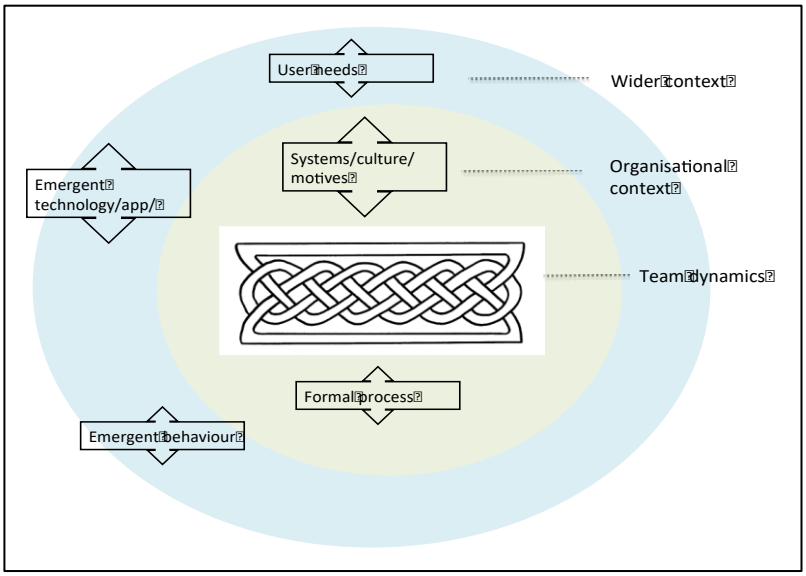



Figure 53 The wider CX operating context

Different dimensions of the operating context for the CX projects are identified as i) *Team Dynamics*, ii) *Organisational Context*, and iii) *Wider Context* (Figure 53*)*. It is important to note that each of these dimensions are dynamic, permeable and interconnected, with factors and forces interacting between the dimensions of context and the team (i.e. reflecting the principles of the ecological perspective illustrated in Figure 41).

- *Team Dynamics*: Factors associated with how individual capabilities, motives, personalities and epistemologies shape internal interactions and those between the team and external dimensions of context. They possess characteristics and factors that act to shape the development of goals, methodologies, roles and behavioural norms within the team. It is within this context that group cognition is situated as manifested in the development (or not) of shared understanding.

- *Organisational Context:* Factors associated with the impact that organisational culture, norms, expectations and procedures have on a given collaboration. In the context of collaborations involving multiple organisations, this can provide a complex matrix of issues that individuals and teams need to navigate and address.

- *Wider Context*: The wider context of the project captures the areas of technology, application and user need that the collaboration is working to understand and address. In practice, wider context is an aggregation of multiple social dimensions of different contexts.

*The importance of shared and agreed understanding (group cognition)*

"*The collaborative task demands of teams to create a common ground, a common representation that could serve as a touchstone for coordinating the members' different perspectives on the problem at hand*" (Schwartz 1995 cited in Bossche et al. 2011, p.3).

Across a multitude of contexts, from operating theatres, space flight, school rooms, corporate boardrooms and factory floors to a small-tech start up working with a university faculty, effective team working is identified as centrally important for success, both at a project level and in relation to a wider organisational context. It is in this context that a number of research disciplines have recognised that '..*structures of collectively created meaning*..' are critical in enabling individual efforts to be coordinated to achieve shared goals (Akkerman et al. 2007, p.39). Akkerman and colleagues identify a range of concepts and terms used to describe both the process and outcomes associated with group understanding (common ground, shared understanding, collective mind, team mental models, distributed cognition), but also note the lack of consistency and clarity in their use and meaning. In a review of literature, two broad perspectives on group cognition are identified, namely the cognitive and the sociocultural perspectives.

The *cognitive perspective* is centred on personal cognition as individuals acquire knowledge through reason, experience and memory, i.e. individuals organising knowledge into structured patterns of meaning stored in and retrieved from memory. In essence, this perspective focuses on individually generated and centred mental models. Cannon-Bowers and colleagues (Cannon-Bowers et al. 1993; Akkerman et al. 2007 ) identify four related mental models relevant to team working including: i) *team task* (strategy and context); ii) *team interactions* (interaction, roles, responsibilities); iii) *team members* (individuals skills and expertise); and iv) *team equipment* (functioning/use).

In contrast, the *sociocultural perspective* places emphasis on the socially embedded nature of knowledge and knowing, thus giving primacy to the process by which individuals interact within a community (team) as they participate together in a collective act of creating meaning and knowledge. In this social and cultural context, cognition is generated and embedded in and through the activity of the group itself (Akkerman et al. 2007, p.45). Different assumptions underpin the two perspectives but each also has respective strengths and weaknesses. The cognitive model places too little emphasis on the wider social context within which understanding is reached, and the sociocultural perspective places too little emphasis on the role of the individual. Regardless of the analytical perspective, all teams face the universal challenge:

"*...of establishing common frames of reference, resolving discrepancies in understanding, negotiating issues of individual and collective action and coming to joint understanding*" (Barron 2000, cited in Akkerman et al. 2007, p.1).

Bossche and colleagues (Bossche et al. 2011) explore the social processes and mechanism that act to enable and catalyse knowledge sharing as a critical element of group cognition. This knowledge sharing leading to the development of a shared understanding identified as a mediating enabler between team learning and team effectiveness, reflecting '*conversation, discourse and dialogue*' as manifest in the co-construction of meaning between team members through the practice of working together. An important finding from the analysis is the importance of *'constructive conflict*' as a means by which shared meaning is generated through discussion, argument and resolution, which acts to shape a convergence of meaning.

A further relevant perspective is provided by Akkerman and Bakker (Akkerman & Bakker 2011) exploring the a growing recognition of the importance of boundaries and boundary crossing in the context of education research and practice where, '*A boundary can be seen as a social cultural difference leading to discontinuity in action or interaction*'. Noting that boundaries are becoming more explicit, driven by social and cultural diversity and professional specialisation, with a related priority on finding ways of bridging boundaries in support of effective collaboration and learning. Where individuals and teams;

"*..face the challenge of negotiating and combining ingredients from different contexts to achieve hybrid situations*" (Engeström et al. 1995 cited in Akkerman 2011, pg. 134).

In the context of bridge building, the concept of *boundary object* is relevant, drawing on Star and Griesemer's definition, where a boundary object is defined as having key characteristics where objects:

*".. which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual- site use. These objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation*" (Star & Griesemer 1989, p.393).

Both the process and concept of boundary objects are strongly aligned with the role of prototyping (both process and artefacts) in stimulating knowledge sharing and providing a catalyst for generating a shared understanding in the complex collaborations demonstrated in the CX cases.

*A synthesis of insights*

Figure 54 provides a synthesis of insights distilled from the analysis integrated into the *Input-Mediator-Output-Input* framework of team effectiveness. The enabling categories (built from Themes and Enablers) are integrated into the framework in the context of an iterative and dynamic team development process, with emphasis on the central role of the development of a shared team understanding in relation to context/needs/aims/method/output (dimensions of shared meaning) between team members, with wider stakeholders and through different stages of project design and delivery.

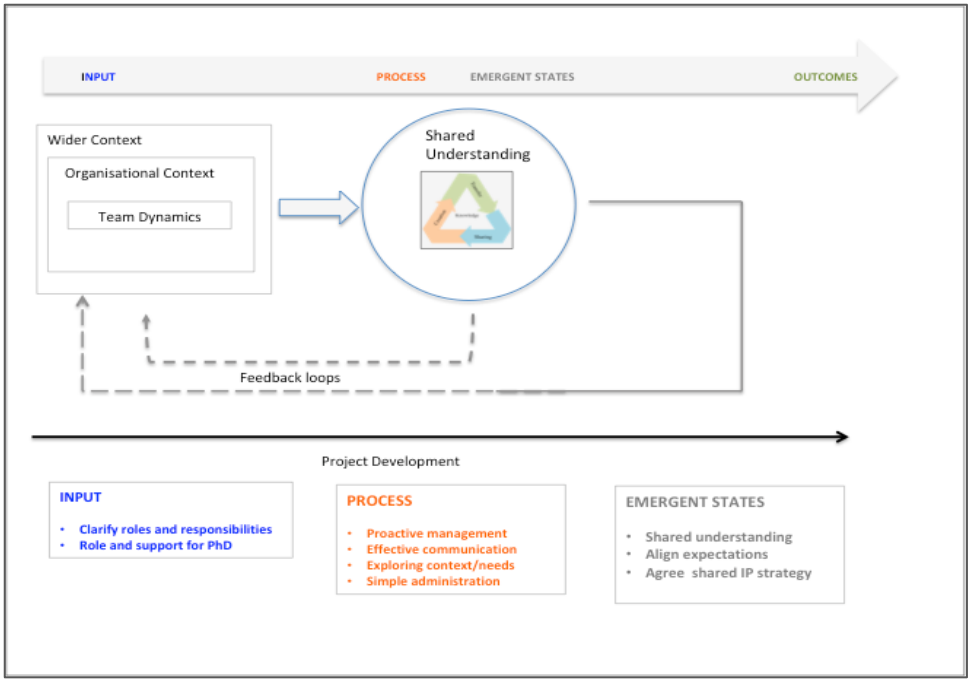



Figure 54 The adapted I-M-O-I model of team effectiveness using case study insights

This shared understanding and meaning providing a basis for self-organising and aligning inputs and methods with achieving desired outcomes that meet user needs in the wider project context. The adapted framework highlights the central and dynamic role of knowledge as a critical drivers in the creation of shared meaning (group cognition), reflecting the mechanisms of transfer, creation and sharing that takes place between team members and with wider stakeholders e.g. representatives of community based user groups.

This in turn provides the mediating energy to transform inputs to desired outcomes. A further important dimension of this framework is the central enabling role of design methods and prototyping in acting to catalyse convergence in understanding across the team and with stakeholders. A key question that arises is the whether the insights can be used in the design of enabling measures to support the mode of knowledge exchange explored in the context of this cross-case analysis (explored in Section 4).

Within the context of the selected CX projects, rather than discrete points on a linear journey, the interplay between the enabling factors and project related processes can be more accurately defined as a dynamic continuum reflected in the design of a *Celtic Knot* (Figure 53) or a *Knowledge Triangle* (Figure 55). Where team members work and learn individually and collectively to develop a shared understanding of context, opportunities, aims and method. This collective understanding providing a foundation for success.

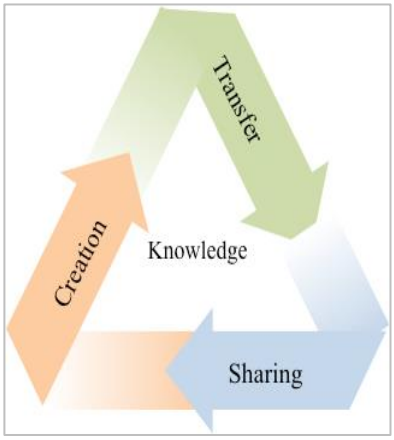



Figure 55 The Knowledge Triangle

Knowledge exchange can refer to both a public-sector policy and related activities focused on stimulating and supporting collaborations between HEIs and non-university partners. In addition, the concept can also be used to describe the dynamic processes associated with project design and delivery, specifically centred on team working.

Central to this dynamic process are the different dimensions of knowledge transfer, sharing and creation (as reflected in the knowledge triangle) which act to generate a positive momentum to project delivery, from conception to closure. The relative weight attached to the importance to each of these processes reflects different factors including the nature and source of knowledge (e.g. explicit/tacit,), type of project (transfer/co-creation) and stage in project design/delivery. Derived from the literature review and case study analysis, the concepts are defined as follows:

*Knowledge transfer*: A process by which knowledge is transferred from the producer and or holder to a potential user(s). The knowledge has both tacit and explicit dimensions but is most likely to be codified in character e.g. formulae, IP, clinical guidance, policy papers, technical papers, background briefing etc. The mechanisms by which transfer takes place are various including presentation, briefing, documentation, site visits, physical exemplars and related discussion.

*Knowledge sharing*: The concept of knowledge sharing (tacit and explicit) reflects the principle of openly distributing knowledge between individuals (a dynamic flow) working as a part of team (and beyond) and taking place without an explicit expectation of it being part of a transactional relationship. Principle mechanisms include discussion, presentation, conversation, making, producing, feedback, correspondence (or a mix) etc.

*Knowledge creation*: Refers to a process through which new knowledge (as distinguished from prior knowledge brought into the collaboration) is generated through the act of working together and with a wider group of stakeholders e.g. patients, community groups. The new knowledge can reflect both tacit understanding reflected in group cognition or/and manifest and applied as explicit knowledge in the form of working prototypes, technical guidance, methods, research outcomes.

With reference to the different forms of university engagement explored in this enquiry, some (transfer-based modes) can be expected to place greater emphasis on transfer focused methods and tools while others (KE in the CX context) prioritise the sharing of knowledge and enabling interventions focused on facilitating co-creation.

The *Enabling Categories*, distilled from the Cross-case analysis (Table 32), illuminate the forces shaping project-based team working in the context of the selected CX case projects. The insights provide a basis for identifying positive enabling behaviours, measures and actions that can support team working and which are further developed into an enabling framework in Section 4 of this thesis.

| Domain | Enabling Categories |
|---|---|
| Inputs | **Clarify** emergent team roles and responsibilities. |
| | **Discuss**, understand and agree the PhD's role. |
| Process | **Proactive** management (inception to delivery). |
| | **Effective communication.** |
| | **Explore and understand** organisational and user context. |
| | **Simple and realistic** administration. |
| | Use **design** (methodology and tools) to align activities with needs. |
| | **Prototyping** to catalyse knowledge sharing and creation. |
| Emergent States | Prioritise development of a **shared understanding** (context and user needs). |
| | Invest in **aligning team and stakeholder expectations** (inputs/method/outputs). |
| | Develop a **shared strategy for Intellectual Property (IP).** |

Table 32 Summary enabling categories from the cross-case analysis

The different enabling themes and their underlying factors identified highlight areas where proactive management has the potential to support and catalyse team effectiveness. Situated in the context of the characteristics of *an exploratory mode of university collaboration* manifest in the CX projects where emphasis is placed on knowledge being generated through an act of collaboration itself. The implications of these insights are explored further in the context of a possible project enabling framework presented in Chapter 11.

# Section 4

## *Research Insights and Conclusions*

## Section 4 Introduction

This final section of the thesis provides the opportunity for the author to reflect on the research journey and outcomes in relation to the overarching research question. The analysis reflects insights from the literature review (Section 2) and case study analysis (Section 3) informed by existing theory and practice. This reflects an approach of intertwining different strands of insights and evidence in '..*constructing explanations*..' in relation to the theory and practice of Knowledge Exchange (KE) in the context of the Creative Exchange (CX) (Lewis-Williams 2002, p.102).

*Chapter 10* examines the concept of Knowledge Exchange as the basis for developing a typology which compares and contrasts the concept with two other important modes of university collaboration; Technology Transfer (TT) and Knowledge Transfer (KT). Drawing on the insights from the literature review and case study analysis, assumptions underpinning and shaping the three approaches and their characteristics are identified and contrasted.

A further dimension of analysis focused on examining the nature of knowledge exchange in the context of the Creative Exchange, in which an *exploratory mode* of university engagement is identified, where interdisciplinary and inter-organisational teams work cooperatively with a high degree of autonomy in project design and delivery. These teams are unlikely to have worked together before and thus are transitory and working within constrained budgets of time and money. This approach to project design and delivery uses design-led methods to catalyse knowledge sharing and creation in addressing opportunities and challenges for innovation. A comparison is explored between this mode of KE and the principles of Agile Management.

*Chapter 11* presents conclusions reached with reference to the overarching research question, the insights being structured with reference to the two propositions identified in Chapter 1. The first proposition focused on identifying the characteristics of knowledge exchange as a discrete mode of university collaboration and as demonstrated in the CX cases. The second identifies enabling themes (and factors) associated with the effectiveness of the projects included as part of the case study analysis. The operational implications arising from these insights are then explored in the form of an *enabling framework* (EF) supporting an *exploratory mode* of KE situated as part of a *knowledge exchange funnel* (adapted innovation funnel). This illustrates one possible scenario for supporting and enabling KE project development, from concept to maturity.

*Chapter 12* presents a closing reflection from the author on the research experience, limitations encountered and lessons learnt in undertaking the enquiry, and possible topics for future research into the theory and practice of knowledge exchange.

# Chapter 10 An Emergent Typology of Knowledge Exchange

This chapter explores the similarities and differences between three principle concepts used to describe university collaboration with non-university partners. These collaborations are principally focused on leveraging and applying knowledge and expertise from within universities in support of innovation and wider economic and social benefits (beyond teaching and research).[54]

Table 33 presents an emergent typology which draws on the literature review and is informed by the case study analysis. The typology identifies distinguishing characteristics of the three concepts of collaboration: knowledge exchange, technology transfer and knowledge transfer. It identifies a number of the assumptions underpinning the three modes, which in turn shape the design and delivery of associated policies and projects. While the categories and characteristics are not watertight, they illustrate the emphasis within each approach. In practice, projects fall along a spectrum where borders between the different modes, forms of knowledge and methodologies can merge (e.g. Knowledge Transfer Partnerships,[55] KTPs).

With reference to the term Knowledge Exchange, when describing a discrete mode of collaboration, characteristics which differentiate it from other modes include:

- An emphasis on an iterative process of discovery and co-creation of knowledge within the collaboration (often involving a process of prototyping).

- Drawing on a range of disciplines across the arts and humanities which may be combined with applied science and technology.

[54] Also acknowledging the benefits that can flow back into teaching, research and student experience from such collaborations.

[55] *Knowledge Transfer Partnerships* (KTPs) are government-sponsored partnership schemes between a university-based academic and an external organisation lasting up to three years. A KTP associate (graduate) supported by an academic is embedded in the organisation for the period of the collaboration with the aim of catalysing innovation (UK 2018). While emphasis is on transfer of knowledge, focus is placed on generating knowledge and insights through the collaboration itself.

- Knowledge and expertise from expert and non-expert sources with priority attached to engaging a wider group of stakeholders/end users as partners in the act of knowledge sharing, creation and application.

- A high priority attached to tacit knowledge and expertise alongside traditional forms of explicit, codified knowledge.

- A wide mix of partners (small/large, public/private/third sector) and motives (commercial and non-commercial) for engaging with projects.

- A mix of patent/IP- and non-patent/IP-based business models.

- A wide range of delivery and supporting mechanisms.

| | Technology Transfer | Knowledge Transfer | Knowledge Exchange |
|---|---|---|---|
| Disciplines | Basic and applied research with science/technology bias. | Broader range of skills across a wider range of disciplines. | Inclusive of different disciplines and a recognition of the value that Arts and Humanities can generate. |
| Partners | Commercial /investors/corporate | Commercial/non-commercial | Commercial/non-commercial/wide range of user groups. |
| Innovation Model | Linear,[56] staged model with related variations e.g. open innovation. Largely reflecting Mode 1 assumptions. | Linear and staged model (although definitions acknowledge a two-way flow of information and knowledge). Largely reflecting Mode 1 assumptions inclusive of a broader range of disciplines. | Non-linear[57] with emphasis on iterations and prototyping solutions (technology/non-technology based). Reflecting Mode 2 assumptions. |
| Nature of Knowledge | Explicit[58]/codified | Explicit/tacit[59] | Explicit/tacit with emphasis on co-creating knowledge with stakeholders. |
| Source of Knowledge | Research expertise/experts<br>Reports<br>IP<br>Technologies<br>Labs<br>Formulae. | Research expertise/experts (reflecting a broader range of disciplines than traditional technology transfer). | Experts, companies, users and wider stakeholders, consumers, partners in the production of knowledge through the collaboration itself (the sum is more than the parts). |

[56] Mode 1 reflects the assumption that knowledge is generated and held by the university with emphasis on finding ways of applying beyond the boundaries of the university through a staged process of development and deployment. See Chapter 6 for background on Mode 1 and Mode 2 research.

[57] Innovation within an organisation catalysed by knowledge from a variety of sources (often driven by the market opportunity) developing through iterative feedback within and external to the organisation.

[58] Knowledge that can be codified and made explicit is easier to transfer/share e.g. writing/IP/programs/formulae/blueprints (Nonaka & von Krogh 2009).

[59] Knowledge that is difficult to transfer in formalised and explicit ways (writing/IP/codified forms) but that reflects experience and expertise gained from undertaking tasks/roles.

| | | | |
|---|---|---|---|
| Enabling Mechanisms | Spin out<br>IP advice/Legal<br>Licensing<br>Contract research<br>Collaborative Research<br>Investment funds<br>Incubators<br>KTP | Contract research<br>Consultancy<br>Collaborative<br>Research<br>KTP<br>Secondment | Fab Lab, Hack labs & challenge-led.<br>Facilitation<br>Co-design workshops/studios<br>Rapid prototyping<br>KTP<br>Consultancy/collaborative research<br>Secondment |
| Intellectual Property | Patent | Patent/Non-patent | Generally non-patent but IP can be generated. |
| Observability[60] | Tangible and precise.<br>Can be measured. | Less tangible and more amorphous.<br>More difficult to measure although qualitative measures can be used. | Less tangible and more amorphous.<br>More difficult to measure although qualitative measures can be used. |

Table 33 The dimensions of technology transfer, knowledge transfer and knowledge exchange

**The characteristics of knowledge exchange in the CX context**

Table 34 provides an overview of characteristics identified from the cases included in the case study analysis and grouped into ten domains (categories) reflecting structure, context, approach and outcomes. These ten domains capture defining characteristics of the CX case study collaborations and are used to validate the typology and explore and develop the model of knowledge exchange associated with the CX case studies. As with the process of identifying enabling themes and factors within the case study, Affinity Analysis[61] was used to group and regroup characteristics identified into clusters of shared meaning. Iterations were repeated by the researcher until each group was composed of statements which reflected a shared meaning, descriptions were then generated for each group.

[60] Gopalakrishnan & Santoro 2004.

[61] Chapter 3

| Case Project | Approach | Context | Complexity | Scale | Degree of autonomy | Motivation | Outcomes | Methodology | Knowledge Exchange |
|---|---|---|---|---|---|---|---|---|---|
| **Participatory Production Technologies** | Exploratory, emergent, novel. | Exploration of user-generated content and how to support. | Multiple organisations and disciplines with strong emphasis on research and creative practice. | Limited resources (cash and time) with significant PhD input. | A high degree of team autonomy (self-organising and -selecting). | Complex motivation and multiple aims of partners with strong emphasis on intrinsic drivers. | Research outcomes. | Participatory/ user-generated content/central role of prototype/iterative. | An iterative process of transfer, sharing and creation - both within the team and wider stakeholders (user-generated content). |
| **Bretton Buzz** | Exploratory, emergent and novel. | Exploring the application of emergent technology. | Multiple organisations and disciplines with strong emphasis on practical application of technology and proof of concept. | Limited resources (cash and time). Significant PhD input and leveraging associated projects. | A high degree of team autonomy (self-organising and -selecting). | Emphasis on intrinsic drivers and potential value to professional practice. | Research outcomes and proof of concept. | Central role of the prototype as a stimulus for feedback and learning. | Emphasis on sharing and co-creation/co-production through iterations (core team and with wider stakeholders). |
| **Open Planning** | Exploratory, emergent and novel. | Exploring the application of emergent technology. | Multiple organisations and disciplines. | Limited resources (cash and time) with significant PhD input. | A high degree of team autonomy (self-organising and -selecting). | Emphasis on intrinsic drivers and potential value to professional practice. | Research outcomes and prototype. Insights for improving professional practice. | Design-led with central role of mockups and prototypes. | Iterative process of transfer, sharing and co-creation (core partners and wider stakeholders). |
| **T.Dan Smith** | Exploratory, emergent and novel. | Exploring innovative methods for using content to engage the public. | Multiple organisations and disciplines. | Limited resources (cash and time) with significant PhD input. | A high degree of team autonomy (self organising and selecting). | Complex motivation and multiple aims of partners with strong emphasis on intrinsic drivers. | Research outcomes. | Design-led with central role of mock ups and prototypes of new methods. | Iterative process of transfer, sharing and co creation (core partners and wider stakeholders). |
| **Hybrid Lives** | Exploratory and emergent. | Exploring social behaviour through the design of space and use of embedded technologies. | Multiple organisations and disciplines. | Limited resources (cash and time) with significant PhD input. | A high degree of team autonomy (self-organising and -selecting). | Complex motivation and multiple aims of partners with strong emphasis on intrinsic drivers. | Public-facing exhibition as the basis for research outcomes and insights for improving professional practice. | Design-led with central role of mockups as the basis for delivering exhibition. | Iterative process of transfer, sharing and co-creation (core partners and wider stakeholders). |
| **Kendal** | Exploratory, emergent and novel. | Demonstrating the value of a design-led approach to visualising patient data using existing technology. | Multiple organisations and disciplines. | Limited resources (cash and time) with significant PhD input. | A high degree of team autonomy (self-organising and -selecting). | Emphasis on intrinsic drivers and potential value to professional practice. | Research outcomes and prototype. Insights for improving professional practice. | Design-led with central role of mockups as the basis for delivering a working prototype aligned with clinical practice. | Iterative process of transfer, sharing and co-creation. |

Table 34 Characteristics of Creative Exchange KE case projects

The following domains of analysis are identified:

- *Approach* (the ways adopted to understand project context and define solutions): The projects emphasised *exploration of emergent themes* associated with technology, its potential applications and related social contexts. These characteristics were reflected in the aims and method by which the collaborations set out to achieve their desired outcomes. Some of the projects introduced novel partners and methods for the respective participants.

- *Context* **(**relates to the wider organisational, cultural and technological context within which project design and delivery occurred): Context varied significantly between projects although all the projects placed a high priority on exploring and understanding emergent opportunities and challenges associated with each. Innovative methods were identified and deployed (technology and/or process) for engaging end users as part of products and services as an integral element of methodology and method.

- *Complexity* (professional and organisational mix of team members and wider stakeholders): Highly complex collaborations in terms of multiple disciplines working across different organisations (small and large, public and private). Each team included creative practitioners as part of the core delivery team. An important characteristic across the CX programme was the central role that PhDs played in project conception, design and delivery.

- *Scale (*related to time and budget)*:* The projects are characterised by limited resources in terms of time (actual time was a fraction of elapsed time from conception through to completion) and cash (average size £12,000). Of particular significance was the PhD's inputs, which were not directly costed against project budgets (instead carried by the overall programme budget).

- *Degree of team autonomy*[62] (the degree of independence that teams have in self-management): A high degree of autonomy was exhibited by all the teams in relation to how they organised themselves to achieve their desired outcomes. There were no pre-conditions or guidance provided by the project sponsor on how or who would take responsibility for respective areas of project management and delivery, nor in terms of the methods to be selected by the teams.

[62] Team autonomy: "*The extent to which a team experiences freedom, independence and discretion in the performance of its tasks*" Buchanan and Huczynski, 2004, p.392.

- *Motivation* (motivation of team members and wider stakeholders**)**: Intrinsic motivation played a significant role in partner engagement and while there was (in some cases) a recognition of potential commercial outcomes in the long term, the principal motivation appeared to be the potential value to professional, research and creative practice.

- *Outcomes* (project deliverables and impacts): Reflecting motivation, the principal outcomes of the project ***(***noted at the time data was collected) focused on: *research outcomes* (papers, presentations, case studies); *prototypes* (technology or method); and insights that would be applied to *future professional practice*.

- *Methodology*:[63] Design as method and creative practice emerged as dominant themes that shaped the project methodology. This was reflected in an iterative process of: i) understanding context; ii) identifying possible solutions; iii) creating generative tools and approaches for co-design; and iv. placing emphasis on exploring and developing working prototypes as part of the project process and outcomes.

- *Knowledge Exchange* (the processes by which knowledge is transferred, shared and co-created within the context of collaborations): In this context, knowledge exchange is related to the *dynamic process by which knowledge is transferred, shared and created* within the core collaboration and with wider stakeholders e.g. community groups. All projects demonstrated a knowledge continuum through their respective lifespans, from transfer and sharing, leading to co-creation and application within the collaborations and manifest in the prototypes themselves.

[63] Methodology: *" the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes"* (Crotty 1998, p.3).

*Agile Management - a point of reference*

While the mode of knowledge exchange identified in the context of the CX strategy reflects the characteristics of knowledge exchange identified in the typology (Table 33), a further dimension of alignment is explored between the characteristics demonstrated by the CX cases and the principles of Agile Management (Table 35).

The Agile Manifesto appeared in 2001 and was written by seventeen software developers (Eck et al. 2001). The manifesto reflected four core values and provided the basis for the definition and development of principles and tools to support management practices associated with new product development:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

These values have been adapted and elaborated by Rigby and colleagues (2016, n.p.):

People over processes and tools:

"*Projects should be built around motivated individuals who are given the support they need and trusted to get the job done. Teams should abandon the assembly-line mentality in favour of a fun, creative environment for problem solving, and should maintain a sustainable pace. Employees should talk face-to-face and suggest ways to improve their work environment. Management should remove impediments to easier, more fruitful collaboration*".

Working prototypes over excessive documentation

"*Innovators who can see their results in real market conditions will learn faster, be happier, stay longer, and do more valuable work. Teams should experiment on small parts of the product with a few customers for short periods, and if customers like them, keep them. If customers don't like them, teams should figure out fixes or move on to the next thing. Team members should resolve arguments with experiments rather than endless debates or appeals to authority*".

Respond to change rather than follow a plan

"*Most detailed predictions and plans of conventional project management are a waste of time and money. Although teams should create a vision and plan, they should plan only those tasks that won't have changed by the time they get to them. And people should be happy to learn things that alter their direction, even late in the development process. That will put them closer to the customer and make for better results*".

Customer collaboration over rigid contract

"*Time to market and cost are paramount, and specifications should evolve throughout the project, because customers can seldom predict what they will actually want. Rapid prototyping, frequent market tests, and constant collaboration keep work focused on what they will ultimately value*".

Based on core values, the Agile Alliance define the following principles for Agile management (Agile Alliance 2016):

| | **Principle of the Agile Approach** |
|---|---|
| 1. | Our highest priority is to **satisfy the customer** through early and continuous delivery of valuable software. |
| 2. | **Welcome changing requirements**, even late in development. Agile processes harness change for the customer's competitive advantage. |
| 3. | **Deliver working software** frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale. |
| 4. | **Business people and developers must work together** daily throughout the project. |
| 5. | **Build projects around motivated individuals**. Give them the environment and support they need and trust them to get the job done. |
| 6. | The most efficient and effective method of conveying information to and within a development team is **face-to-face conversation**. |
| 7. | **Working software is the primary measure of progress**. |
| 8. | Agile processes promote **sustainable development**. Sponsors, developers, and users should be able to maintain a constant pace indefinitely. |
| 9. | Continuous attention to **technical excellence and good design** enhances agility. |
| 10. | **Simplicity** (the art of maximizing the amount of work not done) is essential. |
| 11. | The best architectures, requirements, and designs emerge from **self-organizing teams.** |
| 12. | At regular intervals, the **team reflects on how to become more effective,** then tunes and adjusts its behaviour accordingly. |

Table 35 The Agile Principles

Often contrasted with traditional command and control management practices (both at the corporate and project level), the values and principles of Agile have spread beyond information technology and software development to be adopted and adapted by other industries in both product and service (Rigby et al. 2016). Highsmith (2009) defines Agile Management (Agile) as being adaptive, with its emphasis on *envisioning, exploring and refining*, and in marked contrast to traditional models of innovation described as anticipatory based on *defining, designing and building*. This approach to innovation depends on highly autonomous and skilled teams working efficiently and quickly to explore and prototype in response to emergent possibilities and consumer needs.

The value of the Agile approach is strongly aligned with specific market conditions (Table 36) characterised as dynamic and fast-changing in terms of opportunities and consumer needs; where product- and service-innovation are identified as a continuous and fast-moving process of exploring opportunities and responding quickly and flexibly to emergent and uncertain consumer and user needs.

| | Favourable | Unfavourable |
|---|---|---|
| Market Environment | Customer preferences and solution options change frequently. Close collaboration and rapid feedback are feasible | Market conditions are stable and predictable. Requirements are clear at the outset and will remain stable. |
| Customer Involvement | Customers know better what they want as the process progresses. | Customers are unavailable for constant collaboration. |
| Innovation Type | Problems are complex, solutions are unknown, and the scope isn't clearly defined. Product specifications may change. Creative breakthroughs and time to market are important. | Similar work has been done before, and innovators believe the solutions are clear. Detailed specifications and work plans can be forecast with confidence and should be adhered to. Problems can be solved sequentially in functional silos. |
| Modularity of Work | Incremental developments have value, and customers can use them. Work can be broken into parts and conducted in rapid, iterative cycles. Late changes are manageable | Late changes are expensive or impossible. |
| Impact of Interim Mistakes | They provide valuable learning. | They may be catastrophic. |

Table 36 Ideal conditions for an Agile approach (Rigby et al. 2016)

A further concept relevant to Agile is that of the *Minimum Viable Product* (MVP). Moogk (2012) explores the concept of MVP as part of the lean approach to product development, particularly in relation to its value in exploring the viability of new product concepts in the context of start-up companies operating in highly uncertain environments. The notion is for the MVP to place priority on the development of a working product concept (prototype) that can be used to catalyse feedback from customers and stakeholders to evaluate its technical and commercial viability. This is a working prototype that embodies the minimum mix of features (and costs) that are necessary to evaluate its market potential.

**Alignment between the CX mode of knowledge exchange and Agile principles**

This analysis (Table 37) explores the degree of alignment between the CX model of knowledge exchange identified from the case analysis, and the principles of Agile Management adapted[64] from the Agile Manifesto (Eck et al. 2001). The ratings reflect the researcher's own analysis[65] and are presented by the CX domains reflecting characteristics in relation to the adapted principles of Agile. The ratings range from strong, via partial to neutral alignment, where categories are perceived as not being directly relevant. The overall alignment is considered to be strong.

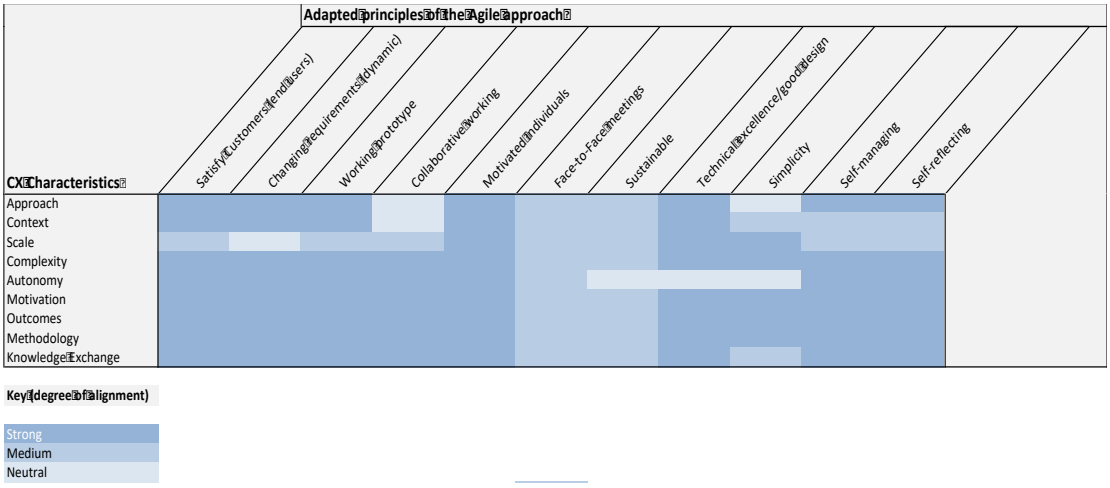



Table 37 Alignment of the case projects with Agile management principles

[64] The adaptation reflects the focus on end users (not just customers) and prototype, to be inclusive of more than just software.

[65] This does not include an ex-post analysis of process and impact but rather insights from data in terms of describing the collaborations or aspirations for the project.

- *Approach*: Of particular significance was the emphasis on exploring complex, emergent and dynamic areas of user context including technology, applications and related social behaviour. The theme of exploration also described the processes by which teams defined aims, methods and roles.

- *Context*: Although the CX social and organisational contexts varied, they exhibited a high degree of novelty and emergent areas of technology, application and method. All the contexts placed a high degree of importance on engaging, understanding and responding to end users' needs.

- *Scale*: The CX projects were transitory in nature with teams not usually co-located and which came together for a limited time with limited budgets during design and implementation. This undermined the capacity for face-to-face meetings (although recognised as important) and the sustainability of team working.

- *Complexity:* The complexity and diversity of project teams (e.g. organisations, expertise, insights) generated benefits in terms of the range of skills and perspectives that could be drawn on in project design and delivery, reflected in the capacity to explore and identify user needs as the basis for developing working prototypes.

- *Autonomy*: The flexibility and autonomy in decision-making exhibited by CX project teams is strongly aligned with Agile. Reinforcing the ability for teams to explore and respond quickly to opportunities for product and service development associated with emergent technologies, applications and methods.

- *Motivation*: CX projects demonstrated a high degree of intrinsic motivation by core team members reflecting their research interests and desire to improve professional practice. This was considered by the researcher to be strongly aligned with a number of the Agile principles, reinforced by the self-selection of people into and out of the project teams.

- *Outcomes*: Reflecting the motivation of core partners, outcomes reflected research interests and insights for professional practice. Often, the partners were aware of a potential commercial value for project outputs but this was not a primary motivator for the collaborations.

- *Methodology*: The methodology demonstrated by the CX projects exhibited a strong emphasis on iterative design and creating working prototypes as part of the process and outcomes. Central to this approach was the value attached to the design methodology and the role of creative practitioners and their ability to facilitate the co-design and production.

- *Knowledge Exchange* (knowledge transfer, sharing, co-creation and application): A dynamic and iterative process of knowledge sharing and creation as a central driver to team learning and developing working prototypes that aim to address user needs.

**Summary**

*"...'tech transfer' is being displaced by 'knowledge transfer' which, in turn, is being challenged by the concept of the more free-flowing multidimensional 'knowledge exchange' between the three sectors of the 'triple helix', comprising universities, business and government, to which some would also add the public"* (Hagen 2008, p.103).

A lack of clarity in the use of the terms 'technology' and 'knowledge transfer' has been identified by Gopalakrishnan and Santoro (2004), noting that the terms are often used interchangeably. Hagen (as reflected in the opening quote to this section) identifies a transition in the use of terms as knowledge exchange is being increasingly adopted to reflect a *'multi-dimensional process*' of collaboration. From the author's own direct experience as a KE practitioner, the terms are often used interchangeably with the lack of a shared understanding on the meaning of the concepts themselves.

The concept and use of the term '*knowledge exchange*' was also explored in a survey of professional staff employed by 25 UK universities working in roles supporting the delivery of knowledge exchange activities (Polkinghorne 2011). While the term was considered by respondents to more accurately describe the two-way flow of knowledge reflected in many collaborations when compared to knowledge transfer, as a concept it was not considered to be grounded in academic rigour, with 59% of those interviewed considering it to be a *'public sector buzz word'* (Polkinghorne 2011, p.4).

In the context of research undertaken as part of this enquiry, the language of knowledge exchange elicited different responses from those interviewed, including a perception, by some, of a negative and transactional meaning associated with the word exchange.[66] During the interviews, the researcher was often requested to provide additional briefing to clarify related issues and questions relating to the concept and meaning of KE in practice, with an accompanying perception that the term described a top-down policy rather than reflecting a dynamic process of collaboration and team working.

In practice, the term knowledge exchange can be used to describe either a distinct mode of collaboration or a continuum of collaboration inclusive of different forms of university engagement, projects and activities (including those associated with technology and knowledge transfer). In order to clarify the nature of knowledge exchange and explore the characteristics of the different forms of collaboration, a typology is outlined (Table 33) drawing on insights from the literature review and the case analysis. The three concepts (TT, KT and KE) are explored in terms of their underlying assumptions, methods and processes as a basis for beginning to clarify KE and its relationship to these other forms of university engagement. On the basis of this typology, KE can be differentiated as a distinct mode of university collaboration.

[66] Exchange: "*An act of giving one thing and receiving another (especially of the same kind) in return*" (Oxford Unversity Press n.d.).

A further dimension of analysis identifies the characteristics of the selected CX case projects included in the case study analysis. These characteristics are grouped into ten categories (domains) and used to identify a discrete approach to knowledge exchange (within the broader KE category). Based on these characteristics, a strong alignment is identified between the Creative Exchange model of knowledge exchange and the principles of Agile Management (Table 37). An important element of this alignment being a strong fit with social contexts which are characterised as emergent and unknown, strongly reflecting the nature of the Digital Public Space.

Notable differences in the CX model of KE in relation to the Agile context, were identified with reference to the non-commercial research interests of key participants and the transitory nature of complex teams, which came together for a limited duration from different organisations and professional disciplines (rather than semi-permanent product development teams working within organisational boundaries). Further distinguishing characteristics included the key role played by PhDs and academics and the central emphasis on design in method and practice (inclusive of a variety of different creative practitioners).

The insights into the CX form of knowledge exchange are explored further in Chapter 11.

# Chapter 11 Conclusions

Chapter 11 provides the opportunity to reflect on the research question in light of the insights and experience generated from this enquiry.

*Can we improve the design and delivery of knowledge exchange through insights from existing theory identified from the literature review and case study analysis based on selected projects implemented through the Creative Exchange?*

Two propositions aligned to the overarching research question provided focus for the study in exploring the concept and practice of knowledge exchange. Insights from the literature review and case study analysis are drawn on in; i) identifying characteristics of CX projects selected for inclusion in the case study as the basis for clarifying the concept of knowledge exchange in in the context of the Creative Exchange; and ii) identifying factors that have influenced the design and delivery of these projects as the basis for defining enabling themes, factors and related measures for supporting future knowledge exchange projects. This chapter is structured to address these two overarching themes.

***Proposition 1.*** *That key characteristics of selected Creative Exchange project-based collaborations can be identified and used to support the development of a typology of knowledge exchange.*

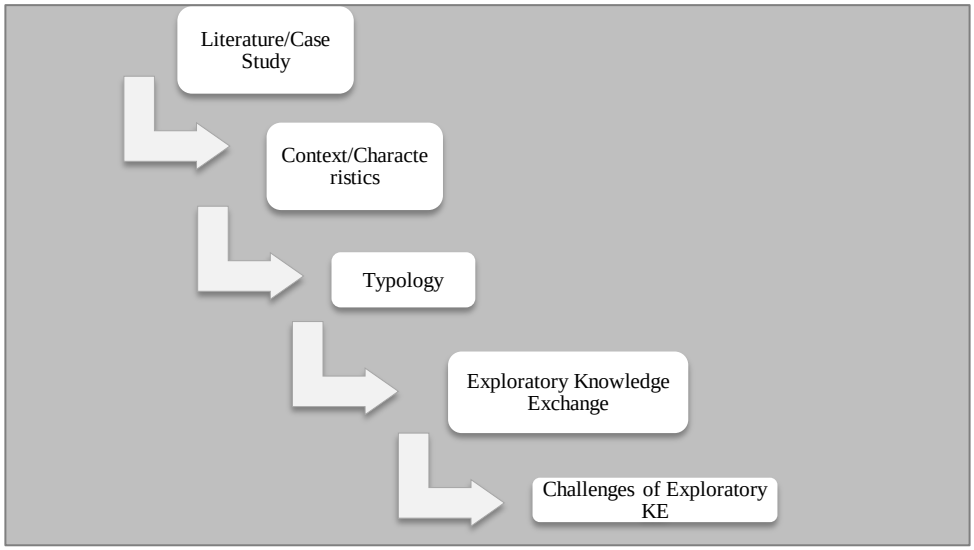



Figure 56 Steps taken in identifying characteristics of selected CX case projects

The term knowledge exchange is increasingly adopted by policymakers, sponsors and universities to describe different forms of collaboration between universities and public and private sector partners (Hagen 2008). It is often used interchangeably with the concepts of technology and knowledge transfer (and other forms of collaboration). A key insight from the research enquiry is that the concepts of technology transfer (TT), knowledge transfer (KT) and knowledge exchange (KE) reflect distinct assumptions concerning the process of innovation and collaboration which act to shape the design and delivery of related enabling policy and support.

To assist in exploring and understanding these three modes of university engagement, a typology was developed (Chapter 10), informed by the literature review (Chapters 4, 5 and 6) and case study analysis (Chapters 7, 8 and 9). In this context, the term knowledge exchange was identified as describing a discrete and distinct mode of collaboration reflecting a non-linear and iterative process of innovation inclusive of a broader range of methods, disciplines and forms of knowledge sharing and creation in comparison to technology and knowledge transfer.

**Knowledge exchange as a dynamic process of collaboration**

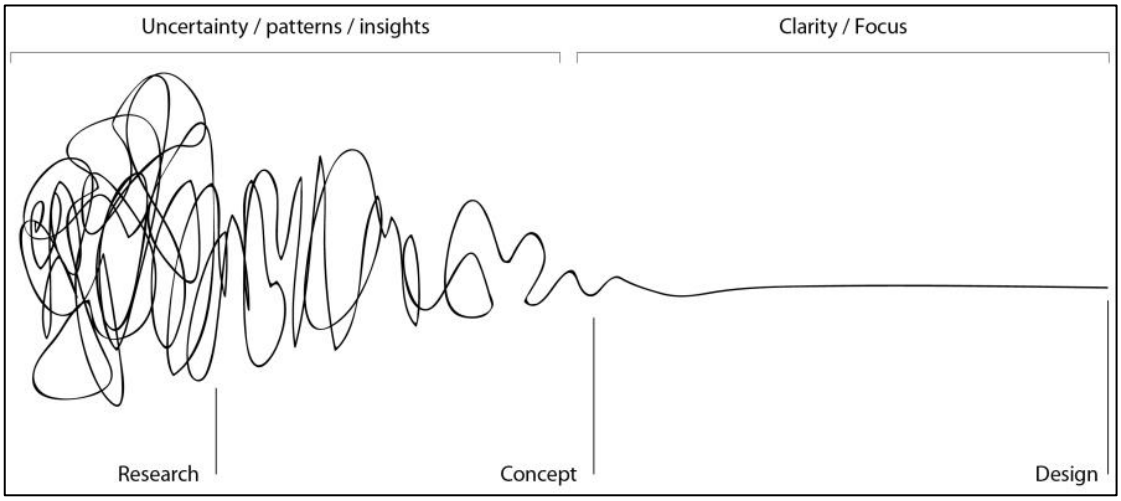



Figure 57 An illustration of the CX project process (Newman 2010)[67]

[67] Creative Commons Attribution (*not for circulation*).

Illustrated by the Design Squiggle (Newman 2010), Figure 57 illustrates a project development process reflected across the case analysis. Where a non-linear journey of exploration and discovery leads from uncertainty to a high degree of clarity in relation to project design and delivery as teams move from design to delivery. A non-linear journey occurring within a temporal and linear framework, where clarity manifests in the form of physical prototypes, evidence into technical and social feasibility and research insights and outputs. The point of final closure may lead to follow-on projects e.g. commercialisation or research follow-up or alternatively, the clarity may be manifested as a decision not to take the project forward[68] to a next stage.

The divergent and convergent natures of the development process can manifest as a *creative tension*[69], where tensions emerge between team members and are resolved through discussion, consultation and prototyping. In this regard, knowledge sharing and creation (e.g. through prototyping) has the potential to catalyse a shared understanding around aims, method and roles. These processes leading to greater clarity and certainty across dimensions of design and delivery, enabling the different perspectives, skills and personalities of a diverse team to be leveraged to achieve project objectives. As noted by Engeström and colleagues, with reference to the development of group cognition, where (Engeström et al. 1995 cited in Akkerman et al. 2007, p.55):

*"The development of group cognition is a process of negotiating and interrelating diverse views of group members. This process enables group members to learn from others' preferences and viewpoints by facing different viewpoints and by accepting the existence of them as legitimate".*

[68] This corresponds to the concept of the innovation funnel for new product concepts which are evaluated and whittled down through stages to those that have the highest chance of success (Institute of Manufacturing n.d.).

[69] A situation where differences and disagreement ultimately lead to better ideas, understanding and outcomes. Reflecting the concept of '*constructive conflict'* as outlined by Bossche and colleagues (2011).

An alternative and relevant perspective reflecting the dynamics of equilibrium is echoed in the concept of *Tensegrity* identified by Buckminster Fuller (Goodman & Kirk 1996) in relation to three dimensional structures. This design concept describes a system of integrated and interconnected structures, where tension and pressure interact, flow and are resolved through the structures to provide and maintain shape. These are principles explored in the context of novel organisational structures and focused on the resolution of tension to secure stability and equilibrium (Judge 1979).

**An Exploratory Mode of Knowledge Exchange**

*"No Maps for these Territories"* (Neale 2000)[70]

A question reflected on in the enquiry was whether the three concepts of university collaboration (TT, KT and KE) adequately describe the approach manifest in the characteristics of selected CX projects included in the case study. Insights from the typology and from the case study analysis presented in Chapter 10 support the identification of a distinct mode of CX collaboration in the form of collaborative research and development, strongly aligned with the principles of Agile Management (Agile Alliance 2001). A distinguishing feature of the CX mode of engagement was the complexity of the collaborations and the central role[71] that creative practice and PhDs played in their design and delivery.

Distilled from this analysis, an *Exploratory Mode of Knowledge Exchange* (specifically collaborative research and development) is identified as a discrete form of a broader KE concept where:

[70] *No Maps for These Territories* (Neale 2000) is the title of a documentary made by Mark Neale centred on an interview with William Gibson, author of *Neuromancer* (1984) exploring the concept of cyberspace.

[71] It is posited that the Exploratory Mode could be designed to include/exclude the PhD element.

*Complex interdisciplinary, interorganisational and transient teams act with a high degree of autonomy and flexibility in exploring and defining opportunities and challenges associated with emergent technology, applications, market places and wider social contexts. Where PhDs play an active role in project design and delivery as an integral part of their own research journeys and where knowledge is shared, generated and applied through the act of collaboration itself. Creative and design practice are critical elements of methodology and play a central role in catalysing knowledge sharing and creation, both within the team and between the team and wider stakeholders. Where the co creation of mock ups and working prototypes are central in project delivery and outcomes.*

The Agile approach to managing innovation is argued to be strongly aligned and demonstrate advantages with reference to particular market conditions where:

*"The problem to be solved is complex; solutions are initially unknown, and product requirements will most likely change; the work can be modularized; close collaboration with end users (and rapid feedback from them) is feasible; and creative teams will typically outperform command-and-control groups"*. (Rigby et al 2016, p.4)

Reflecting the insights related to Agile (Rigby et al. 2016; Thurik 2009; Wang 2015), it is argued that an Exploratory Mode of KE may have a comparative advantage relative to other modes of collaboration in certain social conditions related to emergent technology, user needs and markets (Table 38). As noted by Wang (2015, p.127);

*"... decreasing product lifecycle and increasing product complexities lead to increasingly dynamic and competitive landscape in the high-tech industry*".

Adapted to knowledge exchange to KE, Table 38 identifies the circumstances where Exploratory KE is considered by the author to have a similar advantage:

| Dimension | Context |
|---|---|
| Technology | Emergent and untested technologies and/or applications as the basis for potential products, services and methods (e.g. digitally enabled). |
| Market/Social Context | Dynamic and fast changing social context with emergent demand or no effective demand for untested product or services. Many unknowns with strong emphasis on exploring needs, context, opportunities and challenges (both technical, commercial and social). |
| Customer/User Involvement | Priority attached to understanding social context and align product ideas and concepts with users' needs during development. This is reflected in engaging potential customers/users as partners in design. |
| Type of Innovation | Early stage concept and prototype development with emphasis on proof of concept through mock-ups and prototypes (product and service). |
| Methodology (method) | Iterative and emergent with lessons learnt and applied en route. Cyclical process of prototyping, getting feedback from potential users/modifying and re-deploying. |
| Interim Mistakes | Lessons learning is essential as the basis for iteratively finding product/service solutions in relation to user/customers needs (feedback loops). |

Table 38 Favourable conditions for Exploratory KE (adapted from Rigby et al. 2016)

A mode of collaboration that has potential to generate value in research and teaching and also addresses wider market failures in terms of high-risk commercial research and development investment. This potential fit between exploratory KE at the beginning of a product/service development journey reflects a contingency approach[72] to process design. Where KE projects are designed to create highly flexible, lean[73] and autonomous teams that can react quickly to emergent opportunities and challenges where product/service development is catalysed through prototyping and emphasis is placed on on-going feedback and learning.

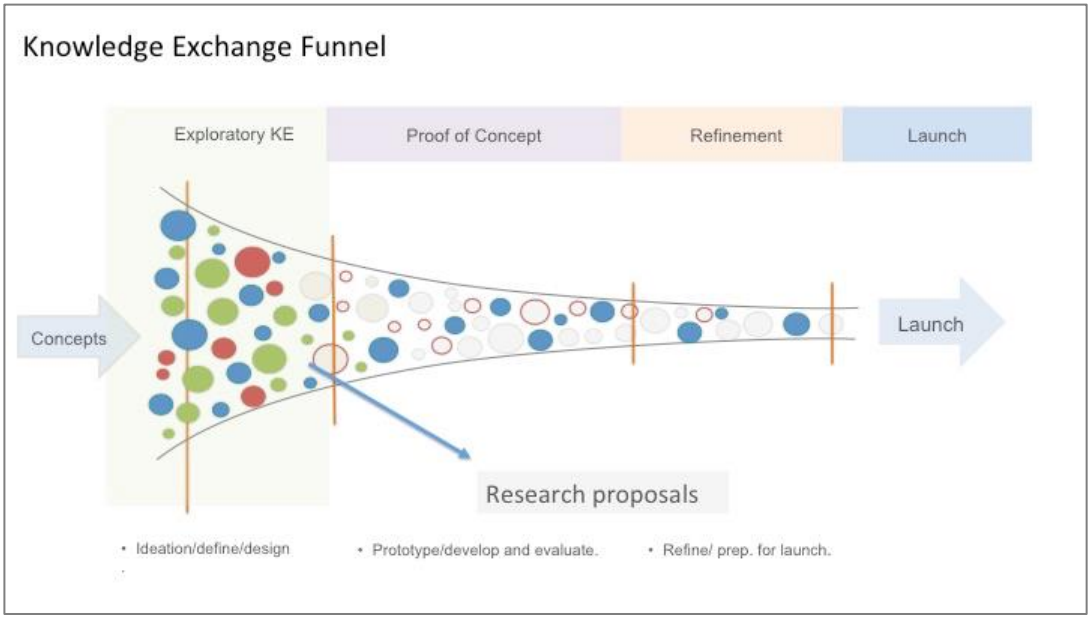



Figure 58 The innovation funnel adapted to a process of KE project development

[72] Contingency approach is a perspective in organisational behaviour which states that for an organisation/team/leader to be effective, it/they must adapt and align with the prevailing circumstances including the operating environment e.g. technology, structures, scale, culture. (adapted from Buchanan & Huczynksi 2004, p.520).

[73] "*Lean means creating more value for customers with fewer resources...The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste*" (Lean Enterprise Institute 2017).

Figure 58 illustrates the example of an *Exploratory Mode of Knowledge Exchange* situated in the operational context of a *Knowledge Exchange Funnel*, adapted from the concept of the Innovation Funnel.[74] The figure shows a development process where projects pass through stages corresponding to funding decisions. The funnel is focused on identifying and supporting concepts which have the potential to develop into commercially and/or operationally viable products and services. It allows for the integration of public and private funding windows in support of project concepts as they progress in maturity. The *research proposal* arrow indicates a separate pathway for projects which emerge from the exploratory phase which are aligned with research aims and funding streams. The funnel illustrates how an exploratory mode of KE could fit into such a structured KE project development process.

***Proposition 2.*** *Factors that enable and support the delivery of knowledge exchange collaborations can be identified from the case study analysis with insights then used to inform the design of an enabling framework to support the delivery of future knowledge exchange projects.*

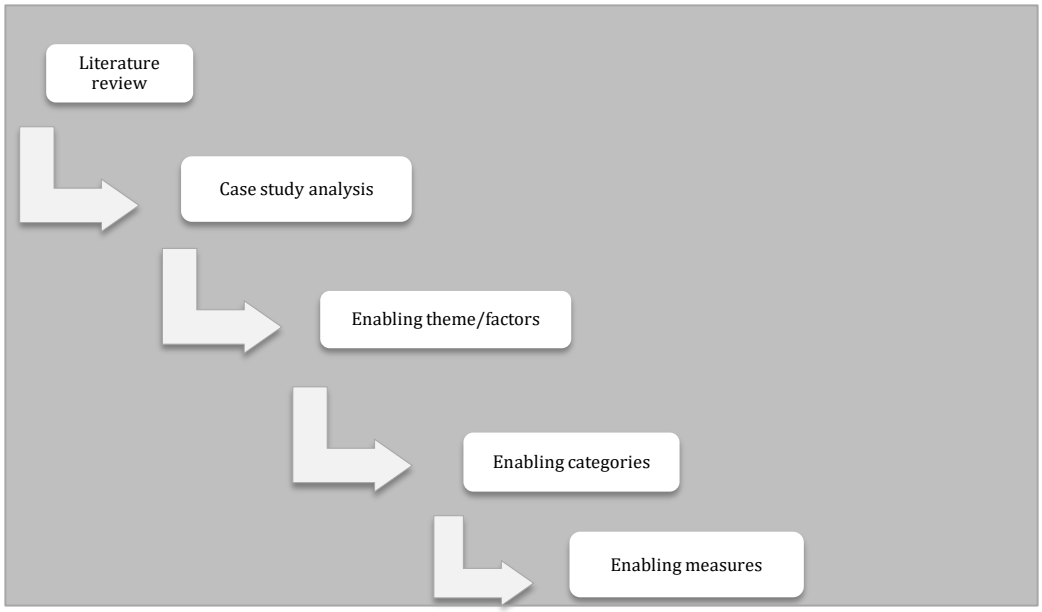



Figure 59 Steps taken in developing a KE enabling framework

[74] The earliest reference to a staged product development journey was cited by Katz (Katz 2010, p.25) regarding the work of Urban and Hauser (Urban & Hauser 1993) with reference to the design and marketing of new products. Subsequent versions and refinements in the concept have occurred including that by Chesbrough in the context of the Open Innovation model of innovation (Figure 9).

The enabling categories (Table 39) emerging from the case study analysis, identify important factors that influence and shape team effectiveness in pursuit of project goals.[75] The categories are defined on the basis of the *enabling themes* (Chapter 9) regrouped under the new category headings. While not exhaustive, the insights provide a basis for developing the Enabling Framework (Figure 60) where the categories are associated with dimensions reflecting project structure, process and method and highlight issues that could be addressed through proactive measures.

| **Domain**[76] | **Enabling Categories**[77] |
|---|---|
| Inputs | **Clarify** emergent team roles and responsibilities. |
| | **Discuss**, understand and agree the PhD's role. |
| Process | **Proactive** management (inception to delivery). |
| | **Effective communication.** |
| | **Explore and understand** organisational and user context. |
| | **Simple and realistic** administration. |
| | Use **design** (methodology and tools) to align activities with needs. |
| | **Prototyping** to catalyse knowledge sharing and creation. |
| Emergent States | Prioritise development of a **shared understanding** (context and user needs). |
| | Invest in **aligning team and stakeholder expectations** (inputs/method/outputs). |
| | Develop a **shared strategy for Intellectual Property (IP).** |

Table 39 Summary of enabling categories from cross-case analysis

[75] The research methodology and methods have not provided a basis for the enablers to be prioritised nor to address causality in detail between the enabler and outcomes.

[76] Derived from existing theory on team effectiveness (Chapter 9).

[77] Distilled from the themes and factors from the cross-case analysis (Chapters 7, 8 and 9).

**Defining an enabling framework (categories, themes and measures)**

The Enabling Framework reflects the categories, themes (Figure 60) and factors identified through the cross case analysis (Table 39). When combined with the enabling measures identified in Table 40 below, they provide both a framework of analysis and action in support of enabling complex KE collaborations of the type identified through the case analysis.

The principal purpose of this enabling framework/measures is to catalyse discussion and reflection amongst knowledge exchange practitioners focused on exploring different approaches for supporting the design and delivery of knowledge exchange programmes and assist teams, sponsors and stakeholders to successfully navigate complexity and uncertainty. Specifically, in relation to the challenges and opportunities identified in relation to the exploratory mode of knowledge exchange and its wider context:

- *Complex* teams working across organisational and professional boundaries (e.g. academic, commercial, not for profit).

- *Highly novel* teams where individuals may not know each other nor have worked together before or after.

- *Autonomous teams with no* ex ante agreement on leadership/roles and responsibilities requiring the team to reach a shared understanding.

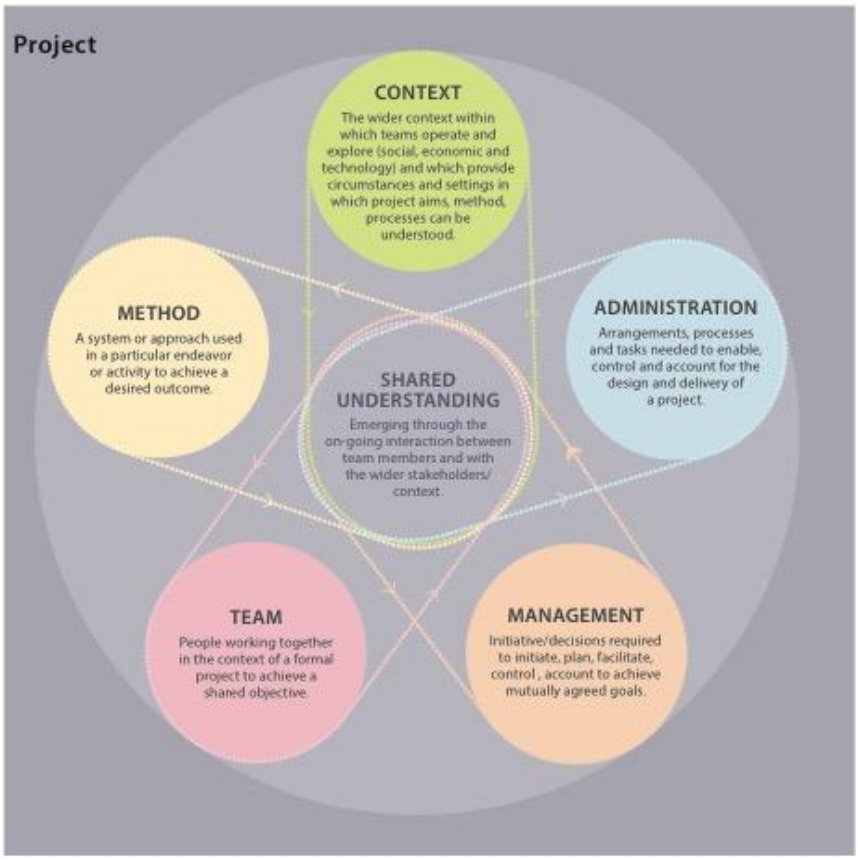
- *Diverse teams and wider stakeholders* in terms of perspectives, skills, motives expectations and often location.

- *Limited resources* in terms of time and money.

- *Emergent understanding of process and context* within an overall administrative framework. Project norms, values, aims and methodology are not pre-agreed or subject to being imposed by external authorities.

The enabling categories, themes and factors are not ranked by relative importance in terms of their impact on project outcomes, although discussion and observation highlighted *shared understanding* as a critical and cross cutting enabling process (as reflected in its central position in Figure 60).

This shared understanding taking place in the context of transitory teams whose members are unlikely to have had experience of working together before. Teams which are operating across organisational and professional boundaries and cultures with limited resources. The arrowed lines in Figure 60 illustrates the dynamic nature of the relationship between the enabling categories in generating a shared understanding at the team level and in facilitating team effectiveness reflecting the insights mirrored in the concept of a Knowledge Triangle (Chapter 9).




**FRAMEWORK THEMES**

**Context**

- Flexible project design
- Leverage diverse skills/expertise
- Indentify risks and opportunites
- Ensure adequate resources for building relationships
- Identify stakeholders who want to engage and support them
- Design provocations to catalyse engagement

**Administration**

- Simple and efficient process
- Adequate administrative support
- Market rates for service providers
- Realistic planning in relation to time and resources
- Use formal procedures eg approval to catalyse clarity and shared understanding

**Management**

- Identify risks and mitigation measures
- Allow time for formal/informal discussions
- Consider challenge led workshops to catalyse collaborations/design
- Explore how knowledge sharing can be facilaited
- Manage/coordiante workflows
- Discuss and agree IP strategy at early stage

**Team**

- Meet and discussface to face (particulary during early phase)
- Flexible and iterative exploration of roles
- Identify and value different expertise, eg from the project context
- PhD to be involved during early stages and be open about interests
- Identify and discuss values that the collaboration aspires to, eg trust/openess
- Keep team and stakeholdres informed
- Discuss and ideate roles and responsiblities

**Method**

- Iterate
- Use protypes to explore and understand context/needs
- Early agreement on the role of prototying
- Adquate resources
- Prototypes/workshops to catalyse knowledge sharing/creation
- Priorise qualitative feedback, eg users
- Create spaces for user groups to engage and provide feedback

Figure 60 Enabling framework - categories/themes and factors

*Enabling measures*

Table 40 illustrates a number of possible measures defined in support of team working at the project level. The measures have been outlined on the basis of insights from case study analysis and research experience in the design and delivery of knowledge exchange projects. The measures identified are aligned with a team-centred model of autonomous decision-making demonstrated in the CX projects and focused on supporting team capacity and shared understanding in relation to the opportunities and challenges at the project level.

| **Enabling Measures** | **Timing**[78] | **Locus** |
|---|---|---|
| Team orientation/check list (for team discussion and agreement) | Design/ Inception | The team with support from the organisational lead.[79] |
| Thematic briefing/discussion | Design/ Delivery | Team with support from organisational lead |
| Team statement on norms | Design/ Inception | Team |
| Criteria for project approval addressing key elements deemed important e.g. clear roles, clear methods to support user engagement, deliverables, IP strategy etc. | Design | Lead and sponsor |
| Workshops/facilitation/tools | Design/ Delivery/Closure | Team with access to support from the organisational lead (s)[80] |
| Team mentoring | On-going | Team with access to support from the organisational lead (s) |

Table 40 Enabling framework: measures for the support of KE project design and delivery

[78] Timing reflects a staged project from inception to design and delivery.

[79] Lead refers to the lead university and/or consortium partners. This reflects the structure of the Creative Exchange and will have different configurations depending on the programme/project funding stream/sponsors.

[80] During inception, design and delivery as required (responsive mechanism).

- *Orientation briefing and checklist:* An early stage team briefing by representative of lead partner(s), highlighting issues that the project team should be aware of and that need to be addressed in project design and delivery including an awareness of formal approval criteria. The briefing will provide a framework for team discussions and agenda for agreement and review during implementation.

- *Subject briefing:* Issues identified as critical to team performance and project design and delivery. The topics identified by the team/sponsor and briefing provided by the team and/or with external support. Topics could include:
    - Values/norms/decision-making processes
    - Social and institutional context
    - Technology/method
    - Intellectual property
    - Workshop design and role of facilitation

- *Team discussion and statement on norms*: Early discussion and agreement on behavioural norms[81] and values related to team working as a key enabler (a manifesto) for effectiveness. Openness, respect and honesty play an important role in developing a shared understanding of motives, roles, workflow, methodology and aims.

- *Criteria for project approval:* Transparency and awareness in relation to administrative processes and criteria for decisions provide a framework in helping teams to focus discussion and catalyse project design. The formal processes helping teams clarify design elements and a mechanism to reconcile autonomous projects with corporate/sponsor aims.

[81] Examples include participation and attendance at meetings, transparency in communication and decision-making.

- *Workshops/facilitation/tools:* The design and delivery of workshops can play an important role in supporting the development of a shared understanding context and user need and/or designing and catalysing feedback on mock-ups/prototypes. The provision of funding and expertise for the design and delivery of the workshop should be built into project design and/or accessed during delivery by the project team.

- *Team mentoring:* Access to external support (mentoring/facilitation) to assist in supporting collective problem solving. The focus being the team's capacity to reach agreement on aims, opportunities, challenges and methods. Examples could include IP, technical and operational issues or unforeseen challenges such as members dropping out, skill gaps etc. The aim is to provide support to the team (on request), that can support collective problem solving and decision making.

**Integrating the enabling framework into the KE innovation funnel**

Figure 61 situates the enabling framework in the context of a KE innovation funnel. The framework is aligned with the principles of '*Ba*' as defined by Nonaka (Nonaka et al. 2000, p.14).

"*Ba is here defined as a shared context in which knowledge is shared, created and utilised. In knowledge creation, generation and regeneration of Ba is the key, as Ba provides the energy, quality and place to perform the individual conversions and to move along the knowledge spiral*".

Noting that Ba can be more than a physical space, reflecting a given moment in space and time (e.g. digital/social/physical), the concept places emphasis on the importance of context and its role in knowledge creation. It thus provides a catalyst for a dynamic process of social interaction between individuals and context as driving forces in the knowledge creation process.

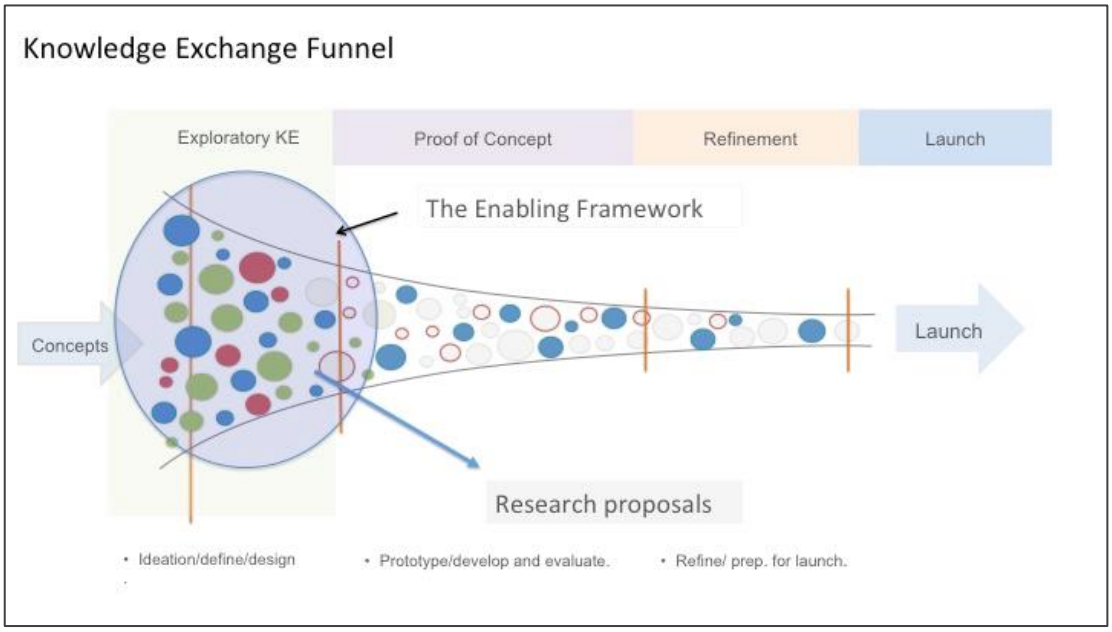



Figure 61 Situating the KE enabling framework in the context of the innovation funnel

As noted by Godin, cited in Chapter 4, the traditional models of innovation have fallen into two broad schools, namely: i) *temporal*, reflecting linear assumption as projects (and related products and services) develop through stages; and ii) *social*, system-framed models which focus on the social context within which innovation takes place identifying important actors and their interactions as central in shaping the process (OECD, 1978 cited by Godin 2017, p.5). The KE funnel (Figure 61) adopts a holistic approach and synthesises both the temporal and social dimensions of project development and of team working. This integration of the temporal and social/systems dimensions of innovation is also reflected in the adapted Input-Mediator-Output-Input model of team effectiveness presented in Chapter 9.

**Summary**

*"It is our strong conviction that knowledge cannot be managed only enabled"* (Krogh et al. 2000, p.1).

In the context of a wider typology of university engagement, specifically with reference to technology and knowledge transfer, knowledge exchange can be identified as a distinct but clearly defined spectrum of collaboration. It is inclusive of modes and forms of team working which place emphasis on a dynamic and iterative process of knowledge transfer, sharing and creation (as defined in Chapter 9). While it is recognised that most, if not all, forms of external collaboration involve codified and tacit knowledge, a distinguishing characteristic of KE is the relative weight attached to co-production of knowledge across a wide range of academic disciplines, social contexts, stakeholder communities, institutional and disciplinary boundaries, strongly drawing on tacit insights, experience and capabilities in the production process.

The *Exploratory Mode of KE*, identified from the cross-case analysis, reflects Agile principles and demonstrates strengths in relation to exploring social contexts associated with emergent technologies and applications. Contexts which reflect multiple dimensions of technology, applications and social behaviour and which are largely unknown at the point of departure as reflected in the concept of the Digital Public Space. This mode of KE provides a point of reference in identifying enabling themes and factors important in maximising positive project outcomes.

The enabling themes identified have illuminated the complex and dynamic processes by which individuals and teams explore and learn in addressing the challenges and opportunities of working together in a wider social and organisational context. Factors that reflect the temporal, structural and procedural dimension of projects and the values, norms and behaviours associated with team effectiveness. The development of a shared cognitive understanding and awareness between team members and wider stakeholders was identified as an important cross-cutting enabling theme providing a basis for self-organising and aligning inputs, method and outputs in addressing project aims.

A central observation is the complexity and multidimensional nature of human cognition (both individual and group). Reflecting the interaction and potential synergy between aspects of individual and group cognitive intelligence, reasoning and affective and emotional states. In this context the enabling and supportive team norms, values and behaviours are of central importance, the value of which appear integral to the development of shared understanding and as an enabler in team working.

Colin Martindale, from the perspective of a cognitive psychology, addresses the complexity of cognition in addressing a perceived bias in cognitive studies towards the rational dimension of human thought and behaviour and in this regard was of the view that:

*"We need to understand the "irrational" thought of the poet as well as the rational thought of the (laboratory) subject solving a logical problem ….Finally, since people are not computers, we must ask how emotional and motivational factors affect cognition"* (Martindale 1981 cited in Lewis-Williams 2002, p.122).

The insights from this enquiry provide a basis for a possible enabling framework and method to support KE teams and projects as they move from inception to delivery. At its simplest, it is a checklist for consideration, discussion and action by team members, sponsors and more generally amongst knowledge exchange practitioners and researchers. A proactive methodology and related actions focused on supporting the delivery of complex Agile KE projects in achieving their stated goals in exploring, defining and designing opportunities in emergent contexts.

Addressing both the structural and processes issues of project delivery and the wider social dimensions of team performance reflected in values and norms and addressing the emotional and motivational dimensions of team working (affective states). This enquiry highlights the importance and value of existing theory and practice across a number of disciplines in providing insight and the building blocks in the development of knowledge exchange as an area of research and professional practice.

One opportunity for the future development of enabling support for knowledge exchange is to leverage the value that design expertise, thinking and methods can bring to the design of policy, programmes and projects. The role of design expertise as an enabler to KE is echoed in the approach elucidated by Cruickshank and colleagues (Cruickshank et al. 2012) where they explore opportunities in applying design to '.. *knowledge exchange and the design of knowledge exchange design'*.

Reflecting on their own experience, they identify the value of design methodology and methods at two levels. At the first (*1st order KE design*), emphasis is placed on design tools[82] and mechanisms[83] used at the programme and project levels which can appear in the form of workshops focused on enabling knowledge sharing. At a second level (*2nd order KE design*), emphasis is placed on supporting practitioners to design their own bespoke tools and mechanisms, reflecting their particular needs and contexts. This approach reflecting the need for bespoke methods and approaches to enabling complex KE projects.

[82] Tools: "*..very specific actions and techniques that are the smallest components of the design of an event, they have very specific functions such as exposing the assumptions participants have brought with them, moving participants around a space or documenting ideas*" (Cruickshank et al. 2012, p.454).

[83] Mechanisms: *"... collections of tools working together to enable an overarching aim to be achieved. This could be a 'workshop' like activity but could also span across a number of events and activities*" (Cruickshank et al. 2012, p.455).

# Chapter 12 A Reflection on the Research Journey: limitations, lessons and topics for further research

This final chapter provides the author with the opportunity to reflect on the research journey in terms of research quality and identify limitations and lessons learnt in relation to the design and delivery of the research strategy. In addition, possible themes and areas for future research into the theory and practice of knowledge exchange are identified.

## Demonstrating research alignment and quality

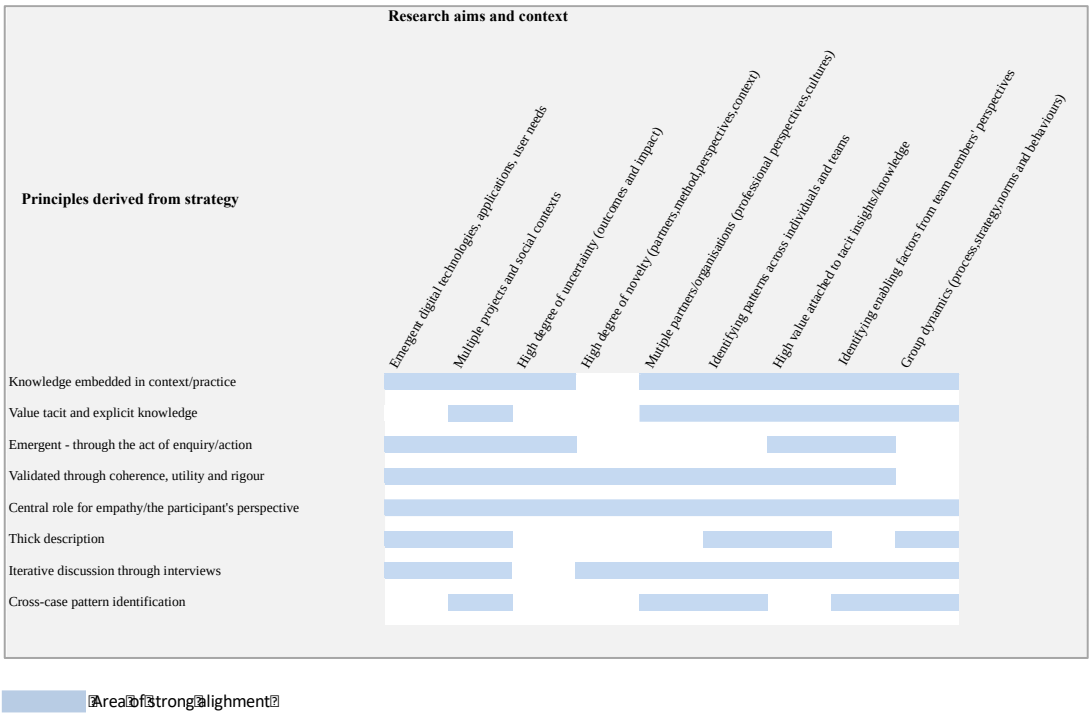



Table 41 The alignment of research strategy with research question and context

The development of the research strategy reflected and was shaped by a number of factors including the author's interests, the wider operating context of the Creative Exchange and the Digital Public Space and the emphasis placed on identifying insights from the perspective of individual team members from the selected CX projects. An overall approach which recognised that the knowledge sought was embedded in a social context and reflects a synthesis between individual and group cognition, as teams work together and with wider partners to achieve shared goals.

Priority has been given to ensuring alignment between epistemology (constructionism), theory (insights from Pragmatism, Phenomenology and Appreciative Inquiry) methodology (case study) and method (critical success factor supported by interview transcript and key document analysis). A further dimension of alignment is that between the research strategy, research question and wider context. Table 41 identifies principles derived from the strategy and their relationship to the characteristics of the research context. The highlighted intersections reflect points of significance demonstrating an overall strong alignment between strategy and context.

Key points include:

- An emphasis on the perspective of individual practitioners (at team level) in their own subjective insights into the dynamics of the collaborative process as they interact with each other within a wider social context and with the objects of their collaboration (e.g. prototyping).

- The value of tacit knowledge in relation to the practice of collaboration. This provides the basis for exploring characteristics of the projects being studied and the identification of factors that influence their design and delivery in relation to their stated aims and objectives.

- Appreciation of the emergent nature of knowledge and understanding generated through the act of team working and practice in novel, uncertain and emergent contexts. This is reflected in both the research process and the act of co-creating knowledge and shared understanding at the level of individual projects.

- The role and importance of empathy as a guiding principle in exploring knowledge exchange collaborations from the perspective of individual team members.

- A methodology and method that provide flexibility and rigour in generating insights that can then provide the basis for cross-case analysis and pattern recognition. These insights leading to detailed descriptions of a dynamic process of team working reflecting multiple dimension of experience and meaning for each project and across projects.

The question of research quality is addressed with reference to the overall approach adopted and its underlying epistemological and theoretical assumptions rather than limited to research methods. Morse et al. (2002) note that the question of research quality boils down to validity and the steps taken by the researcher during the enquiry process to ensure quality and consistency (rather than purely ex-post judgments). This reflects the principle that qualitative research is an iterative rather than linear process where the researcher:

*".. moves back and forth between design and implementation to ensure congruence among question formulation, literature, recruitment, data collection strategies and analysis"* (Morse et al. 2002, p.17).

*Criteria for demonstrating research quality adapted for the enquiry*

Established criteria and measures have been drawn upon in shaping the design and delivery of the research strategy (Guba 1981; Shenton 2004) and adapted to the research question, context and assumptions pertaining to this study. They provided a guide to the author, a way of demonstrating the approach adopted to an external audience and a point of reflection for lesson learning. A strategy which draws on different strands of insights and evidence in addressing the research question and related propositions.

*Credibility*

This criterion emphasises the need to demonstrate the alignment of the research findings with the reality and phenomena under study (Table 42), as stated by Merrian:

"*How congruent are the findings with the reality*" (Merrian 1998 cited in Shenton 2004, p.64).

| **Proposed Action** | **Researcher's Comment** |
|---|---|
| Recognised research methods | The case study methodology combined with the adapted critical success factor method was the point of reference in guiding data collection and analysis. Both are well established in literature and practice and provided a flexible framework that was adapted to the research objective and context (Chapter 3). |
| Familiarity with culture of participating organisations | The Creative Exchange consortium provided a wider framework to become acquainted with the three partner institutions and individuals involved in the CX projects. Time was allocated to undertake desk- and web-based research for each case. |
| Triangulation (use of different methods, types of informants and sites) | Different methods (interview and document analysis), sources of information (six cases/contexts) and different team members (three per project from six teams) as the basis for identifying patterns of meaning associated with the design and implementation of the selected projects. |
| Iterative questioning in data-collection dialogues. | The semi-structured interview schedule (Appendix 5) provided a framework to explore individual perspectives. The framework was flexible and iterative allowing the researcher to explore themes and issues from the perspectives of the different interviewees. |

| | |
|---|---|
| Debriefing with supervisors. | Regular meetings with supervisors provided the opportunity to discuss research context, process and progress. |
| Peer scrutiny of project. | Informal presentation and discussion including a conference paper. |
| Inbuilt reflection as part of an iterative process of design and delivery. | A process of exploration and reflection was inbuilt into the research journey at the project level and in relation to the research strategy as it emerged during the literature review, project practice and from the act of data collection and analysis. |
| Description of background. | Provided in relation to policy context, operational context (the Creative Exchange and Digital Public Space) and the author's personal perspective. In addition, for each case in the study (subject to resources). |
| Thick descriptions[84] of phenomena under scrutiny. | Contextual information provided with a focus on the i) background/context for each project, ii) characteristics of the collaborations, and iii) the identification of important enabling factors shaping project design and delivery. |
| Examination of previous research to frame findings. | The literature review provided insights into existing theory and practice in a number of disciplines and areas relevant to the research question and propositions established for this study; i) innovation (including the national innovation system); ii) knowledge management theory and practice; and iii) different models of team effectiveness supporting a meta-framework for the cross-case analysis. |

Table 42 Summary of actions taken in support of research credibility

84 "*Thick description is described as a way of achieving a type of external validity. By describing a phenomenon in sufficient detail, one can begin to evaluate the extent to which the conclusions drawn are transferable to other times, settings, situations, and people*"
(Lincoln & Guba 1985, n.p.).

*Transferability*

In addressing transferability (Table 43), the researcher is focused on demonstrating that the findings may be relevant to other operational contexts as the basis for catalysing discussion and reflection. Reflecting the epistemology and strategy defined for the enquiry, it is not assumed that findings can be generalised at the level of a population of projects (correspond statistically). However, reflecting Bassey's perspective (Bassey 1981 cited in Shenton, 2004, p.69) sufficient information for readers and practitioners needs to be provided to allow them to determine whether insights are relevant for their own practice and context.

| **Proposed Action** | **Researcher's Comment** |
|---|---|
| Provision of background data to establish context of study and detailed description of phenomena in question to allow comparisons to be made. | Different dimensions of background information provided in relation to the wider research strategy and methods, operational context of the Creative Exchange and for each case included in the case study analysis. This provided the context for data collection and analysis at the level of individual cases and cross-case analysis (characteristics of the collaborations and enabling factors/themes and categories). |

Table 43 Summary of actions taken in support of research transferability

*Dependability*

While assuming that the research outcomes could not be replicated (as under positivist assumptions) reflecting the overall epistemology in relation to the dynamic nature of the research context and phenomena (Marshall and Rossman 1999 cited in Shenton 2004, p.71), this criterion (Table 44) focuses on a need to demonstrate the validity of research design and its implementation, as the basis for generating confidence in its findings.

| Proposed Action | Researcher's Comment |
|---|---|
| Employment of overlapping methods. | Case and cross-case analysis supported by analysis of transcriptions, key documents at the level for individual cases supported by coding and grouping (affinity analysis) into themes/categories reflecting shared meaning. |
| In-depth methodological description to allow approach adopted by the study to be understood and repeated. | Detailed description of methodology and methods in the context of the wider research strategy adopted for this enquiry and a step-by-step guide to data collection and analysis. Included in the conclusion is a reflection on lessons learnt in the design and delivery of the research strategy. |

Table 44 Summary of actions taken in support of research dependability

*Confirmability (objectivity)*

While the researcher has been cognisant of needing to be self-aware of his own interests and experience in undertaking data collection and analysis, the approach adapted has reflected the value in the role of the researcher as interpreter as outlined in Chapter 2 (Koch & Harrington 1998).

| Proposed Action | Researcher's Comment |
|---|---|
| Triangulation (different methods, different informants and different projects and their contexts) | Different methods (interview and document analysis) with different sources of information (six cases) and different team members from the six project contexts and teams (seventeen interviewees) as the basis for identifying patterns of meaning associated with the design and implementation of KE projects. |
| Admission of researcher motivation, belief and assumptions | The introduction provided the opportunity to outline the author's interest and perspective on the theme of knowledge exchange. Subsequent chapters relating to research strategy made clear the author's underlying |

| | |
|---|---|
| (ensuring transparency). | epistemology and related assumptions. |
| Recognition of shortcomings in study's methods and their potential effects. | Addressed in Section 4, Chapter 12. |
| In-depth description of methodology/ methods to ensure transparency. | Detailed description of methodology and methods in the context of the wider research strategy adopted for this enquiry (Section 1). Combined with a step-by-step guide to data collection and analysis with related background appendices. A reflection on lessons learnt is included in Chapter 12. |

Table 45 Summary of actions taken in support of research confirmability

**A reflection on the research journey**

The design and delivery of the study approximated a design process leading from uncertainty to clarity through a non-linear and iterative process. The enquiry was exploratory with reference to the design and implementation of the research strategy, in part reflecting the design of the Creative Exchange and the active role that PhDs played in CX project delivery. The emergent character of the study was reflected in the author's own development and understanding of the research strategy (epistemology, methodology and choice of method) and of the wider research context.

The Kendal case provided the opportunity to explore the challenges and opportunities of a design-led collaboration in a complex clinical context while working across epistemological boundaries. In this project the author was both *KE practitioner and patien*t in addition to playing the role of *observer,* generating a tacit knowledge and understanding of the project context and the dynamics of the collaboration itself. The five other cases reflected different teams, professional paradigms, social contexts and technologies. In these projects, the author was not directly involved in their delivery and played the *role of observer*.

*Opportunities* provided by the enquiry (research question, strategy and context) included:

- Insights from six projects and teams into the theory and practice of knowledge exchange, where design and creative practice played a central role in project design and implementation, taking place in complex collaborations working across different social and operational contexts.

- An iterative process of learning and refining research strategy through practice and reflection in the wider context of the Creative Exchange community.

- The opportunity for self-reflection on assumptions and perspectives on the theory of knowledge and related research methodologies and methods.

- Scope to draw on and learn from existing theory and practice relevant to the research question and context. A related opportunity to interrogate and develop descriptive models of KE team working.

- An adapted CSF method which linked insights generated to stated goals of the collaborations, providing insights that may have practical value and wider relevance.

**Limitations and challenges encountered**

Important limitations are identified from the author's own experience of using the adapted Critical Success Factor (CSF) method and from related literature (Davis 1979, Walters 2006, cited by Cooper 2009 pp.2-3). Of particular relevance, are limitations reflecting the principle of *Bounded Rationality*. This concept emphasises the limitations of human cognition restricting our human ability to process and understand information as the basis for accurate judgements and related decision-making.

Originally defined with reference to the rationality of economic decision-making (Simon 1972), the concept is also relevant to the limitations encountered in the CSF method in identifying the number, impact and timing of enabling factors. Both from the perspective of those interviewed and the researcher's own capacity to identify and understand these factors. In particular, a degree of uncertainty as to whether the factors identified provide a full picture of the different influences shaping the collaborations studied.

Further restrictions arise in the ability to rank the different enabling themes and factors in their relative importance in shaping team working. While it has been possible to identify important themes and build a descriptive model of how they work together, the method adopted does not provide a systematic basis for exploring the relative importance of the factors nor the causal relationship between the factors themselves and between the factors and effectiveness in terms of the stated goals for the project.

A number of dimensions considered relevant to decision-making in highly complex and autonomous teams were not fully addressed, specifically reflecting the dynamics of authority and perceptions of authority between team members in the absence of pre-defined roles and responsibilities. A further dimension of interpersonal dynamics and the sharing of authority was that between patients/clinicians in the context of the theme of '*patients as partners*' in the management of chronic health conditions.

**Priorities for future research**

With reference to future research, the enquiry has revealed that while knowledge exchange can be demonstrated to be a distinct form of university collaboration (in relation to other modes of collaboration), a range of different academic disciplines, existing theory and explanatory models have proved relevant and useful in interrogating and clarifying the concept of KE, both as a *mode* and a *spectrum* of collaboration. At the level of the team, a theme identified as being of particular importance is group cognition and related learning behaviours (reflected in mechanisms associated with transfer, sharing and creation of knowledge), manifest in the development of shared understanding of opportunities, methods and solutions between team members and wider stakeholders.

An important and underdeveloped theme in relation to both the theory and practice of knowledge exchange is related to the perspective of external partners (e.g. micro and small businesses, not for profit sector etc.) to the collaborative process, both in terms of the meaning and potential value of such KE collaborations and their own perspective on the important factors that act to influence the effectiveness of collaborating with academics. An important insight from the literature review on both innovation theory and knowledge management is the relatively limited research that has been undertaken on micro and small companies[85] and organisations. This integration of these non-university and non-corporate perspectives should be addressed in future research into the theory and practice of knowledge exchange.

[85] In the UK context (start of 2014) SMEs accounted for over half of employment (60%) and approximately half of turnover (47%) in the UK private sector (Department for Business Innovation and Skills 2014).

*Typology*

Reflecting the importance of clarity in terms of KE concepts and terminology, the development of a typology reflecting three different approaches to university collaboration provided a useful framework to explore their characteristics and the underlying assumptions shaping these modes of engagement. Further research is required to validate and develop the content of the typology and underlying assumptions that underpin the concept (both as a distinct mode and as part of a wider continuum of collaboration).

| | |
|---|---|
| Typology | Development and validation of typology of different modes of university collaboration and related supporting measures including assumptions, similarities and differences (additional literature review and survey of practitioners).<br><br>Evaluation/validation of the characteristics and comparative benefits (with reference to context) of an exploratory mode of KE. |

Table 46 Possible research theme: typology

*Enabling themes and factors*

The insights gained from the enquiry provide a useful point of reference in relation to existing theory on team effectiveness and as a basis for adapting existing models to address characteristics of knowledge exchange teams. The study's insights highlight that while knowledge exchange projects have distinct characteristics, they share fundamental similarities in relation to other project teams and collaborative structures (structure, process, factors shaping effectiveness). Existing areas research and practice in other relevant disciplines should be identified and drawn on in supporting the development of knowledge exchange, both as an area of policy and at the level of programmes and projects e.g. cognitive and organisational psychology.

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| Enabling themes, factors and processes | Interdisciplinary research is required to validate the insights gained across a wider range of programmes and projects, including the need to rank and prioritise factors (and the development of a related method). |

Table 47 Possible research theme: enabling factors and factors

Dimensions of the enabling environment requiring further interrogation include: i) the character and nature of the enabling themes identified as important; and ii) the processes through which they work in shaping team and project performance (causality) and; iii) the extent they are context specific. This clarity providing a basis for reflecting on their implications in terms of KE design, management and enabling support.

| | |
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| Causality | i. A literature review identifying critical enabling factors in relation to KE projects and causality in impacting team and project performance.<br><br>ii. Further research at project level in mapping and validating enabling themes, ranking, causality and impact. |

Table 48 Possible research theme: causality

*Enabling framework and measures*

Having identified the characteristics of knowledge exchange (as a discrete mode of collaboration), further research is required on the alignment and impact of different types of management and enabling interventions in supporting related programmes and projects, with the aim of identifying criteria for appraising their future design and impact. A critical dimension of this analysis is the perspective of external organisations on KE from those who have collaborated or who may have the potential to benefit from such collaborations.

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| Enabling framework/ measures | Definition and evaluation of existing enabling interventions (infrastructure) in terms of their alignment with different modes of collaboration (and related needs) and impact in terms of project outcomes. |

Table 49 Possible research theme: enabling framework and measures

*The role of design as enabler to shared team understanding*

Design and creative practice are central elements in all the projects included as part of the case study analysis. Both as methodology and method, design was instrumental in relation to understanding context, defining opportunities and catalysing the creation of working prototypes (often in partnership with user groups).

Reflecting the concept of '*the design of knowledge exchange design'* (Cruickshank et al. 2012), alternative methods and their impact on supporting the design and delivery of KE programmes and projects (the design of enabling frameworks and measures) should be identified and evaluated e.g. in relation to the challenges of developing a shared understanding in the context of resource-bound complex collaborations.

A design led approach in a clinical context is presented by Louise Valentine in the form of a *design sprint* (Valentine et al. 2017). A five day, five step collaborative and interdisciplinary development process (understanding- diverging- converging- refining/testing-communicating/disseminating). A process of integrated design led activities (with the support of experienced facilitators) focused on iteratively exploring context and solutions. An approach which places emphasis on the social, cultural and behaviour dimensions of health and wellbeing (not just the clinical context) as the basis for understanding challenges, context and identifying solutions.

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|---|---|
| Design methodology and methods as an enabler in the design/ delivery of knowledge exchange programmes and projects | A proposition for further exploration centres on the role of design methodology and methods in catalysing a shared understanding across multiple partners and stakeholders, multiple dimensions of project design and implementation (structure, processes and team behaviours) and at different stages of project development. Further research focused on exploring mechanisms, impact and causality. |

Table 50 Possible research theme: the role of design as KE enabler

**A final reflection**

***Can we improve the design and delivery of knowledge exchange through insights from existing theory identified from the literature review and case study analysis based on selected projects implemented through the Creative Exchange?***

The citation from Essers and Schreinemakers, in the opening introduction for this thesis (1997), adapted by the author to the context of knowledge exchange, highlights an important theme informing this enquiry:

*… to design and enable knowledge exchange initiatives effectively, it is necessary to understand the intention, context and characteristics of this mode of collaboration and identify important factors that shape the delivery of related projects.*

In reflecting back to the research question, insights gained from the literature review and case study analysis have provided the basis for a greater understanding of the concept and practice of knowledge exchange, specifically in the context of the CX case study. It is intended that these insights will facilitate discussion and provide a catalyst for further developments in understanding amongst knowledge exchange practitioners. This in turn facilitating the design of enabling interventions, aligned with the characteristics, needs and social context of the programmes and projects being considered with the aim of maximising KE effectiveness and impact.

Important insights in relation to the research question include:

- Clarification of differences between three modes of university collaboration- Technology Transfer (TT), Knowledge Transfer (KT) and Knowledge Exchange (KE). Definition of their underlying assumptions in relation to innovation theory and practice and dimensions of knowledge and its management, illustrated in a typology of knowledge exchange (Chapter 10).

- Identification of an *exploratory mode* of KE associated with the CX projects included in the case study analysis. Projects which demonstrated a strong emphasis on the co-creation of knowledge through the act of collaboration and where design and creative disciplines (and prototyping) played a central role in project design and delivery. An alignment between this mode of KE to the principles of Agile Management is demonstrated (Chapters 10 and 11).

- Insights into the *dynamics of team working* in the context of the selected CX projects leading to the identification of important enabling themes and factors shaping project effectiveness in relation to the stated goals of the collaborations.

- On the basis of the insights gained, an *adapted model of team effectiveness* was used to explore and understand insights in the context of existing theory with reference to different dimensions of team effectiveness.

- Using insights into important enabling factors, an *enabling framework* was developed, aligned with operational needs associated with the mode of KE referred to as exploratory.

Central to the projects studied are different mechanisms and processes by which knowledge is shared and generated through the act of collaboration, both within the core team and with wider stakeholders. Rather than discrete points on a linear journey, knowledge is characterised as a flow, where different strands of transfer, sharing, creation and application of knowledge occur within the structural, contextual and emotional dimensions of a given collaboration, from concept to closure.

In the context of team working, it is important to acknowledge the complexity that arises from the unique mix of circumstances and factors that can shape how teams work together. The research insights illustrate that the KE collaborations also mirror the complex and multi-dimensional nature of individual and group cognition and the complexity of the social contexts within which projects are designed and implemented. It is within this context that shared understanding takes on a central role in having the potential to bind teams and stakeholders together in working towards shared goals.

The language of landscapes, exploration and navigation provide useful metaphors in capturing the essence of the researcher's journey in exploring the meaning and practice of knowledge exchange. These metaphors are also relevant when applied to the concept of an enabling framework conceived as a tool to support teams as they successfully navigate complexity and uncertainty in guiding project from conception to closure.

# *Appendices*

# Appendix 1 Illustrative Case Analysis (Bretton Buzz)

## 1. Overview of method

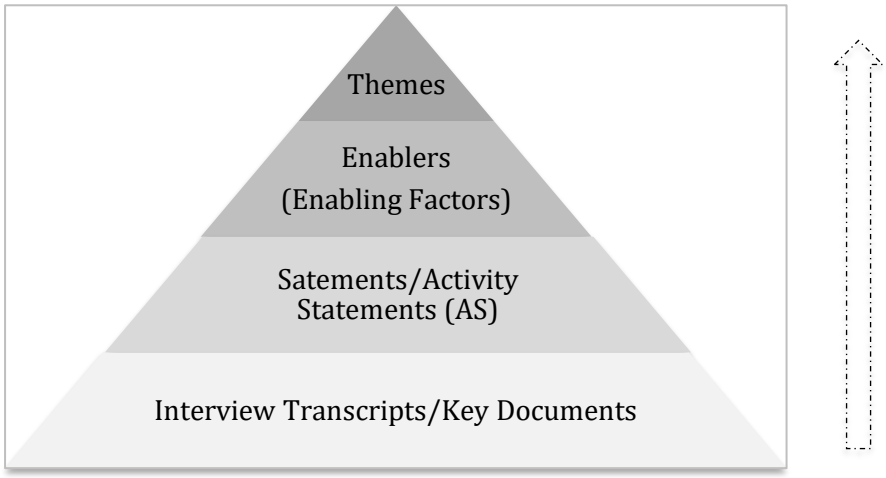


Figure 62 The applied CSF method in stages

This Appendix provides a more detailed example of case analysis using the adapted CSF method. It works through the stages of the analysis and illustrates each stage with elements from the *Bretton Buzz* case analysis. Figure 62 provides an overview of the key stages in building up a picture of enabling themes and factors. These insights in turn being used to define the *Enabling Categories* identified in the cross-case analysis (Chapter 9). The foundation for the analysis is provided by the interview transcripts and key documents related to project design and delivery. Table 51 provides an exemplar of a transcript where the individual paragraphs are numbered.

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| 34. *Interviewee*: Yeah, absolutely. The tools that you use right at the beginning cannot determine successful or unsuccessful outcomes, but what they can do is determine successful attempts at engaging and making links with a community. |
| 35. *Interviewer:* Increasing your chances of success really. |
| 36. *Interviewee:* I think in areas where Twitter etc. is more popularly used, Bretton was identified as an area where that was low by J. I don't want to say that I'm correct in this, it's my interpretation of what I think he said. I think where there's a high use of things like Twitter etc. you would have potential to reach out to a much broader audience, and I think that's important in terms of sampling a methodology and outreach, and you don't always go to the same people all the time. For example, where I've been working today in the Paradise area, people will say we're sick of being surveyed and nothing happening. Using the same sort of approach or the same communities or the same places. |

Table 51 Exemplar of anonymised transcript preparation

Following preparation of transcriptions and key documents, the first stage of the analysis involves text from the documentation being used as the foundation for generating *Statements* (grouped across all sources) which are then distilled into *Activity Statements*, where AS refer to those actions and conditions identified by practitioners as being important in relation to effective collaboration.

They have been defined based on identifying the actions/conditions taken/met or which should be taken/met in relation to successful outcomes. AS are i) anonymised, ii) condensed to essential meanings, and iii) distilled into discrete elements that enables further analysis. Judgment and interpretation has been used by the researcher in transforming text into discrete, positive statements.

| **Digital** | **Para** |
|---|---|
| **S9** Use LocalNets analytical tool to generate a map of community assets and networks as the basis for supporting the design of community interventions. | 13/14/15 |
| **S10** Seed the LocalNets app with key data relating to relevant blogs/twitter accounts as the basis for enlarging the coverage of online network analysis for the community. | 13 |
| **S13** Run LocalNets continuously to generate a comprehensive database that can be used for before and after analysis of impact. | 20 |

Table 52 Example of intermediary iteration where statements are placed into groups of shared meaning

Table 52 shows an exemplar of *Statements* being grouped into intermediate themes of shared meaning which are further distilled into *Activity Statements, Enabling Factors and Themes* (see below*).*

## 2. Enabling Themes, Factors and Activity Statement Analysis

This section provides a detailed summary (reflecting several iterations) of statements/activity statements/enablers as the basis for clustering into emergent themes.

| **Team roles and responsibilities** |
|---|
| **B1. Explore and agree roles and responsibilities during the project's early stages.**<br><br>**B2. Identify the lead senior manager within each participating organisation.**<br><br>**B3. Discuss the role of the PhD on the project in relationship to their wider research goals.**<br><br>In the absence of clear lines of hierarchy and authority that can directly shape and dictate project design and management, the Bretton Buzz project developed through discussion and negotiation. This process included an element of self-selection by partners in terms of their roles and responsibilities. This principle of self-organisation within a project-based collaboration was also reflected in the work of Community Capital programme in community engagement and co-production of project-based interventions.<br><br>A21. Identify clear roles and responsibilities between team members as an important milestone in project development.<br><br>A22. Identify individual within each partner/stakeholder organisation to act as lead project contact.<br><br>A23. Develop a clear understanding between partners of the role and responsibilities of PhD if they are involved in project design and delivery. |
| **S59** Clear differences in expertise can provide the basis for clear and agreed roles and responsibilities. |
| **S57** Identify the appropriate person (policy/operational perspective) from each organisation to be an active partner in the collaboration. |

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| **S51** Accessibility of key project personal is important for the collaboration. |
| **S85** Self-selection can provide the basis for clarifying roles and responsibility within the collaboration and with community stakeholders. |
| **S58** Successful collaborations don't have to be hierarchical. |
| **S127** Need to create a shared understanding between supervisors and team members as to how the PhD will engage with projects and when in relation to their research. |
| **S128** A clear statement as to what the new PhD model is would help provide the basis for a shared understanding amongst interested parties. |
| **S35** Innovative model of PhD requires explanation for partners so they understand and can make sure project delivers what the PhD needs. |
| **S136** For greater collaboration between the respective CX hubs more time would be needed for the PhDs to spend together. |

| **Managing an exploratory and emergent project.** |
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| **B4. Ensure adequate time and resources are committed to developing relationships during early stages of inception and design.**<br><br>**B5. Use flexible management for exploratory projects.**<br><br>**B6. Identify risks and related mitigation strategies.**<br><br>The project management theme reflects the initial formal process of project design and management. As outlined in project characteristics, Bretton Buzz was focused upon exploring the development and application of new software and related applications with a related uncertainty in terms of final outcomes but also the potential to learn. The enabling factors identified reflect the exploratory nature of the project but also the value in of developing relationships at an early stage with both core partners and wider stakeholders. The theme of risk management has also been identified as the basis for mitigating potential risks that impact on project delivery.<br><br>A13. Explore new potential partners at an early stage.<br>A14. Ensure sufficient time is allocated to develop the partnerships and design the project e.g. TOR. |

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| A15. Recognise the value that exploratory projects can generate.<br><br>A16. Ensure that risks are identified with discussion on how best they can be managed. |
| **S20** The collaborators are committed to observing the project TOR. |
| **S56** Flexibility in project design provides the opportunity to explore and see what's possible. |
| **S60** Formal project management tools not appropriate when the project has got specific outputs (exploratory). |
| **S61** Approach to managing exploratory projects different from those with clear research objectives, outcomes and timeframes. |
| **S63** Exploratory projects may fail but still generate valuable insights for partner. |
| **S68** Design collaborations to meet your needs. |
| **S32** Clear terms of reference form the outset to generate a clear understanding of direction and what was required. |
| **S70** A formal project with time bound deliverables and links to policy will be prioritised over exploratory collaborations. |
| **S98** Existing partners and networks provided the basis for new collaboration. |
| **S67** Fewer core partners make it easier to identify and sustain shared interests within the collaboration. |
| **S129** Need to ensure that the right mix of potential partners are at the project development workshops/labs in relation to potential projects. |
| **S130** Need to work beyond the circle of the usual academics/companies in terms of bringing potential partners to project development events. |
| **S131** Existing relationships with partners can provide be important in generating collaborations. |
| **S134** Challenges in engaging with big business on small scale CX projects with limited funding. |
| **S116** Need to facilitate the identification of appropriate academics in terms of expertise and experience. |
| **S65** Big reports are not always the best mechanism for getting value from academic engagement. |
| **S86** Lack of time can undermine the development of the collaboration. |

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| **S30** Motivated to engage and participate by a desire to learn more about media analytics. |
| **S31** Strategic partners providing a clear policy focus. |
| **S26** Collaborate with the aim of accessing relevant technology and expertise. |
| **S41** Collaboration must make implementation (of our strategy) better. |
| **S42** Collaboration is providing the opportunity to explore and learn about new methodologies and approaches. |
| **S71** The collaboration provided a new opportunities to look at social networks at the community level. |
| **S73** Collaboration provide the opportunity to augment traditional network analysis with digital tools. |
| **S99** Administrative necessity drove the inclusion of an additional academic partner. |
| **S100** While the project would have taken place anyway, CX provided scope for including web developer and providing academic rigour to the journey. |
| **S55** Absence of internal research budgets provides a catalyst for engaging with external partners. |
| **S54** Collaboration provides the opportunity to achieve things for very little money. |
| **S36** Be prepared for key stakeholders to go on sick leave. |
| **S69** Be clear that changing internal work priorities and pressures can impact on capacity to engage with the collaborative process. |
| **S50** Be pragmatic in managing unforeseen changes in senior staffing. |
| **S123** Need to ensure consistency in the way different staff members manage and process the budget particularly when staff changes occur. |
| **Simple and effective administration** |
| **B7. Design simple, efficient and flexible administrative/budgetary procedures.**<br><br>**B8. Pay market rates for service providers (sub-contractors).**<br><br>The theme addresses issues related to the overall design of administrative and budgetary procedures impacting on the design and delivery of individual CX project. Points arising related to both the development of the initial collaboration to issues impacting on the downstream delivery of the project and wider |

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| collaborations related to Community Capital.<br><br>A28. Have simple administrative and budgetary procedures and ensure that resources are available to ensure speedy processing.<br><br>A29. Flexibility to allow different types of partners to collaborate<br><br>A30. Pay market rates for services provided. |
| **S1** The project to be carried out in accordance with the AHRC grant terms and conditions and the CX Collaboration Agreement. |
| **S114** Not all project partner need or want cash to participate in the collaboration. |
| **S137** Value in having the flexibility to enable PhDs to work with external non-academics to support project design and development. |
| **S113** Should have flexibility to employ individuals as well as companies |
| **S112** Need to have flexibility to pay market rates. |
| **S115** The flexibility to incorporate partners who do not wish pay can provide value to the collaboration. |

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| **S117** Efficient processing of formal agreements important to avoid delay or necessitate an administrative work around. |
| **S118** Provide sufficient resources to ensure speedy processing of administrative agreements. |
| **S122** Explicit training on budget process/documents should be provided to PhDs involved in the collaboration. |
| **S84** Universities need to develop simpler procedures for working with community researchers with small amounts of cash. |
| **Importance of effective communication.** |
| **B9. Budget for regular face-to-face meetings.**<br><br>**B10. Ensure short and regular project updates are circulated.**<br><br>**B11. Place emphasis on developing a high trust ad open working culture.**<br><br>Communication reflects the importance of face-to-face and online communication between stakeholders, both in the core project partnership and |

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| the wider group of community partners.<br><br>A24. Plan and budget for regular face to face meetings between partners and stakeholders.<br><br>A25. Keep everybody informed of project progress by short emails updates.<br><br>A26. Make explicit the importance of trust and ethical behaviour in the partnership.<br><br>A27. Develop a team culture where partners and stakeholders can be open about their role and capacity to deliver and support the project. |
| **S46** Regular face-to-face meetings provides and effective means of communicating and sharing. |
| **S19** The collaborators are committed to regular and open communication. |
| **S62** Simple one-line email updates are a powerful way of keeping partners up to speed. |
| **S75** Traditional means of communication can be more effective in soliciting a response than Twitter. |
| **S66** Sustaining an ongoing dialogue between partners can generate knowledge sharing and value during implementation. |
| **S95** Navigating organisational boundaries requires getting stakeholders around the table to opt in/out project areas reflecting their own professional, cultural and financial boundaries. |
| **S90** Communication with and between partners and stakeholders is critical to maintaining a sense of belonging, purpose and maintaining the momentum. |
| **S108** Face-to-face meetings an important catalyst for knowledge transfer and sharing. |
| **S141** Regular and short email updates on project progress a valuable in keeping project partners connected and up to speed. |
| **S94** Project champions need to create a positive ethos and sense of contribution from each partner/stakeholder to the overall purpose of the collaboration. |
| **S132** Important to create a culture where people can be open about their capacity to provide inputs and deliver as expected - particularly when circumstances change. |

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| **S18** Collaborators will build a partnership based upon trust and ethical behaviour. |

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| **S82** Creating the right conditions is important in initiating and sustaining local collaborations is important. |
| **Role of prototyping** |
| **B12. Use prototypes as a catalyst for knowledge sharing and co-creation between partners and wider stakeholders.**<br><br>**B13. Recognise the value in deploying existing prototypes as the basis for lesson learning for future development and use (proof of concept).**<br><br>At the heart of the collaboration has been the deployment of the *LocalNets* prototype. Unlike other CX projects, an existing prototype was deployed in the CX project with the intention of testing and evaluating its performance in mapping and catalysing an understanding of community networks and assets to support i) uptake of community rights and ii) the co-production of community-based interventions. The factors that emerged in the context of this theme reflect the value that this prototype brought to the project and related issues about the co design and development of the digital tool.<br><br>A11. Use the deployment of early stage prototypes to generate relevant guidance and realistic data expectations for its future use.<br><br>A12. Use prototypes to catalyse understanding about overall project direction, and as a tool for co-design. |
| **S29** Co-design/co-produce local projects to catalyse greater connections to existing service providers and figures of authority in the community |
| **S45** Working together to develop and test the app. provides the opportunity to learn together about the community. |
| **S48** Good design helps impart information more effectively. |
| **S124** In emergent areas of digital technology existing guidance maybe wrong. |
| **S125** A key deliverable in emergent areas of digital technology is evidence-based guidance gained from direct experience of developing the software. |

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| **S110** CX Collaboration provided the basis for further development of the prototype and potential to explore how it could be scaled up. |
| **S97** The concept of a digital analytical tool had been proven in a previous project with demonstrated value added. |
| **S101** An existing prototype provided a high degree of clarity for the collaboration. |
| **S111** The value of CX project reflected impact at the community level. |
| **S139** Have realistic expectations about data complexity to avoid undue delays. |
| **Emergent technology and applications.** |
| **B14. Be flexible in project design and delivery when context and outcomes are uncertain.**<br><br>The project is focused upon exploring emergent technology and application areas without being able to draw up on extensive experience and knowledge in terms of process nor outcomes. Central to the Creative Exchange support for the Bretton Buzz project was the deployment of an early stage prototype in support of social network analysis as part of a wider programme of community engagement. Central to the deployment of the prototype under the CX Bretton Buzz project was its central role in providing an innovative approach to social network analysis based upon identifying community asset and networks on the basis of twitter traffic. The points and factors clustered under this theme reflects the role of the prototype in the Community Capital methodology and the related interests of project stakeholders.<br><br>A6. Explore the use of digital analytics as a cost-effective catalyst for off line community activity and related supporting interventions.<br><br>A7. Creative visualisation of data generated by the prototype is critical in supporting stakeholder understanding.<br><br>A8. Social media analytics can provide a new way of connecting to people online.<br><br>A9. Deployment of a digital tool for social network analysis must take into account the non-digital based networking that takes place in the community. |

| A10. Use local knowledge to reality check the results of social network analysis (physical/digital). |
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| **S23** Digital data must catalyse offline community activity and engagement. |
| **S24** Use social media analysis to identify community-based opportunities that can support the uptake of Community Rights. |
| **S107** Creative visualisation of data generated by software can be critical for stakeholders to engage and understand its value. |
| **S25** Use digital analytics (prototype) to reach out to people who are more used to engaging online. |
| **S37** Use digital analytics to provide cost effective ways to identify and make contact with key people at the community level. |
| **S15** Social media users are happy to have their content analysed. |
| **S49** Collaboration with designers can provide the basis for boosting the impact of analytical work. |
| **S39** Significant online activity at the community level as the basis for successful digital analytics. |
| **S38** Use digital analytics to catalyse peer interaction online. |
| **S80** The tools used to undertaken social network analysis can determine successful engagement and developing links with the community. |
| **S64** Important to explore new ways of connecting with young people on their social networks to increase their engagement with government. |
| **S104** Digital analytics of twitter focused upon identifying community assets and information people of the options they have in protecting their assets. |
| **S109** Digital analytical tool provides a catalyst for bringing key local people together as a basis for community action. |
| **S74** The power of digital analytical tools to analyse social network activity is directly related to the amount of online social networking activity taking place. |
| **AS9** Use LocalNets analytical tool to generate a map of community assets and networks as the basis for supporting the design of community interventions. |
| **AS10** Seed the LocalNets app with key data relating to relevant blogs/twitter accounts as the basis for enlarging the coverage of online network analysis for the community. |
| **AS76** Local feeling and knowledge can provide a reality check to social network analysis generated form surveys or digital analysis (sample bias). |

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| **AS43** Structure online data to catalyses greater insights into local communities. |
| **AS13** Run LocalNets continuously to generate a comprehensive database that can be used for before and after analysis of impact. |
| **AS21** Expand the functionality of LocalNets as the basis for staging a series of interventions to improve community rights uptake in the parish of Bretton. |
| **AS22** Digital tools must provide a cost-effective way of undertaking social network analysis and discovering community assets. |
| **AS79** Using traditional network analysis and digital analytics maximised the probability of engaging with the maximum number of stakeholders. |
| **Understanding and engaging communities as partners.** |
| **B15. Prioritise understanding of user context and needs.**<br><br>"*The tools that you use right at the beginning cannot determine successful or unsuccessful outcomes, but what they can do is determine successful attempts at engaging and making links with communities" B34*<br><br>Engaging with users as the basis for co-creation/co production was demonstrated in the context of the core project partnership and in the wider Community Capital project (RSA) working with individual communities. In the wider projects which LocalNets was supporting, a number of different but related concepts are used to describe the process of working in partnership e.g. co-production, co-creation and co design. All these phrases share the central concept of engaging with wider groups of stakeholders (service users, community groups, citizens) as partners in the design and implementation projects.<br><br>Social network analysis and related interventions should catalyse information sharing and physical networking.<br><br>A1. Ensure those involved in community-based projects should have access to senior level support.<br><br>A2. Understand the external factors that can impact on the capacity of community-based organisations to effectively engage in community projects.<br>A3. Identify and understand community assets, networks and connectors. |

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| A4. Understand the factors that impact on community organisations' capacity to engage.<br><br>A5. Define structure and methodology as the basis for developing partnerships. |
| **S11** Catalyse local information sharing. |
| **S12** Catalyse offline networking using digital data. |
| **S14** Community interest in community rights. |
| **S28** Follow up identification of individuals with invitation to networking event. |
| **S87** Community researchers need to have easy access to senior-level support. |
| **S91** Local community organisations act as effective intermediaries for the local community. |
| **S105** Fiscal constraints impact on the ability of community organisations to actively engage in the collaboration. |
| **S106** External factors can impact on the capacity of government partners to engage e.g. forthcoming elections. |
| **S8** Identify and understand community assets, networks and connectors as the basis for designing successful community interventions. |
| **S16** Positive reaction from individuals to messages from DCLG. |
| **S40** Increase awareness of community rights as the basis for increasing uptake. |
| **S72** Austerity impact on the capacity of community organisations to actively participate in community-based interventions. |
| **S78** Allow sufficient time to develop and design how the collaboration will utilise technology. |
| **S92** Successful community collaboration requires working with a diverse group of community stakeholders. |
| **S81** Structure and methodology are central to successfully engaging and linking stakeholders together at the community level. |
| **S89** Continuity of partners/staffing sustains the collaboration and buy-in from community stakeholders. |
| **Understand and aligning partner expectations.** |
| **B16. Commit time to understanding and aligning partner motives and expectations.**<br><br>**B17. Be realistic about what can be achieved within the resources available.** |

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| The theme of expectations relates to the process by which the respective ambitions and expectations were aligned between partners as the basis for effective collaboration.<br><br>A17. Work to align expectations with reference to overall aims and the process by which they will be achieved while maintain flexibility to accommodate partners' interests.<br><br>A18. Use face-to-face discussion to generate a shared understanding of project aims and objectives.<br><br>A19. The prototype can be used to catalyse a shared understanding of project goals.<br><br>A20. Be realistic about project timelines and milestones. |
| **S88** Misaligned expectations can be resolved during implementation. |
| **S140** Important to align intentions/interests between key stakeholders in relation to project aims and objectives. |
| **S102** Misalignment of people's incentives is super dangerous. |
| **S33** Clear what is being asked of partners. |
| **S34** Flexibility to accommodate divergence of aims during implementation. |
| **S126** The existing prototype facilitated a strong alignment of interests related to the areas where it would be applied. |
| **S93** Developing a shared vision takes place around the table with discussion on purpose, direction, process and the journey the collaboration will go on. |
| **S52** Developing and sustaining shared interests as the basis for motivation. |
| **S103** Alignment of interest with stakeholders provided the basis for collaboration. |
| **S138** Being realistic about timelines in relation to external factors that impact on the project can avoid stress and wasted work. |
| **Intellectual Property** |
| **B18. Discuss and agree a framework for IP at the beginning of the project.**<br><br>This theme related to issues associated with the ownership of the different dimensions of knowledge that have been brought into the collaboration by partners and how new knowledge generated through the collaboration is treated. |

A31. Explicitly agree a policy for intellectual property at the beginning of the project.

A32. Agree how insights and lessons arising for the collaboration will be disseminated and on what basis.

**S119** If IP is not explicitly addressed at the beginning then policy will be determined by default.

**S17** Lessons learnt and innovations arising from the collaboration will be jointly owned by the collaborators.

**S53** Jointly preparing and agreeing terms of reference provides the opportunity to reach agreement on key issues e.g. IP.

**S83** Pre-agreement on IP, collaborative structures and process mitigates the risk that the issues will cause problems during implementation.

**S120** Open source approach to IP is strongly aligned with the philosophy of community engagement.

**S121** Business model around open source is focused upon the strength of the brand created by its development and related expertise.

**Misc.**

" *The vision for Connected Communities is one in which people are embedded within local networks of social support: in which social isolation is reduced and in which people experience greater well-being and other benefits form the community capital in their neighbourhoods*" Community Capital: The Value of Connected Communities, 2015.

At the heart of the Bretton Buzz project is the concept of community well-being. As explored in *Community Capital: The Value of Connected Communities*, community well-being is identified as *'...the sum of assets including relationships in a community including the value* (to community members) *that accrue from these…*' (Community Capital, 2015, pg. 11). Reflecting this principle, social networks have value in supporting individual well-being in terms of providing support, assistance, comfort and enjoyment to individuals within the community.

Social networks and connectivity are critical for social well-being**.**

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| Key factors supporting well-being include speaking English, access to information and access to key people and services. |
| **S2** Access to local information has a significant positive impact on well-being. |
| **S3** The more practical help people can access, the greater their well-being. |
| **S4** Doing local activities and using local resources has a positive impact on well-being. |
| **S5** Knowing people who get things done has a positive impact on well-being. |
| **S6** Important that people feel they can influence decisions in their local area. |
| **S77** Speaking English is a key factor in successfully engaging with local services. |
| **S7** Overcome barriers that inhibit community members accessing community rights. |

Table 53 Bretton Buzz- data analysis identifying statements, activity statements and enablers

## 3. Identification of key characteristics of the Bretton Buzz collaboration

This dimension of analysis has focused on exploring and identifying key characteristics of the CX collaboration[86]. Insights have been identified from documents and interview transcripts and grouped into themes, reflecting structure and processes associated with project design and delivery

**Co-creation**

**Themes**

- Working to iteratively improve the basic prototype of LocalNets in response to experience gained through engaging with core stakeholders (RSA/DCLG) and related projects (Community Capital).

- Projects and related activities should be done *with* people not *to* them and that people and communities have assets that can help them realise their own needs and aspirations.

[86] Due to word count constraints - not all components relating to the identification of characteristics have been included in this worked example.

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| • The process of co-production/design embodies carefully designed processes to engage and support users become partners in co-production.<br><br>**Examples**<br><br>• The development of the visualisation dimension of LocalNets in response to feedback from stakeholders.<br><br>• The process of community engagement in Bretton.<br><br>• The co-design and implementation of related project interventions in Bretton.<br><br>• The use of workshops, facilitation, training and physical engagement as the basis for working with stakeholders and wider communities. |
| CS1 Bretton Buzz will offer an opportunity to iteratively improve the LocalNets software… |
| CS9 The effect of social networks and the results of intervening to strengthen them are locally specific, unpredictable and non-linear. |
| CS10 The search is on to find ways of helping communities to better support themselves. |
| CS11 Over the last two decades there has been a growing interest ...with the co-production of more personalised services, through increasing levels of community empowerment and/or cross -sector partnership working. |
| CS12 Co-design social interventions that would have a positive impact on the neighbourhoods. |
| CS14 Central to the Connected Communities approach is the idea that things should be done with people not to them and that people and communities have assets that can help them realise their own needs and aspirations. |
| CS41 Via email saying 'I found these people, I've identified these nodes and I'd say I have got the same, yes I have got the same, okay I haven't got that one let's have that…' so we produced a database together and that database was re-contacted. |
| CS15 For this reason we endeavoured to co-produce the research with the communities at every stage. |
| CS16 These interventions projects were also co-produced being designed |

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| through participatory workshops… |
| CS17 Placing emphasis on the participation of attendees as opposed to straightforward receipt of services or goods… |
| CS18 Co-production and intervention project: |
| CS20 Community capital can be increased through an informed and co-productive approach to increasing social connections… |
| CS21 The intended beneficiary of any intervention should then be fully engaged in the process of producing that intervention. |
| CS25 So that's what we did as a local intervention. It came from the idea of stakeholders… |
| CS28 He had an innovative idea for engaging communities, not to go in and do research on communities but with communities… |
| CS29 The majority of the work would be done by the communities for the universities. |
| CS30 …the power of engaging communities and training and capacity building within communities and leaving some level of sustain ability |
| CS31 …We've got more official labels now, co-producing, co-designing, co-production, valuing communities, community assets and social assets… |
| CS81 …is very interesting because we don't have very much money and the idea of being able to use digital solutions to identify people and make contact with people when you've got no advertising budget is really interesting… |
| CS103 …sometimes in more traditional things you have this problem where you ask an academic to do something for you and they come back with something that's impossible to read and understand |
| CS104 The ongoing dialogue meant that we weren't waiting for a big report at the end that we didn't understand, that it was just always understanding where we're going next and why we're doing it. |
| CS37 I think it (knowledge) goes back and forward… |
| CS39 It's the buy-in of the community to want to do it, to deliver it, to take control of it. |
| CS42 We invited people and if they agreed then meeting them as a focus group or a steering group or a stakeholder group, or whatever you might want to call it. |
| CS24 …new collaborations have been formed… |
| CS40 The knowledge was that's what they wanted, also choosing where they wanted and how they wanted it meant that it was successful |
| CS26 So that project…was taking advantage of getting local stakeholders |

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| together for them to form a discussion group to identify issues and also come up with potential solutions and then supporting those solutions in a practical way… |
| **Exploratory and Emergent**<br><br>**Strategic Themes**<br><br>• A shared appreciation by partners that in exploring the development and application of new software and related applications brings with it uncertainty in terms of final outcomes but also the potential to learn.<br><br>• A value created by the Creative Exchange to support exploratory and emergent projects that would not be possible under traditional commission procedures that require clearer outcomes and related management processes.<br><br>**Examples**<br><br>• The CX project has provided the opportunity to explore the value that social network analytics can generate as a cost-effective methodology to support community level engagement.<br><br>• The methodology will evolve and develop on the basis of experience gained and opportunities identified for its further development and application. |
| CS4 Novelty -what is the state of the art in this area, how will your project attempt to extend this? |
| CS2 Explore the potential of social media analytics. |
| CS8 It is expected that the data collected by this method will naturally evolve over time… |
| CS5 The project aims to extend and test the potential of LocalNets… |
| CS27 I think where there is a high use of things like Twitter you would have the potential to reach out to a much broader audience and I think that's important in terms of sampling methodology and outreach, and you don't always go to the same people all the time. |
| CS46 Not how we're going to do this, but what I would like to explore with you as to how we can do this…. |
| CS51 Each time it's bespoke but it's a reworking of a model rather than a new |

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| model |
| CS56 (the collaboration) was driven by opportunity |
| CS54 As much as it's experimental and you don't know what the outcomes are going to be, but explaining the purpose and the journey we are going to make… |
| CS84 It's an emerging area, so I think we are quite near the beginning of understanding what's possible… |
| CS102 …it was an exploratory project… |
| CS69 It's a problem for my practice-based PhD that I can't say here's the statue we carved as a result… |
| CS93 A potential future application is …to make something that's open access that allows people to say I live in this area, I'm interested in cycling, who are the other people in my area who are interested in cycling… |
| CS82 Because it is innovative we don't know exactly what it looks like yet and we're still experimenting. |
| CS98 Lets see what's possible… |
| CS99 I would never have commissioned a 'let's find about this' project… |
| CS100 If it was something that had very clear research questions and outputs and outcomes that I would expect that it would be delivered by a certain time. |
| CS89…the methodology was completely new to us, it wasn't the same kind of social media analytics that we'd been exposed to from elsewhere because ….it starts with the very small and works its way out… |

**Knowledge Exchange (transfer/sharing/creation)**

The explicit reference to knowledge exchange reflects both the policy and practice as experienced by those who are familiar with the concept. Points have also been captured which reflect wider themes such as the transfer and sharing of knowledge as a dynamic part of the project and collaboration.

**Strategic Themes**

- In the context of community engagement and co-production, universities and their infrastructure are central to catalysing community participation and ensuring a two-way flow of expertise and knowledge with stakeholders with insights generated from the university informing the development of teaching and practice.

- Within the CX collaboration, reference was made to the different dimensions of knowledge transfer, sharing and co-creation as part of the overall project process (both explicit and tacit).

**Examples**

- The process of knowledge transfer, sharing and co-creation between key stakeholders within the core and wider CX collaboration (RSA and DCLG) e.g. LocalNets visualisation.

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| CS3 To stage an intervention in Bretton which increases local information sharing with a view to demonstrating methods for improving well-being and mental health |
| CS7 The project provides opportunities to inform and stage interventions in Bretton to increase local information sharing… |
| CS22 The insights into the networks…should be shared with the individual or community… |
| CS8 The project aims to exchange knowledge between academic researchers, policy makers and local communities as a means of simultaneously better disseminate government policy and engage local communities in civic activity… |
| CS32 …to bridge the gap between academic research and community research… |
| CS33 Knowledge exchange is exchanging the knowledge about how to do research with people who would otherwise not become researchers… |
| CS34 …knowledge exchange is what I do with communities within the infrastructure of a university |

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| CS35 Very much that the university can train community researchers and then community researchers can gain the results and information… |
| CS36 Universities can then feed the knowledge back into the community, policy or practice |
| CS38 …their production of knowledge from a local source gets fed back into the universities.. |
| CS39 We can take that (knowledge) back in, it becomes a CPD course, it becomes accredited courses, it becomes knowledge that is shared and understood by the community |
| CS59 In terms of understanding of where it was really informative I'd say it was more a tacit understanding of how other people might conceptualise my work |
| CS62 They definitely transferred knowledge to me as well actually… |
| E83 So were learning all the time and potentially getting something interesting form it… |
| CS85 We are certainly very interested in learning, mainly from academics but also from industry… |
| CS87 Knowledge transfer's probably the term that is more used I suppose within government… |
| CS88 So the first meeting we had there was an exchange of knowledge - we explained our policy interests and what our policies are and I think that was completely new… |
| CS95 We don't just think we develop everything, we know that there is expertise out there that we don't have… |
| CS96 So the idea that the work …has the potential to allow us to achieve things for very little money… |
| CS97 …the fact that we don't have massive research budgets means that we look to build relationships with people outside the department in different ways… |
| CS101 I think that's what happens when we just speak to a lot of people because there are lots of really interesting people out there and sometimes opportunities emerge as a result of that and we go with them… |
| CS91 One of the things that I do is try to visualise the data that we hold, through the infographics that tell a narrative of our understanding of a policy context… |
| CS43 We went in and provided the knowledge to the sixth-form students that we trained, so they were gaining knowledge from us. Then with the knowledge of research skills, they were able to carry out research and feed that back to us… |

**Prototype (Further development)**

At the heart of the CX project has been the deployment of the LocalNets prototype. Unlike other CX projects, an existing prototype was deployed in the CX project with the intention of testing and evaluating its performance in mapping and catalysing an understanding of community networks and assets to support i) uptake of community rights and ii) the co-production of community-based interventions.

**Strategic Themes**

- The deployment of an existing prototype with known parameters (rather than the process of developing one) for its performance can act to catalyse a shared understanding of how partners can engage and generate value from the project.

- The insights and knowledge generated through the collaboration provide the basis for refinement and development of the software and its related application.

**Examples**

- Development of visualisations for data generated.

- The evaluation of existing related software guidance creating the potential to develop new evidence-based guidance e.g. database.

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| CS19 We worked with a researcher from the RCA to further develop an online tool originally piloted in our Community Mirror project… |
| CS23 Working in partnership with the intended beneficiary is one that can consistently be shown to build community capital… |
| CS57 We had quite a strong prototype of what the tool would be, so it wasn't about some type of process, |
| CS63 I think a lot of the design work was already embodied in the piece of software really. |
| CS64 One thing they keep on telling me - this is a lesson- is that they loved the visual graph aspect of it. |

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| CS65 I guess what's happened is they've (visual graphics) gone from something that I do manually to something I do automatically in the software… |
| CS66 It's certainly been the most important thing for me to realise that (importance of visual graphics)… |
| CS67 When you are explaining and selling a piece of software which does an abstract thing, a certain kind of visualisation is extremely helpful. |
| CS68 It's the evolution of software |
| CS70 So you can scale it up - exactly |
| CS71…don't evaluate me on the one we did, evaluate me on the potential notion (scaling up) |
| CS76 It seemed to me that the guidance that existed is wrong in that we had specifically found very mixed messages about whether we needed a special kind of database for the project… |
| CS58 There is social value in the data… |
| CS60 The next stage is them saying what can you do for free…by the way we can't offer any support - monetary or otherwise. |
| CS75 (Open Source) One thing I think it's very aligned with the political philosophy behind the process… |
| CS78 The fundamental resource for me is the web developer time… |
| **Self-organising**<br>The theme of self-organising refers to the process by which the immediate project collaboration and the wider group of stakeholders develop a shared understanding of project aims, methods and related roles and responsibilities. In the absence of clear lines of hierarchy and authority that can directly shape and dictate project design and management, the Bretton Buzz project developed through discussion and negotiation. This process included an element of self-selection by partners in terms of their roles and responsibilities. This principle of self-organisation within a project-based collaboration was also reflected in the work of Community Capital programme in community engagement and co-production of project-based interventions.<br><br>**Strategic Themes**<br>• An overall structure to the process of collaboration provides a supporting framework which facilitates the development of a shared understanding of the project and how each partner can engage. |

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| • The development of a shared understanding of how the project will develop and the respective roles takes time and personalities are important,<br><br>• Facilitation e.g. Community Capital helps create the conditions to support the development of a shared understanding and the emergence of clear roles and responsibilities.<br><br>**Examples**<br>• Jointly generating a shared Terms of Reference, collaboration and project agreements.<br><br>• Physical contact and regular communication in the development of both the CX Bretton Buzz collaboration and the wider collaboration. |
| CS47 (Roles/responsibilities) It's whoever chooses 'I could do this' and the rest of the group buying in and saying that's a good idea. |
| CS48 First they are invited, then they self-select. |
| CS49 But who does what and how the roles work becomes negotiated as team work. |
| CS44 You have to produce the conditions under which that (engaging and bringing people together) can happen… |
| CS50 I think they are often resolved as you go along…If they don't get resolved then obviously there is team conflict and disparity. |
| CS61 I went to see them about doing a CX project with them and just had one meeting and thought that's not the one. |
| CS77 Everybody's goal is to see how we'd use this thing to increase social capital… |
| CS90 Yes, it's our interest in it; if we weren't interested then we wouldn't do it |
| CS58 It's a practice issue - to leave behind good relations and you close the door…getting them around the table and most of them will say 'we can't do that, our ethics procedures wouldn't allow us to do that'. So they opt out and would say we won't take part in that properly. |

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| CS94 We were all motivated to give it a go… |
| CS45 Of course there is an overall structure, and without those being in place you couldn't actually engage and do this process of linking stakeholders together… |
| CS80 So we were very concerned about being clear on the terms of reference from the outset… |
| CS55 (generating a collaboration across disciplines). Again it comes down to people, personalities being able to communicate, to provide a positive ethos, to provide a sense of contribution that each stakeholder can make to any purpose. |

Table 54 Bretton Buzz- data analysis identifying characteristics of the collaboration

# Appendix 2 Ethics Approval

*1. Approval from Lancaster University's research office*

Dear Jeremy,

Thank you for submitting your completed stage 1 self-assessment form for **An exploration of Knowledge Exchange in the digital public space and identification of factors critical for successful KE.**

The Part B information has been reviewed by a member of the University Research Ethics Committee and I can confirm that approval has been granted for this project.

**However, for completeness, please can you forward a copy of the Kendal Case Study before the research begins.**

As principal investigator your responsibilities include:

- ensuring that (where applicable) all the necessary legal and regulatory requirements in order to conduct the research are met, and the necessary licenses and approvals have been obtained;

- reporting any ethics-related issues that occur during the course of the research or arising from the research (e.g. unforeseen ethical issues, complaints about the conduct of the research, adverse reactions such as extreme distress) to the Research Ethics Officer;

- submitting details of proposed substantive amendments to the protocol to the Research Ethics Officer for approval.

Please contact the Research Ethics Officer, Debbie Knight (ethics@lancaster.ac.uk 01542 592605 if you have any queries or require further information.

Kind regards,

*Debbie*

Debbie Knight | Research Ethics Officer | Email: ethics@lancaster.ac.uk | Phone (01524) 592605 | Research Support Office, B58 Bowland Main, Lancaster University, LA1 4YT
Web: Ethical Research at Lancaster:
http://www.lancaster.ac.uk/depts/research/ethics.html

Lancaster University

2. *Lancashire Teaching Hospitals Trust (Preston Royal) with reference to the Kendal project*

From: Bennett Kina (LTHTR) <Kina.Bennett@lthtr.nhs.uk>
Date: Mon, Jan 19, 2015 at 1:40 PM
Subject: RE: Kendal Case Study Enquiry
To: "jeremydavenportcx@gmail.com" <jeremydavenportcx@gmail.com>
Cc: "Adams Heather (LTHTR)" <Heather.ADAMS@lthtr.nhs.uk>

Hello Jeremy,

Heather forwarded your proposal to me as Innovation and Ideas Facilitator for the Trust. Your proposal sounds very interesting, but I would say at this stage it is more of a service improvement project rather than research, and as it involves your data only, it would not require National Research Ethics (REC) approval. However, during the later stages where you wish to test / evaluate the app, you would need NHS approval, probably both REC and local Trust R&D approval through us, as it will involve other patients. We would be happy to provide guidance through the process for that.

Although we do register service evaluations, I feel your project fits more under service improvement, and is more of an innovation. We do not have a formal process or requirement to record such projects, however, I will add it to my innovation file if that is okay with you. In reality, all that means is that I have your proposal on file, as a record of an innovation project that is occurring within the Trust.

If there is anything else we can help with or your need further guidance please don't hesitate to contact either Heather or myself.
Kind regards
Kina

**Dr Kina Bennett**
*Innovation and Ideas Facilitator*
CENTRE FOR HEALTH RESEARCH AND INNOVATION

Tel: 01772 52 (4611)
Reception: 01772 52 (2031)

# Appendix 3 Ethics: Supporting Documentation

## 1. Participant Information Sheet (Interviews)

| | | | |
|---|---|---|---|
| **Project Title** | Knowledge Exchange in the Digital Public Space | **Date To be provided** | |
| **Researcher/s** | Jeremy Davenport | **Academic Lead** | Rachel Cooper |
| **Contact details** | j.davenport2@lancaster.ac.uk | **Website** | www.thecreativeexchange.org |

Dear participant *< insert name if known >*

I would like to invite you to take part in a PhD research study that I am undertaking as part of the Creative Exchange based at Lancaster University. Before you decide whether or not to take part you need to understand why the research is being done and what it would involve from you. Please take time to read the following information carefully. Please don't hesitate to ask for clarification if you have any questions on the documentation provided or you would like more information.

**What is the Creative Exchange?**
The Creative Exchange is an Arts and Humanities Research Council (AHRC) funded research programme exploring the digital public space and includes Lancaster University, Newcastle University and the Royal College of Art. The programme is exploring the digital public space in partnership with a host of companies, organizations and individuals through six core themes and related collaborative projects:
i) Public service innovation and democracy.
ii) Making the digital physical.
iii) Performance, liveness and participation.
iv) Re-thinking working life.
v) Stories, archives and living.
vi) Building social communities.
Each theme is explored through a series of events, from which collaborative teams and project ideas emerge, are developed and later submitted to our management team for approval and funding.

**What is the purpose of this Research Project?**
My research is exploring the nature of Knowledge Exchange and innovation in the context of collaborative projects being implemented as part of the Creative Exchange. Through working as part of the delivery team and in undertaking research on a number of these projects, I will explore the role of Knowledge Exchange in catalysing innovation. Specifically, my research will address the following questions: 1) What are the organizational conditions that support or alternatively inhibit successful Knowledge Exchange in multi-organizational and multi-disciplinary teams and; 2). Can complex collaborative teams be structured and managed to optimize Knowledge Exchange outcomes in relation to successful problem solving and innovation.

**Why have I been invited?** You have been invited to participate in an interview as part of this research on the basis of your role in project design and implementation. Your knowledge and insights will provide an important dimension of analysis in understanding the factors that shape Knowledge Exchange processes and outcomes.

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| **Do I have to take part and can I withdraw from the research?**<br>Taking part is voluntary and you may withdraw from the research up to two weeks after your participating in any interviews or workshops. If you decide to withdraw and at your request, any information provided by you will removed from the research being undertaken. The deadline for withdraw is two weeks after the completion of the interview. Any data (written or verbal) will be removed from this research project. |
| **What will taking part involve for me?**<br>Interviews will be documented by the researcher by taking notes and also recorded. Identifiable data, including participant voices will be transferred to a password protected hard drive and deleted from the device within 24 hours of the interview. In that interim period the device will be stored securely. Interviewees will be anonymised in any publication or dissemination of research findings unless explicit additional consent is obtained. Data generated from this research will be used in the named researchers PHD study. |
| **How long will data be stored?**<br>As this is an AHRC funded research project that aims to secure publication in a number of studies, the data will be stored securely for a minimum of 10 years. However, the data will only be used as detailed above. |
| **What are the possible benefits of taking part?**<br>There are no direct benefits for participants other than their valued contribution to shaping the outcome of the research being undertaken. |

Thank you for reading this information sheet.

**If you have concerns or complaints about this project you can contact an independent person at Lancaster University:**

Dr Martyn Evans
Head of Department
The LICA Building
Lancaster University
UK LA1 4YW
Email : m.evans@lancaster.ac.uk
Phone : 01524 594157

*2. Participant Consent Form*

Participant Name _____

Project title Knowledge Exchange in the Digital Public Space

Researcher Jeremy Davenport

| | Please Initial |
|---|---|
| 1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. | |
| 2. I understand that my participation is voluntary and that I am free to withdraw up to two weeks after participating in the interviews or workshops, without giving any reason. That at my request, any information provided by me will be removed from the research being undertaken. | |
| 3. I understand that any information given by me may be used in future reports, articles or presentations by the researcher, including their final thesis for their PhD. | |
| 4. I understand that my name will not appear in any reports, articles or presentations without additional consent being sought. | |
| 5. I agree to take part in the above project. | |

| *Name of Participant* | *Signature* | *Date* |
|---|---|---|
| *Name of Researcher* | *Signature* | *Date* |

## Appendix 4 Identification of Case Projects

Appendix 4 provides background information on the process by which case projects were identified from the overall CX portfolio of projects. The criteria for selection included the stage of project development along the *concept to prototype* spectrum. A further dimension of analysis being the type of lead external partner. These criteria were combined with i) balance of projects between the three CX partner institutions ii) availability of lead contacts and iii) variety of different social and technology contexts. In order to assess the stage of development for each project the following definitions were used:

*Concept:* The earliest stage of project development where emphasis is on generating and exploring ideas, principles and possible innovations reflecting need, opportunity and inspiration.

*Proof of Concept:* An exploration and evaluation phase of project development addressing the extent to which a concept/mock up and early stage development will be technically, commercially and socially viable in the context of real world products/services.

*Prototype:* "*Prototypes are physical manifestations of ideas or concepts. They range from rough (giving the overall idea only) to finished (resembling the actual end result)*" (Sanders & Stappers, 2014, p.9)**.**

In relation to differentiating on the basis of the lead partner, the following definitions have been used:

*Government:* Organisations and bodies that act to manage and control a country including creating and administering laws, raising and accounting for tax, providing public services etc. A national government exercises this mandate across the entire country while local government implements this mandate at a county, district and municipal level.

*Not for Profit***:** Economic activity not falling under direct government control (national, regional or local) where the organisations and activities do not generate profit and where the motive for those involved is not to maximise profit.

*Private Sector:* Economic activity not falling under government control (national, regional or local) where the primary motivation is to seek profit.

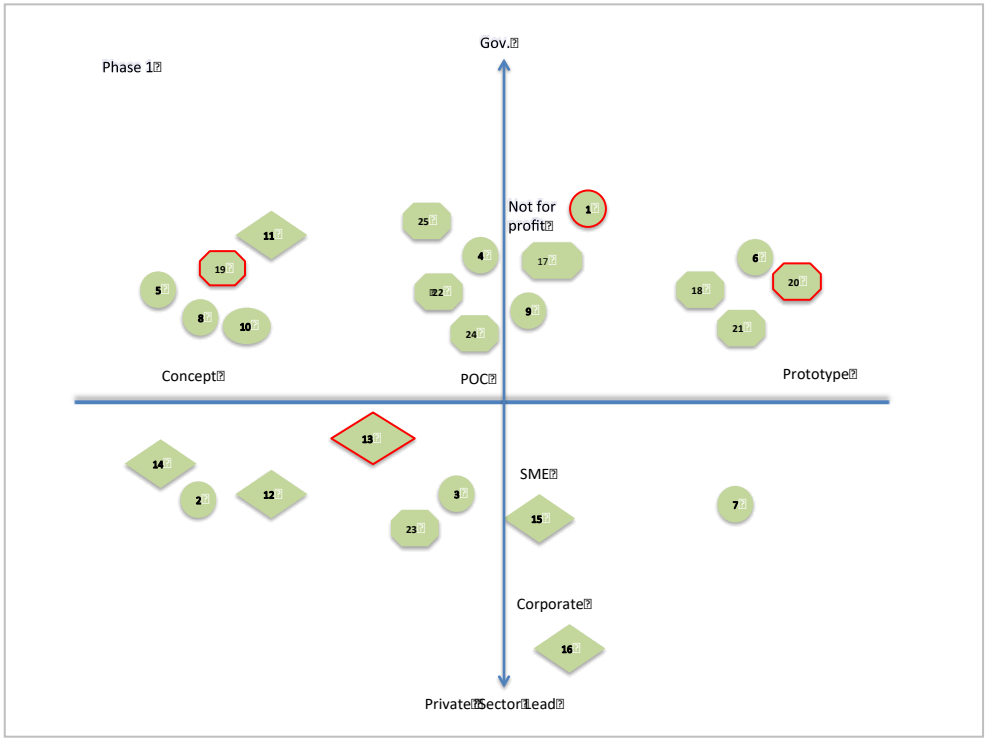
| | | |
|---|---|---|
| **Lancaster** | i. Kendal | ii. Open Planning |
| **RCA** | iii. Hybrid Lives | iv. Bretton Buzz |
| **Newcastle** | v. Partici. Prod. Tech. | vi. T. Dan Smith |

Table 55 Selected case projects by CX partner institution

| | Name | Type | Lead Partner | Other Partners |
|---|---|---|---|---|
| **Lancaster** | | | | |
| 1 | **Open Planning** | **POC** | Liverpool Vision (NP) | Stardotstar (SME), Red Ninja (SME), Liverpool University. |
| 2 | **Alpha Procurement** | **Concept** | StartdotStar (SME) | Infonomics (SME), Swirrl (SME) |
| 3 | **Cold Sun** | **POC** | Mudlark (SME) | |
| 4 | **Physical Play List** | **POC** | BBC (NP) | |
| 5 | **Numbers that Matter** | **Concept** | Future Everything (NP) | Madlab (NP) |
| 6 | **Digital Fiction Factory** | **Proto** | BBC - Digital Fiction Factory (NP) | |
| 7 | **Good Day at Work** | **Proto** | Robertson Cooper (SME) | |
| 8 | **Chattr** | **Concept** | Future Everything (NP) | Kimchi and Chips (NP) |
| 9 | **TILO** | **POC** | FACT (NP) | NESTA (NP), Me You and Us (?) |
| 10 | **Café/Salon: Imatarium** | **Concept** | Lancaster University | AHRC Hubs |
| **RCA** | | | | |
| **11** | **Rhythmanalysis** | **Concept** | FACT (NP) | Liverpool Uni, |
| **12** | **Where Do You Go To?** | **Concept** | Integrans (SME) | UCL Bartlett, |
| **13** | **Hybrid Lives** | **Concept** | Bosson Group (SME) | FACT (NP), Unwork (SME?) |
| **14** | **A Walk in the Park** | **Concept** | Mydex (SME) | Southampton Uni (NP) |
| **15** | **Community Data Journalism** | **POC** | Guardian Digital Agency (SME) | Design for Social Change (NP). |
| **16** | **Tumble Pilot** | **POC** | Blackberry | B3Media (NP) |

| | | | | |
|---|---|---|---|---|
| | | | (SME+?) | |
| **Newcastle** | | | | |
| **17** | **The News Where You Are** | **POC** | BBC | University of Central Lancs (NP) |
| **18** | **On the Precipice** | **POC** | ISIS Arts (NP) | University of Hull (NP) |
| **19** | **Participatory Production Technologies** | **Concept** | Co-opera-co | Redhavoc media University of Hull (NP) |
| **20** | **Playful Narrative Realms** | **Proto** | English Heritage (NP) | Northumbria University (NP) |
| **21** | **Tuning in to T.Dan Smith** | **Concept** | Northern Architecture (NP) | |
| **22** | **This is How We Do It** | **POC** | Beamish Museum (NP) | Edinburgh University (NP) |
| **23** | **Project R-hythm** | **Concept** | Fevered Sleep (NP) | |
| **24** | **Interglacial-Erratics** | **POC** | Pacciti Company (NP?) | Ipswich and Colchester Museums (NP) |
| **25** | **Department of Hidden Stories** | **POC** | Benjamin Road Library (NP) | |

Table 56 CX phase 1 - project profiles



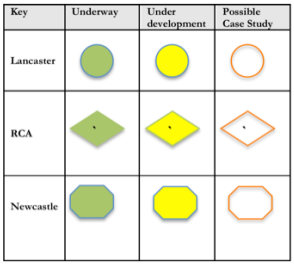



Figure 63 Analysis of CX project portfolio - phase 1

*Phase 2 Project profiles and landscape 2015-2017*

| | Name | Type | Lead Partner | Other Partners |
|---|---|---|---|---|
| **Lancaster** | | | | |
| **26** | **Perceptive Media** | **POC** | BBC (NP) | Glasgow School of Art(NP) Mudlark (SME), |
| **27** | **Sea breeze** | **POC** | Winter Gardens theatre (NP) | Raisin and Willow (SME), Imitating the Dog (SME) Sheffield Hallam University |
| **28** | **Near Miss** | **Concept** | Blaze.cc (sme) | Resonance.FM (np), University of Westminster (np) Goldsmiths (np) |
| **29** | **Indie data** | **POC** | IndieOS (sme) | LSE (np) Hope London – Graphic Artist |
| **30** | **Political Mine craft** | **POC** | Ourlife (np) | CRED University of Cumbria (np) |
| **31** | **Being There (Cheshire East)** | **POC** | Cheshire East Reflects (np) | |
| **32** | **Aging Playfully** | **POC** | Age UK (NP) | |
| **33** | **Kendal: Data Visualisation** | **Concept** | NHS-Kendal/Preston Royal (NP). | Lancaster University |
| **34** | **Paths of Desire** | **POC** | ? | |
| **RCA** | | | | |
| **35** | **Bretton Buzz** | **POC** | Department of Culture and Local Government, (Gov) | Manchester University Royal (NP) Royal Society for the encouragement of Arts, Manufactures and Commerce (NP) Tableflip (SME) |
| **36** | **Drawing Stages** | **POC** | Nexus Productions | University of Wales (NP) |

| | | | | |
|---|---|---|---|---|
| | | | (SME) | FACT (NP) |
| **37** | **Designing for Pseudonymity** | **POC** | Open Rights Group (NP) | York University (NP) |
| **38** | **Bio Digital Silk Road** | **Concept** | The Arts Catalyst (NP) | Tufts University (NP)<br>Zurich University (NP) |
| **39** | **Shakespeare in Shoreditch** | **Concept** | RIFT (NP) | NA |
| **40** | **Now you see it** | **Concept** | Tactical Technology Collective (NP) | Plymouth University |
| **41** | **Transmission** | **Concept** | Resonance FM(NP) | NA |
| **Newcastle** | | | | |
| **42** | **Red Tales** | **Concept** | Red Squirrels Northern England (NP) | University of Northumbria (NP)<br>University of York (NP)<br>Wildscreen (NP) |
| **43** | **Sound and Guts** | **Concept** | ? | Arts Council England (NP)<br>Northumberland Council (NP)<br>Woodhorn Museum (NP)<br>Berwick Museum (NP)<br>Morpeth Bagpipe Museum (NP)<br>Queens Hall Arts Centre Hexham (NP)<br>Drop Everything (arts production company |
| **44** | **Fax Machine Game** | **?** | ? | ? |
| **45** | **Toyplay** | **?** | ? | ? |
| **46** | **Squidge** | **?** | ? | ? |
| **47** | **Walks for Change** | **?** | ? | ? |
| **48** | **The Beat** | **?** | ? | ? |

Table 57 CX phase 1 - project profiles

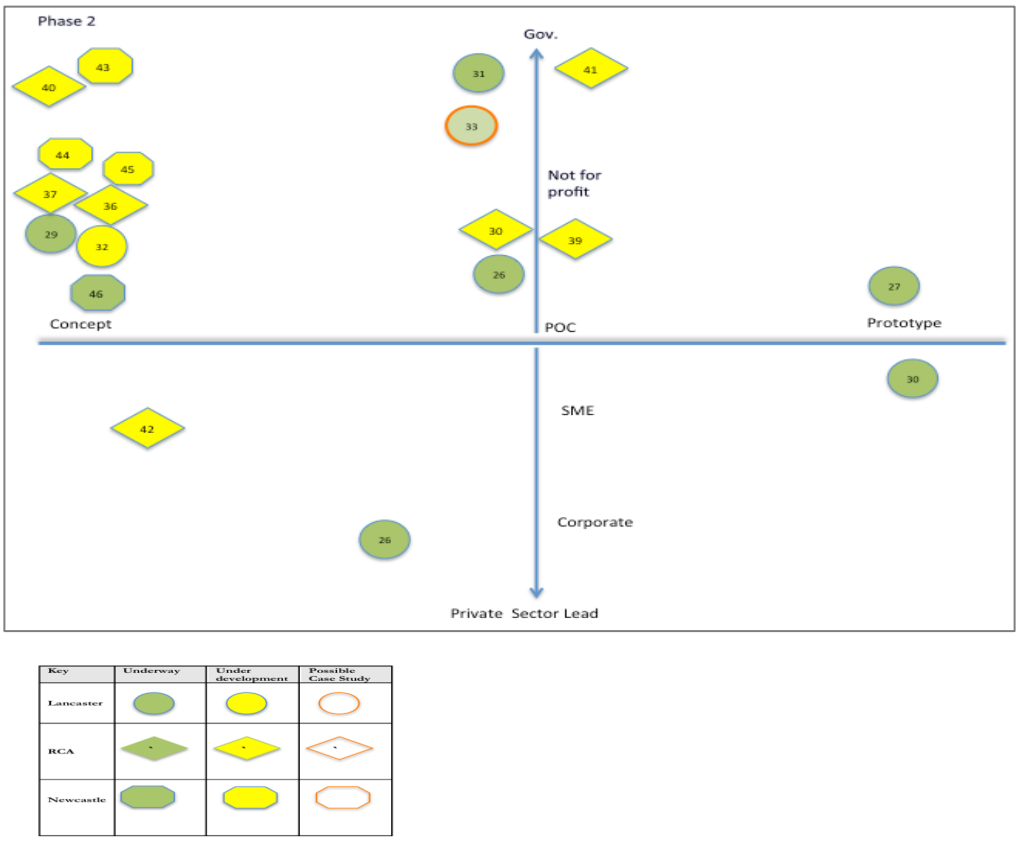



Figure 64 Analysis of CX project portfolio - phase 2

## Appendix 5 Semi-structured Interview Schedule

*Part 1 Exploring meaning and manifestation of knowledge in the project.*

- What do you understand by the **Knowledge Exchange?**
- What is/was your **personal vision** and role in the project?
- Where did the **inspiration** for the project come from?
- In **what ways has knowledge manifested** within your CX project (tacit/explicit)?
- Can you **identify the processes** by which knowledge has manifested and been applied during the life of the collaboration (sharing/transfer/creation/application)?

*Part 2 Exploring key design factors*

The aim of this part of the interview is to **explore the factors** that have shaped the collaborative process. A semi-structured conversation on the basis of the questions outlined below will be undertaken. Expected duration 1 hour.

- What were the critical factors for successful Knowledge Exchange in your project?

  **Operating environment** (within and outside the organisation)
  - admin/payments/IP
  - mgt. support/guidance
  - Formal processes e.g. conflict resolution
  - wider economic climate/technology drivers

  **Team/Project design** (formal and cultural)
  - formal design/process/flexibility
  - composition and expectations
  - roles and responsibilities. (Skills mix) - how was this clarified.
  - formal processes (e.g. conflict resolution)

  **Interpersonal processes** (within the team and outside the team)
  - communication
  - coordination
  - collaboration
  - interaction with management/between partners/wider

  **Technology and digital impact on collaborative process**

- What have been your three greatest project level obstacles?
- Your experience of working across **professional disciplines**? Factors that help or hinder the process of working together.
- Experience of working across **organisational boundaries** e.g. University with SMEs.
- **What key lessons have you learnt** about the process of collaboration and knowledge exchange…

# Appendix 6 The Kendal Project: Infographic

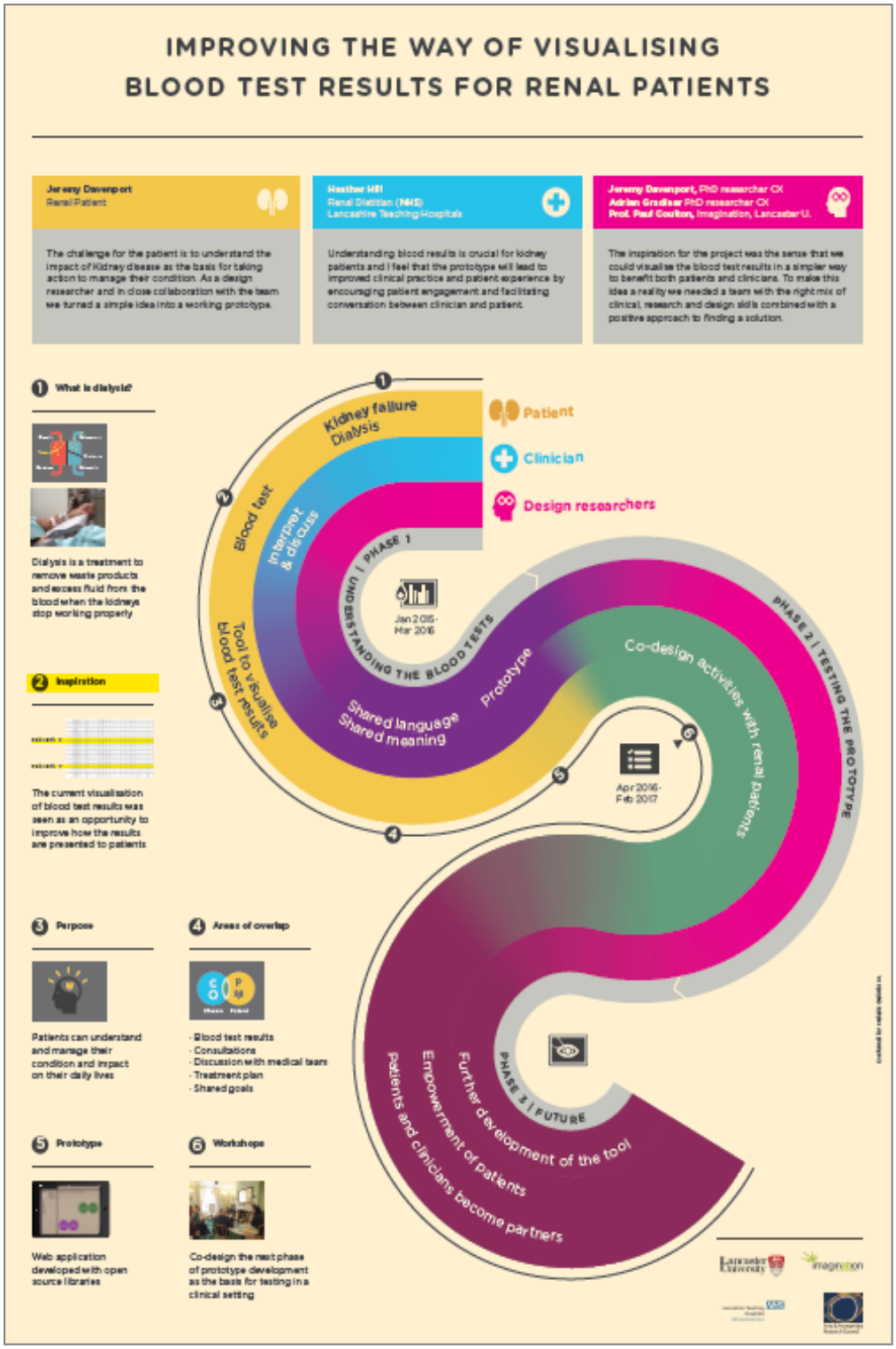



Figure 65 Infographic from the Kendal case project

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