

INSTITUTIONAL WASTE WITHIN THE UK CONSTRUCTION INDUSTRY: AN EXPLORATORY STUDY

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of Nottingham Trent University for the degree of Doctor
of Philosophy

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1. Sarhan, S., Pasquire, C., King, A., and Manu, E. (2018) 'Institutional Waste within the Construction Procurement Context', *Engineering Project Organisation Journal*, 8 (January 2018), 36-64

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2. Sarhan, S., Pasquire, C., Manu, E. and King, A. (2017a) 'Contractual governance as a source of institutionalised waste in construction: a review, implications, and road map for future research directions', *International Journal of Managing Projects in Business*, 10 (3), 550-577

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3. Sarhan, S., Pasquire, C., and King, A. (2017b) 'The concept of Institutional Waste within the Construction industry: A potential theoretical framework', *Lean Construction Journal*, 2017 Issue, pp 12-24

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ABSTRACT

The construction industry is often criticised for being wasteful compared to other industries, confrontational, and for lacking capacity for learning and improvement. Numerous industry reports have been commissioned by the United Kingdom (UK) Government and industry organisations, over the past eighty years, with the aim of highlighting concerns and calling for industry reform. In 2013, the UK Government challenged construction to achieve 50% faster delivery and a 33% reduction of clients' capital costs by 2025. In 2016, the Government Construction Strategy 2016-20 was produced with an ambition of achieving efficiency savings of £1.7 billion over the course of the current Parliament. It is however suggested that prevailing business models are unlikely to meet these targets.

Eliminating (process and physical) waste from construction design and delivery is a necessary step towards achieving the aforementioned targets. However, waste-reduction understood simply as the improvement of current processes rather than fundamental system redesign is insufficient. Obtaining a wider understanding and conceptualisation of waste in construction is crucial, in order to prepare the industry for the radical change demanded of it. This research was, thus, undertaken to explore the institutional, procurement and commercial environments surrounding the design and delivery of construction projects, and reveal the consequential wastes. A reflexive grounded-theory methodology was adopted to explore the institutional factors influencing construction procurement, and to facilitate an in-depth understanding of the impact of prevailing construction procurement arrangements on project performance and outcomes. Data were primarily collected through in-depth and iterative interviews with 24 senior professionals within the UK construction industry, including a review of supporting documentations provided by the interviewees.

Consequently, a conceptual model of 'institutional waste in construction' was developed by the author of this study, which was then evaluated by various UK industry experts to assess its quality and rigour. This model is a novel contribution to knowledge providing innovative perspectives to the generation and persistence of waste in construction projects. The model also provides novel explanations as to why wasteful procurement practices prevail in the construction industry. It is concluded by stressing that any industry-wide initiatives for improvement (e.g. BIM and Partnering) will stall or at least fail, to achieve its full potential, unless the prevailing institutional factors, identified within this study, are addressed.

DEDICATION

Almighty Allah (God) who always blessed me for what I asked and even for what I did not ask. All the thanks and praises to Allah.

DEDICATED TO MY WONDERFUL DEEPLY MISSED MOTHER who passed away, unexpectedly, half-way through my PhD journey. FOREVER YOU REMAIN IN MY HEART.

My lovely Father: for his unconditional love, encouragement and prayers.
Without his support and sacrifice, this work was impossible

Monika, my wife, for her love, support, kindness and patience with me throughout my PhD Journey

Laila: my gorgeous daughter, whose love enlightened upon me a deeper and newer understanding of the meanings of Life

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LIST OF ABBREVIATIONS

A-D-I-A	Abductive-Deductive-Inductive-Abductive
BIM	Building Information Modelling
CIOB	Chartered Institute of Building
CIPS	Chartered Institute of Procurement and Supply
CM	Construction Management
CP	Construction procurement
CPS	Construction Procurement System
D&B	Design and Build
DB	Design-Build
D-B-B	Design-Bid-Build
D-I	Deductive-Inductive
DRM	Dispute Resolution Mechanism
DSR	Design Science Research
FICE	Fellow of Institution of Civil Engineers
FIDIC	Fédération Internationale des Ingénieurs-Conseils
GT	Grounded Theory
GTM	Grounded Theory Methodology
H&S	Health and Safety
HM treasury	Her Majesty Treasury
IBE	Inference to the Best Explanation
ICE	Institution of Civil Engineers
IF	Imperfect Institutional Factors
IGLC	International Group for Lean Construction

IP	Inefficient Procurement Arrangements and Practices
IPD	Integrated Project Delivery
IT	Information Technology
IW	Institutional Waste
JCT	The Joint Contracts Tribunal
JICEC	Joint Inter College Ethics Committee
JIT	Just-in-Time
LC	Lean Construction
LCI	Lean Construction Institute
LPS	Last Planner System
MICE	Member of Institution of Civil Engineers
NEC	The New Engineering Contract
NHS	National Health Service
NIE	New Institutional Economics
NSR	Natural Science Research
NTU	Nottingham Trent University
NVA	Non-Value Adding
OGC	Office of Government Commerce
PB	Inefficient Performance and Behavioural Impacts
PhD	Doctoral of Philosophy
PMI	Project Management Institute
P _n	Proposition _{number}
PPC 2000	Contract for Project Partnering
PPP	Public-Private-Partnership

PQQ	Procurement Qualification Questionnaire
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
S&S	Subcontractors and Suppliers
SC	Supply Chain
SCM	Supply Chain Management
SME	Small-Medium Enterprises
SSR	Social Science Research
TC	Transaction cost
TCA	Transaction Cost Analysis
TCE	Transaction Cost Economics
TFV	Transformation-Flow-Value generation
TPS	Toyota Production System
TVD	Target Value Design
UK	United Kingdom
USA	United States of America
W	Consequential Waste
WRAP	Waste and Resources Action Programme

CHAPTER ONE: INTRODUCTION

1.1 Research background

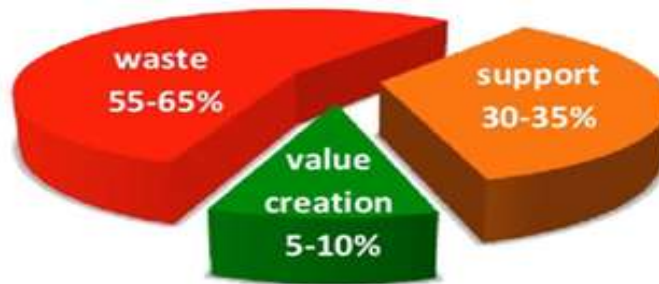
It is widely accepted that there is considerable waste in the end-to-end design, construction and facility management process (Egan, 1998; Koskela, 2000; Keys *et al.*, 2000; Mossman, 2009; Sandberg and Bildsten, 2011; Viana *et al.*, 2012; Dassault Systems, 2014; Formoso *et al.*, 2015; Bølviken and Koskela, 2016). Over the past eighty years, the UK Government and many organisations have commissioned several reports, with the aim of reviewing the performance of the construction industry and suggesting means of improvement (see for example, Bossom, 1934; Simon, 1944; Banwell, 1964; Latham, 1994; UK Government, 2012; Farmer, 2016; Infrastructure and Projects Authority, 2016). Of these, the Egan report, ‘Rethinking Construction’, was produced in 1998 to address concerns raised by clients engaging services of construction companies; and was followed by the ‘Never Waste A Good Crisis’ report published by Construction Excellence in 2009 to review the subsequent progress. The former report sent a clear message to the construction industry by stressing that:

“Recent studies in the USA, Scandinavia and this country suggest that up to 30% of construction is rework, labor is used at only 40-60% of potential efficiency, accidents can account for 3-6% of total project costs, and at least 10% of materials are wasted...The message is clear - there is plenty of scope for improving efficiency and quality simply by taking waste out of construction” (Egan, 1998, p.15).

Empirical evidence points to ‘waste’ in excess of 50% of the activities performed (what we do) in construction projects (Figure 1.1), where ‘waste’ is defined as anything that is not required to create value for the customer/client or end-user. This is primarily process waste with some physical waste. In the construction industry, the idea and understanding of ‘waste’ among practitioners is typically synonymous with physical waste (i.e. on-site material waste). Construction managers and practitioners have for a long time focused their attention on the transformation of activities, while giving much less consideration to the flow of activities across the whole project process (Koskela, 1992; Sarhan and Fox, 2013; Sarhan *et al.*, 2018).

The concept of flow in construction was first presented by seminal work of Koskela (1992) “Application of the new production philosophy to construction”. It views production (i.e. design and construction) as a ‘flow’ composed of value adding activities (i.e. transformation) and non-value adding activities (Koskela, 1992; Koskela, 1999; Kraemer *et al.*, 2007). The main objective of the flow concept is to eliminate or reduce non-value adding activities (or process waste) from production; thereby leading to production improvements including lead time reduction, increased transparency, and variability reduction (Koskela, 2000). Non-value-adding activities can be divided into two categories: supporting activities and unproductive activities (i.e. waste), as shown in Figure 1.1. Supporting activities are work elements that do not directly add value, but cannot be removed, as they are essential in carrying out an operation. These include for example: logistic activities, accounting and cost-estimating activities, reading drawings, cleaning up the workplace and so on. Unproductive activities on the other hand, are those wasteful activities that are not necessary and can be eliminated from the production flow without diminishing the value of the work.

The fact that much of the waste, illustrated in Figure 1.1, is common to many projects suggests that there are systems and structural arrangements that support and/or encourage wasteful activities in construction. To say that waste is created due to human error is unhelpful; blame arguably fails to facilitate learning to ‘do better’ and similarly fails to lead us towards effective methods of reduction or prevention. As Dr Deming taught us: *‘94% of troubles and failures are attributed to the system (responsibility of management), 6% are due to special cases (such as human mistake)’* (Deming, 1984, p. 315). Human behaviour is always influenced by the environment in which it takes place. Without a deep understanding of the economic, social and environmental issues contributing to poor decision-making, it is very likely that similar flawed or risky decisions will recur. As emphasised by Levensen (2011) *“without changing the environment, human error cannot be reduced for long. We design systems in which human error is inevitable and then blame the human and not the system design”* (p. 61).



e.g.	What the customer wants	What we have to do to enable us to create what the customer wants e.g.
Delay, waiting, Rework, Accidents, Over-ordered materials, Damaged materials, Multiple handling of materials, Making-Do, Poor payment systems, Duplicate insurance cover, Settling disputes after project completion, Tendering, Procuring services on cost,		Procurement Taxes Insurance Logistics Accounting Cost estimating Commercial management - for clarification see: Zimina & Pasquire (2011)

Figure 1.1: Analysis and examples of waste in construction [Proportions based on studies by Diekmann *et al.* (2004) in the US and unpublished studies in the UK by Cameron Orr, AWD and Construction Excellence, as cited by Mossman (2009)].

Diagram adopted and modified from Mossman (2009)

From the analysis and examples presented in Figure 1, it appears as if the construction industry is doing the same thing over and over again, but expecting different results. The observation of this intriguing fact that 'much of the waste produced in construction is common to many projects and keeps recurring' motivated the study to look for behavioural explanations to this phenomenon. It also supports recent arguments for obtaining a better understanding of the concept of waste in construction (Koskela *et al.*, 2013; Bølviken *et al.*, 2014; Formoso *et al.*, 2015; Bølviken and Koskela, 2016). Compellingly, the concept of waste-reduction has been fundamentally used as a key driver for improvement in the manufacturing industry, and arguably led to great achievements; but it has not yet been a prevalent concept in construction literature or practice (Koskela and Ballard, 2012; Koskela *et al.*, 2012; Bølviken and Koskela, 2016). The next sections formulate the research problem, highlight gaps in knowledge, and present the research questions, aim and objectives of this study.

1.2 Research Problem and Gaps in Knowledge

The construction industry is often criticised for being wasteful, confrontational, and for lacking trust and capacity for learning and improvement (See for example, Zaghoul and Hartman, 2003; Rooke *et al.*, 2004; Eriksson and Laan, 2007; Hartmann and Dorée, 2013; Sarhan and Fox, 2013). These characteristics are attributed to a number of factors including fragmentation (Latham, 1994; Egan, 1998); an adversarial hierarchical structure (Ghassemi and Becerik-Gerber, 2011; Sarhan and Fox, 2013); obsolete procurement methods (Eriksson and Laan, 2007); confusing and treacherous contractual arrangements (Cox and Thompson, 1997; Sebastian., 2011; Hawkins, 2012); a highly competitive, cost-driven environment (Bresnen and Marshall, 2000) and the sequential organisation of construction processes (Koskela, 2000). In general, increased trustful collaboration between project parties is argued to be a suitable remedy for many of the industry's problems (See for example Tookey *et al.*, 2001; Eriksson *et al.*, 2008; Xue *et al.*, 2010; Sebastian, 2011; Zimina *et al.*, 2012; Daniel *et al.*, 2017; Walker *et al.*, 2017). However, the prevailing project-procurement processes are thought to be a root-cause for many of the aforementioned industry problems (Latham, 1994; Rooke *et al.*, 2003; Osipova and Eriksson, 2011) and to adversely affect the extent of cooperation and trust needed for project success (Rahman and Kumaraswamy, 2004; Eriksson and Laan, 2007; Tezel *et al.*, 2018).

Different solutions have been proffered by various industry reports and academic studies for delivering the industry-wide reform needed, including the use of partnering and framework arrangements, new models of construction procurement, Building Information Modelling (BIM), and Project Bank Accounts (PBAs) to support collaborative procurement practices (Infrastructure and Projects Authority, 2016). However, despite the many criticisms and the different solutions promulgated, the construction industry persistently resists the radical change demanded of it (Garvey and McDermott, 2017). There seems to be a particular project delivery mind-set embedded in the organisational fabric of the industry that prevails regardless of the attempts to address the recognised inadequacies – the question is why does this mind-set prevail?

In 2013, the UK Government created a set of challenging construction targets for 2025, including 33% lower costs, 50% faster delivery, 50% lower emissions, and 50% improvement in exports (HM Government, 2013). It then produced the Government

Construction Strategy 2016-20 report to build on progress made in the previous 2011-15 strategy, and to seek new targets of achieving efficiency savings of £1.7 billion over the course of the current Parliament (Infrastructure and Projects Authority, 2016). However, it is suggested, based on the proportions and examples of waste that commonly occur in construction (illustrated in Figure 1.1), that prevailing ‘business as usual’ will not meet these targets.

Eliminating waste (process and physical) from construction design and delivery, as advocated by lean ideals, could help towards achieving the aforementioned targets. However, it is suggested that waste-reduction understood simply as improving current processes, rather than fundamental system design, will not be enough. Obtaining a wider understanding and conceptualisation of waste in construction is crucial, in order to prepare the industry for the radical change demanded of it. One aspect of this conceptualisation is the consideration of the wider institutional, procurement and commercial environments that surround the design and delivery of construction projects. It is this aspect which led to the formulation of the study’s research problem, and motivated the author of this study to explore whether there is anything in the institutional, procurement and commercial contexts surrounding construction that is blocking radical new production system design and therefore pinning the prevailing wasteful system in place.

There is a broad consensus among social and economic researchers that ‘institutions’ matter (see for example, North, 1994; Williamson, 2000; Scott, 2001; Meyer, 2008; Peng *et al.*, 2009; Scott, 2012). Institutions influence beliefs, norms and actions; thus they shape performance and outcomes. According to Nelson and Sampat (2001), the term ‘institution’ is generally used or defined by scholars in three different ways and causal levels: (1) Standardised behaviour patterns (*Institutionalised behaviour or routines*); (2) Factors and forces that constrain or support these customary (expected or habitual) behaviour such as: norms and belief systems, or rules of the game, or governing structures (*Institutions or institutional forces/factors/processes*); and (3) Broader social and cultural context within which particular rules and organisational forms take shape (*Institutional environment*). Interestingly, the concept of institutions is

not well established in construction management research, specifically in waste-related literature.

Many of the problems that lead to the occurrence of waste in construction are strongly related to lean theories adopted in production management. However, it can still be argued that waste is created primarily from project-organisational and contractual problems (Williamson, 1991, pp.78-79); and as such, a focus on waste reduction in production (design and delivery of design) alone would be insufficient. As emphasised by Matthews *et al.* (2003), it is difficult to maximise value and minimise waste at the project level if the prevailing contractual structure hinders coordination, constrains collaboration and innovation, and sub-optimises performance and goals. Similarly, it is proposed in this study that procurement systems, as institutional arrangements, are designed to assign liabilities and authorities to people and organizations (Love *et al.*, 1998) at the project and programme levels, and thus structure the borders that shape '*the play of the game*' (Williamson, 2000). From a production management perspective, organisation and contracts are essential parts of the production system design (Koskela and Ballard, 2012); therefore it makes sense to suggest that poorly aligned procurement and commercial arrangements may cause waste and impact on project outcomes.

A small but growing number of studies have attempted to investigate the influence of procurement processes on the generation of waste in construction projects (for example see Jaques, 2000; Gamage *et al.*, 2009). However, most of these studies, if not all, have limited their attention to physical (material) waste; other important considerations such as process waste and value creation or loss in relation to procurement have been hardly explored. In the construction management literature, there are hardly any studies that have sought to explore the institutional, procurement and commercial environments that surround the design and delivery of construction projects, and how these may contribute to the generation and persistence of process waste. This study, therefore, hopes to contribute to the overall understanding of waste in construction, by addressing these gaps in knowledge. The underlying premise here is that if we can understand the apparent causes of coherence for the prevailing construction model and reveal the

consequential wastes, then the adoption of more efficient and collaborative business and project delivery models in construction may become more effective and widespread.

1.3 Research Questions

Based on the foregoing discussions, the following overarching research question has been developed:

RQ: Why is the prevailing construction model so embedded and so entrenched, despite the substantial attempts to address its recognised inadequacies?

1.4 Research Aim and Objectives

The aim of this study is to develop a conceptual model of ‘institutional waste in construction’, which has the potential to provide different predictions and/or explanations to the occurrence and entrenchment of wasteful behaviours and activities in construction projects in the UK. Accordingly, the following research objectives have been developed:

1. To critically review the current understanding of the concept of ‘waste’ in construction
2. To conceptually analyse theories from other disciplines outside both construction and manufacturing (e.g. social science and economics), which can help to predict and explain the reasons for the establishment, process and outcomes of several forms of institutional and organisational arrangements
3. To investigate the relationship between construction procurement and waste in construction
4. To explore the factors (root-causes) leading to the prevalence and persistence of inefficient procurement practices in construction
5. To develop and evaluate a conceptual model of ‘institutional waste’ that contributes to the overall understanding of waste in construction

1.5 Research Design and Methodology

This study adopted an 'interpretivist' epistemological position supported by a 'constructivist or relativist' ontological position. These philosophical stances were seen to be essential, in order to enable the study to discover the underlying motives and meanings in human behaviours and actions, and also to allow for a better understanding of contextual factors (Gaddon, 2010). Accordingly, these aforementioned philosophical positions dictated the use of a qualitative research strategy. This strategy aligns with the exploratory nature of the research and responds to widespread criticisms related to the extensive use of quantitative methods in construction management research (for example, see Seymour and Rooke, 1995; Seymour *et al.*, 1997; Koskela, 2017).

The study adapted a reflexive grounded theory methodology (GTM), which draws upon the legitimacy of the evolved approach to grounded theory (GT) (Strauss and Corbin, 1998) and the abductive intent of the constructivist GTM (Charmaz 2008). In this sense, the study was supported by the theoretical strand of evolved GTM, which argues that previous knowledge about the world and scientific theories (prior to data collection) are useful (Reichertz, 2010). The study was also informed by Strauss and Corbin's (1998) formal coding scheme (open, axial and selective coding procedures) using NVivo 10 software for qualitative data analysis. Furthermore, the study was guided by the interpretative stance of both evolved and constructivist approaches to GT that recognises the role of the researcher in theory building. At the same time, the research was inspired by Charmaz's (2008, 2009) explicit adoption of abductive logic during data collection and analysis stages. However, this study adopted an Abductive–Deductive–Inductive–Abductive (A-D-I-A) approach to theory building (see section 3.5 in Chapter 3), at which abduction was adopted during data collection and analysis to foster theoretical innovation, but also used during research initiation to pave the way towards the contextual choice of topic guides. The research methodology of this study is discussed in more detail in Chapter 3.

1.6 Research Scope and Setting

The scope of this study is commercial and industrial construction as well as smart-motorway infrastructure projects in the UK. The primary data collection method used for this study was in-depth and iterative interviews with 24 senior professionals within the UK construction industry, using a GTM. This also included a review of supporting documentation provided by the interviewees. The participants of this study represented a wide range of professions and organisations (e.g. owners, client representatives, project managers, architects, designers and engineers, consultants, main contractors, sub-contractors and suppliers). However, the nature of contracting in the UK construction industry tends to be multi-layered, due to the fragmentation of the industry (Egan, 1998; Vrijhoef and Koskela, 2005; Mokhtariani *et al.*, 2017). This research is therefore limited to exploring the contractual and commercial relationships that take place between construction buyers and their first and second suppliers. It is important, however, to stress that a qualitative study guided by GTM does not seek representativeness to achieve statistical generalisability; but instead aims to explain and sometimes perhaps predict phenomena based on empirical data. It is also important to note that in GT, the unit of analysis is not the individual participants themselves, but incidents in the data (Glaser and Strauss 1967; Corbin and Strauss, 1990; Breckenridge, 2012).

1.7 Structure of the Thesis

This thesis is organised into nine chapters as illustrated in Figure 1.2. A summary of the content of each chapter is presented below.

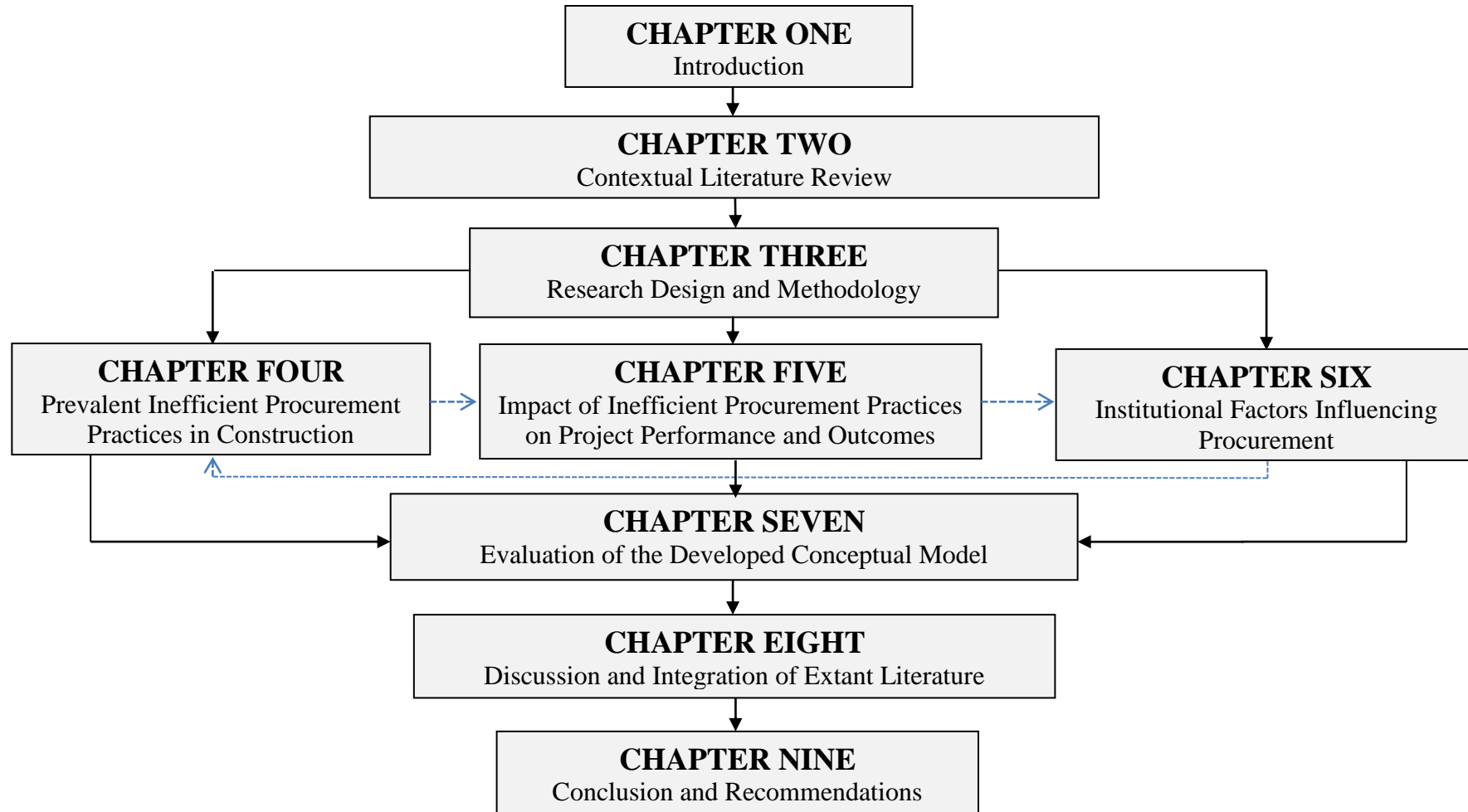


Figure 1.2: Structure of the thesis

Chapter 1: Introduction

This chapter provides an overview of the context of the thesis. It describes the research background, states the research problem, and identifies gaps in existing knowledge. The chapter also presents the research aim, objectives and overarching questions. In addition, a summary of the research design and scope of the study is provided. Finally, an outline of the structure of the thesis is presented, followed by a note about the place of literature within the overall structure of the thesis.

Chapter 2: Contextual Literature Review

This Chapter is the starting point of the study's inquiry strategy (A-D-I-A). It starts by using a 'selective abduction' reasoning approach (Magnani, 2001), which allowed the study to select appropriate theories and research topics that were seen to have the potential to provide useful guidance and novel explanations to the research problem under investigation. Four theories were targeted and reviewed for this purpose, namely (1) The concept of waste in construction; (2) Transaction cost theory of economics; (3) Neo-institutional theory of social science; and (4) The construction procurement context. Considering, the researcher's background as a civil (site) engineer with limited prior practical and theoretical knowledge related to pre-construction activities and processes, the use of theory, tentatively, at this stage was seen to be important to aid the researcher during data collection and analysis stages. According to Schweder (2015), the use of theory in 'interpretative' research allows the researcher to "*see things differently than either their subjects or they would have without it*" (p. 845). Following this, deduction reasoning enabled the study to outline the concept of 'institutional waste in construction', formulate six (guiding) propositions, and to develop a preliminary conceptual model to provide some focus to the study prior to data collection.

Therefore, the use of abduction paved the way for contextual choices of theory due to observation of surprising or interesting facts, in comparison to pre-determined selection of theories in case of a purely deductive approach. In this study, the fact that 'much of the waste produced in construction is common to many projects and keeps recurring' motivated the study to go beyond previous investigations, and to seek different explanations drawing up on theory from disciplines outside both construction and

manufacturing, such as economics and sociology. This approach, accordingly, led to an abductive exploratory logic, which aligns with the study's motives and objectives, rather than a deductive confirming logic. A summary of the outline of this chapter is provided in Figure 1.3

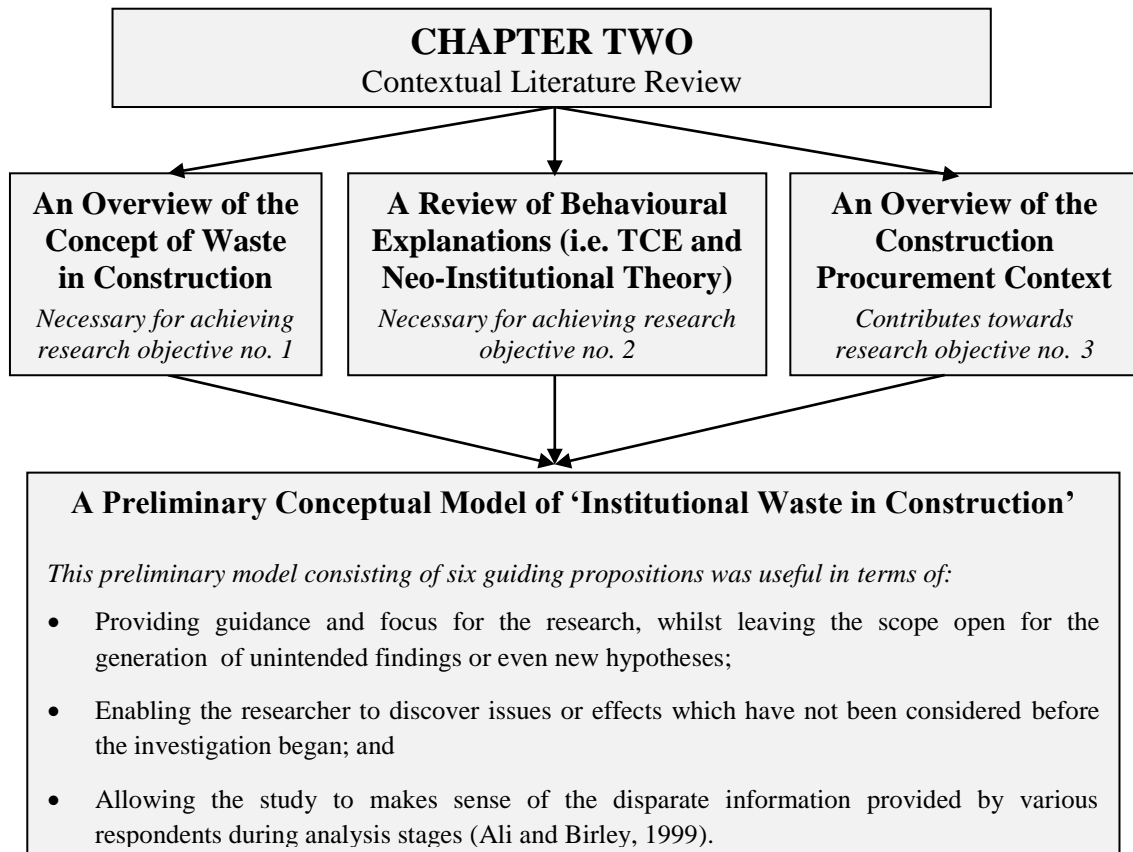


Figure 1.3: An outline of the contents and outcomes of the study's contextual review

Chapter 3: Research Design and Philosophy

This chapter explains and justifies the research philosophy, methodology and methods adopted for this study. This includes a detailed explanation of the sampling, data collection and analysis techniques used in the study. The Chapter also presents a critique on the limitations of the adopted research methodology, and outlines the strategies used for complying with the stringent guidelines for ethical conduct of research set by the Nottingham Trent University's Graduate School. Finally, the criteria used for evaluating rigour and quality in interpretative grounded-theory research are defined and discussed.

Chapter 4: Prevalent Inefficient Procurement Practices in Construction

Chapters 4, 5 and 6 illustrate the analysis and findings of the study that led to the development of the conceptual model of ‘institutional waste within the UK construction industry’. The three chapters combine together to provide a systematic analysis of the four principal categories and the constituent sub-categories of the developed conceptual model, including the established relationships between the four categories (See Figure 4.1 in Chapter 4). However, Chapter 4, in particular, is focussed on describing the coding structure that led to the emergence of the category titled ‘Inefficient Procurement Practices’ out of the primary data collected for the study. The chapter also provides explanations to eleven constituent sub-categories that evolved from the data. The chapter therefore draws up on direct quotes extracted from the raw data, whenever possible, to demonstrate the logical connection between the developed categories, subcategories and the collected primary data. The analysis of the empirical data presented in this chapter led to an identification of various inefficient procurement practices and arrangements that prevail in the construction industry.

Chapter 5: Impact of Inefficient Procurement Practices on Project Performance and Outcomes

This chapter illustrates the impacts of the identified procurement arrangements (presented in Chapter 4) on project-team performance and behaviour. Accordingly, the chapter therefore describes the coding structure that led to the emergence of the category titled ‘Inefficient Performance and Behaviour’, and provides brief explanations to each of its ten constituent sub-categories. The analysis presented in this chapter led to an identification of various wasteful behaviours and commercial practices that lead to consequential wastes. Concomitantly, the chapter also illustrates the analytical process that led to the development of the category titled ‘Consequential Waste’. This category was developed based on the emergence of four main classifications of waste that are detailed within the chapter.

Chapter 6: Institutional Factors Influencing Procurement

This chapter introduces various institutional factors that have been found to influence construction procurement choices and practices. It is argued that these identified

institutional factors provide novel explanations as to why inefficient procurement practices prevail and persist in the construction industry. The chapter therefore describes the coding structure that led to the emergence of the category titled ‘institutional factors’, and provides brief explanations to each of its twelve constituent sub-categories.

Chapter 7: Evaluation of the Developed Conceptual Model

This chapter presents and discusses the results of an evaluation exercise that was conducted with various academic and industry experts to critically assess and provide feedback on the rigour and quality of the developed conceptual model and the main findings of the study. The chapter commences by describing how the evaluation exercise took place, and then provides a detailed analysis of the received feedback. The results of the evaluation exercise demonstrated that the developed conceptual model has met the quality criteria outlined in Chapter 3.

Chapter 8: Discussion and Integration of Extant Literature

This chapter discusses the main findings of the study and the developed conceptual framework, in line with the study’s aim and main objectives. The chapter refers to relevant extant literature and feedback received during the evaluation exercise, whenever appropriate, to augment the main arguments of the study and delineate how the emergent findings relate to previous work. The chapter also includes discussions about the theoretical perspectives underpinning this study, and the theoretical and practical implications of this research study.

Chapter 9: Conclusion and Recommendations

This chapter presents the conclusions and recommendations of the study. The chapter commences by providing a summary of how research objectives were achieved, followed by a summary of the main findings. The main conclusions of the study are then presented before discussing the study’s theoretical, methodological and practical contributions to knowledge. Subsequently, a reflection on the research limitations is provided. Finally, publication plans out of this thesis are itemised, and various recommendations for future research are provided.

1.8 A Note on the Place of Literature Review within the Structure of this Thesis

For PhD students employing GT as a research methodology, the issue of ‘how, when and where’ to incorporate a literature review within the overall structure of their thesis is often confusing (Dunne, 2011; El Hussein, 2017). GT students are expected to minimise predetermined ideas to ensure that their emergent concepts or theories are grounded in the data, but at the same time are required to conduct a literature review to comply with institutional ethical and scientific requirements for doctoral progression or research grant applications. Debates about the role of literature in GT are discussed in detail in Chapter 3 of this thesis. This study supports the arguments of the ‘evolved’ version of GT (i.e. Corbin and Strauss, 1990; Strauss and Corbin, 1998), which advocate an early review of literature. As summed up by Coffey and Atkinson (1996):

“The open-mindedness of the researcher should not be mistaken for the empty mindedness of the researcher who is not adequately steeped in the research traditions of a discipline. It is after all, not very clever to rediscover the wheel, and the student or researcher who is ignorant of the relevant literature is always in danger of doing the equivalent” (p. 157).

There is a fine line between not conducting a literature review at the beginning of a GT study and being informed so that a study is focused enough (McCallin, 2003). For this reason, a substantial amount of studies have been conducted with the aim of providing PhD researchers with advice and strategies for GT literature integration (see for example, McCallin, 2003; Andrews, 2006; Hallberg, 2010; Dunne, 2011; El Hussein, 2017). Of these, for example, Andrews (2006) suggested that novice GT researchers need to accept that they may well end up doing two literature reviews: (1) a preliminary review that puts the study into some context, and (2) a detailed review of extant literature that is used as data to fully integrate the emergent theory.

The place of presenting the literature within the structure of a thesis, however, is often problematic for PhD students (Dunne, 2011). Students may get advised by their PhD supervisors to follow the traditional ‘literature review → findings → discussion’ structure, but this linear approach may not fit the logical presentation of the study and may contradict how the actual research was conducted. Likewise, incorporating

theoretical concepts and explanations into research findings may lead to excessively long chapters and undermine the flow of the study. Conversely, the decision to postpone the engagement with extant literature until after the study's empirical findings have been presented *"might be met with confusion by examiners or reviewers who may be experts in the substantive field, but not necessarily experts in grounded theory"* (Dunne, 2011, p. 120). There is no 'one size fits all' solution to this challenge; nevertheless *"whatever decision is taken, it is imperative that the researcher clearly articulate this issue from the outset and cogently outline and defend the preferred option in order to minimise the potential for misunderstanding between the author and the reader"* (Dunne, 2011, p. 121).

In this thesis, a preliminary literature review was conducted to provide the research with focus and contextualisation (presented in Chapter Two) prior to data collection, rather than a traditional literature review. However, detailed engagement with extant literature was not conducted until the data analysis chapters (Chapters Four, Five and Six.) were completed. Therefore, the decision was to integrate extant literature to the overall discussion of the findings of the study in Chapter Eight, and to clearly refer to this in the introduction and data analysis chapters of the thesis.

1.9 Summary

This introductory chapter provided an overview of the research study's context and structure. The research background revealed an interesting fact that 'much of the waste produced in construction is common to many projects and keeps recurring'. It is this aspect that led to the development of the study's research questions, which in turn paved the way towards the contextual choice of theories and literature to review. The purpose of the following chapter (Chapter 2: Contextual Literature Review), therefore, is to provide the study with focus, whilst leaving the scope open for the generation of unintended findings or even new hypothesis from data collection and analysis.

CHAPTER TWO: CONTEXTUAL LITERATURE REVIEW

2.1 Introduction

The previous chapter (Chapter 1) provided an introduction to the thesis highlighting the research gap, aim, objectives and overall structure. This chapter considers the theoretical context. It begins with a critical review of the concept of waste in construction. This is followed by an analysis of theories, from outside both construction and manufacturing, which can provide an insight into the establishment, process and outcomes of several forms of institutional, organisational and commercial arrangements. In particular, two principal theories are conceptually analysed for this purpose: (a) Transaction cost economics (TCE) and (b) Neo-institutional theory of organisational studies. Subsequently, an overview of literature pertaining to the construction procurement context is provided. Finally, an outline of the concept of ‘institutional waste in construction’ is presented and six guiding propositions are developed based on the aforementioned contextual literature review.

As noted in Chapter 1, the preliminary literature review presented in this chapter (Chapter 2) was undertaken to enable the study to identify gaps in existing knowledge, and to provide context and some focus to the study prior to data collection. A more detailed and in-depth review was conducted towards the end of the data collection and analysis process, in order to compare the emergent concepts and developed categories with extant literature (see Chapter 8, Discussion and Integration of Extant Literature).

2.2 An Overview of the Concept of Waste in Construction

The concept of waste-reduction has been fundamentally used as a key driver for improvement in the manufacturing industry, and arguably led to great achievements; but it has not been as prevalent in construction economics or management (Koskela and Ballard, 2012; Koskela *et al.*, 2012; Bølviken and Koskela, 2016). Research efforts aimed at understanding waste are relatively limited when compared to other topics in construction, and many waste-related studies continue to focus on the causes rather than

the *root* causes. Two subsequent systematic literature reviews on empirical studies that relate to waste-minimisation in construction (Viana *et al.*, 2012; Formoso *et al.*, 2015) found that the number of papers focusing on the concept of waste in construction is relatively small, considering its relevance and significance for the field of construction management. They also indicated that many of the studies they reviewed do not present a clear definition of waste, either explicitly or implicitly. The findings of their reviews revealed that research is broadly focused on addressing three different categories of waste:

- (1) Construction material waste (physical waste);
- (2) Non value-adding activities (process waste);
- (3) Specific sorts of waste (such as accidents and rework).

Many studies in construction literature have concentrated on ‘waste-management’ strategies and implementation efforts on construction project sites (for example, see Peng *et al.*, 1997; McDonald and Smithers, 1998; Lawson *et al.*, 2001). These studies have broadly focused on identifying and assessing strategies for re-using and recycling construction material waste, waste-quantification, waste management mapping to help with the handling of on-site waste, investigating the impact of legislation on waste management practices, suggesting improvements for on-site waste management practices, and developing on-site waste auditing and assessment tools (Osmani, 2012). The current and on-going approaches to research in the field of construction waste-minimisation are mainly focused designing out waste (e.g. Keys *et al.*, 2000); waste minimisation guides for architects and designers (e.g. WRAP, 2009); attitudes and perceptions of practitioners towards construction waste minimisation (e.g. Osmani *et al.*, 2008); the need for improved supply chain integration (e.g. Dainty and Brooke, 2004; Taggart *et al.*, 2014); and procurement waste-minimisation strategies (e.g. Gamage *et al.*, 2009).

There are also some other research studies that have focused on specific types of waste such as: rework and design error reduction (for example see, Busby and Hughes, 2004; Love *et al.*, 2009, 2011a, 2013; Feng and Tommelein, 2009) knowledge flow and

integration in different construction working environments (e.g. Ruan *et al.*, 2012), designing for construction worker safety (e.g. Toole and Gambatese, 2008), reducing waste by appropriate coordination mechanisms (Sandberg and Bildsten, 2011), and project disputes causations (Mitropoulos and Howell, 2001; Love *et al.*, 2011b). Interestingly, it can be noted that most of the studies that have investigated process waste and non-value adding activities, have been undertaken by members of the lean construction community. There are many general classifications of process waste as defined in lean thinking. For example, they include Tachii Ohno's seven wastes: transportation, inventory, motion, waiting, over-production, over-processing, and defects (Ohno 1988, pp. 19-20). In addition, the waste of human potential - e.g. 'Not speaking, not listening' by Macomber & Howel (2004), and the 'Making-do' waste presented by Koskela (2004) is included within this category. Making-do, in particular, has been argued by Koskela *et al.* (2013) to be a core waste in construction with substantial negative impact on the production system. Nevertheless, making-do is not widely recognized or used as a focus for improvement in construction projects (Formoso *et al.*, 2015). The next section, therefore, provides more details about the 'making-do' category of waste and its possible antecedents and consequences.

2.2.1 Making-do as a prevalent source of waste in construction

Making-do is an invisible form of waste (Koskela, 2004) that has been confirmed in recent empirical studies to be prevalent in construction (see Formoso *et al.*, 2011, Brodetskaia *et al.*, 2011; Emmitt *et al.*, 2012; Fireman *et al.*, 2013). It refers to starting a construction task before its preconditions are ready, or continuing a task although at least one of its standard inputs has ceased (Koskela, 2004). This wasteful activity often occurs for keeping the utilization of capacity high and also for the sake of schedule compliance (Koskela *et al.*, 2013). As a result the task is not fully completed, leading to inefficiencies and unnecessary re-work (Emmitt *et al.*, 2012). These preconditions necessary for starting and executing a task are described by Koskela (2000) as the seven types of flow in construction: (1) information; (2) space; (3) interdependence of tasks; (4) manpower; (5) materials; (6) equipment; and (7) external conditions. Thus, according to Formoso *et al.* (2011) Making-do could be defined as a reduction of performance that results from the fact that a task is started or continued even though one

or more of its standard inputs, required for its completion, are not available. Making-do can actually be regarded as the opposite of buffering, hence work starts without the minimum amount of resources (inventory) for carrying out a task to completion (Koskela, 2004).

Interestingly, a study by Emmitt *et al.* (2012) sought to improve the attitude of the trades' workers, foremen and site managers towards completing their work packages, so that the work flow and quality could be improved. Their study found that waste can occur due to lack of common understanding, amongst trades involved, about what constitutes a completed task. Consequently, work by Pasquire (2012 & 2013) suggested that 'common understanding', has to be managed as a soft flow in the same way as Koskela's (2000) seven flows mentioned above. She describes this as follows:

"In their paper about inappropriate processing, Emmitt et al. (2012) claim that the phenomenon of doing only just enough to allow the next trade to start necessitating operatives to come back to finish work...This waste should be included within the category of 'making-do' (Koskela 2004) but currently falls outside because it doesn't arise as a result of starting work before all flows are in place. If understanding were one of the flows, then it can be argued more strongly that leaving work before it is at the best stage of completion is a form of making-do because in this example, a proper understanding of the hand-off stage was not present" (Pasquire, 2012, pp. 6).

According to Formoso *et al.* (2011), making-do is a result of the poor management of upstream processes, which may result in the execution of tasks under sub-optimal conditions. Consequences of making-do, as reported by Ronen (1992), Koskela (2004) and Formoso *et al.* (2011), Emmitt *et al.* (2012), and Fireman *et al.* (2013) include:

- More work-in-progress, and longer lead time;
- Decline in overall productivity;
- High negative impact on site safety conditions;
- Decline in workers' motivation;
- Poor quality;

- Increase in the share on non-value-adding activities;
- Unnecessary increased costs (e.g. due to need for re-work); and
- Material waste.

Furthermore, a study by Formoso *et al* (2015) demonstrated through a causality framework that making-do, as a major category of waste in construction, can lead to the generation of a complex network of inter-related wastes. According to Ronen (1992), as cited in Koskela (2004), the possible causes of making-do are:

- The Efficiency syndrome: the urge to have the resources utilised as much as possible, based on the assumption that overall productivity increases if all workers and equipment have a high utilization rate;
- The pressure for an immediate response - based on the belief that by starting early, even if with an incomplete kit, the task will also be completed earlier. Another motivation could be to start the work just for getting the job. Also for trying to comply with the master plan; and
- Improper division into levels of assembly - a situation where the number of components per kit grows to an uncontrollable level, leading to high variability

Koskela (2004) accepts Ronen's conclusions; however he argues that the high occurrence of making-do in construction is not just caused due to a failure in implementing a conventional managerial system. Instead making-do is fundamentally caused by the phenomenon of variability in production. He criticised a number of underlying concepts adopted in construction, which in his opinion lead to the persistence of making-do in construction. These are as follows:

- The transformational view of production (Koskela, 2000), which characterises traditional construction, where managerial focus is on value-adding activities (transformation), while giving much less attention to the relationship between the activities (flow);
- Variability in task execution and upstream flows are often neglected and not properly managed;

- Using a standard utilisation rate as a performance measure may provide wrong incentives to managers;
- The conventional one-way top-down communication approaches, which are insufficient for managing highly complex production systems, such as construction projects.

Last Planner System (LPS) for production control (Ballard, 2000), is deemed to be an effective way for protecting production from upstream variability (Ballard and Howell, 1998), and therefore avoiding making-do waste. However the findings of an empirical study by Formoso *et al.* (2011) provided some empirical light on the limitations of LPS in avoiding making-do. For example, much of the work carried out by crews and workers in construction sites is done informally; thus not included in formal short term look-ahead and constraint analyses plans (Fireman *et al.*, 2013). Furthermore, Bølviken *et al.* (2014) argue that from the perspective of the production system as a whole, focussing merely on reducing making-do can be counter-productive. That is because it can result in root-causes not being addressed; thus by that way increasing rather than decreasing the negative consequences (Bølviken *et al.* 2014). These arguments suggest the need for obtaining a better understanding about the fundamental paradigms that underlie wasteful behaviours and practices construction, and which also obstruct waste-minimisation efforts. Accordingly, the next section provides a review of various fundamental factors impeding waste-reduction and improvement efforts in construction.

2.2.2 Barriers to waste-reduction in construction

Construction is already one of the most booming industries worldwide. In the UK, the construction sector is a fundamental part of the economy, contributing to 8.2% of Gross Value Added (Pryke, 2009). It is also one of the largest sectors of employment in the UK, accounting for about 7.5 % of total UK employment (UKCES, 2012). However, the construction sector is commonly criticised for being wasteful and adversarial (Koskela, 2000; Dassault Systems, 2014; Sarhan *et al.*, 2014; Bølviken and Koskela, 2016). Over the past eighty years, several reports have been commissioned on the construction industry with the aim of raising concerns and suggesting means for

improving performance and productivity (for example see Bossom, 1934; Simon, 1944; Banwell, 1964; Latham, 1994; Egan, 1998; Wolstenholme *et al.*, 2009; UK Government, 2012; Farmer, 2016; Infrastructure and Projects Authority, 2016). Of these, the Egan's report emphasised the significance of adopting and implementing the concept of 'waste-reduction' as a strategy for improving efficiency and productivity in construction, by stressing that:

“Recent studies in the USA, Scandinavia and this country suggest that up to 30% of construction is rework, labor is used at only 40-60% of potential efficiency, accidents can account for 3-6% of total project costs, and at least 10% of materials are wasted...The message is clear - there is plenty of scope for improving efficiency and quality simply by taking waste out of construction” (Egan, 1998, p.15).

It is therefore paradoxical how that waste-reduction has not yet become a prevailing strategy for improving the productivity of the construction industry. There are hardly any studies that have explicitly sought to investigate this paradox. However, in an initial attempt to explore this issue, a review study by Bølviken and Koskela (2016) has offered eight possible reasons as to why waste-reduction has not conquered construction; these are as follows:

1. Construction management is focussed on management of contracts rather than the management of production;
2. The fire-fighting culture and mentality to solving problems in the construction industry;
3. The prevalence of the task-centred view to construction, as opposed to the flow perspective, has effectively shifted attention away from waste;
4. Ohno's classical seven wastes are context-specific; and thus are not fully relevant for construction;
5. The complexity of the construction process results in waste being a more complex phenomenon to tackle;
6. The low degree of stability and repetitiveness in construction flows

7. Temporary organizations and the fragmented value chain
8. Integrated management of income, cost and risk

According to Bølviken and Koskela (2016), these reasons indicate that the slow uptake of waste-reduction in construction is not simply due to lack of interest or lack of skills in the industry. Instead it's mainly attributed to two fundamental reasons: (1) focussing on management and economics approaches while giving less attention to production theory; and (2) treating construction projects as something we buy and sell, rather than something we make (production). Additionally, a series of recent studies (Viana *et al.*, 2012; Koskela *et al.*, 2013; Bølviken *et al.*, 2014; Formoso *et al.*, 2015; Bølviken and Koskela, 2016) have urged the need for a better understanding and conceptualisation of waste in construction. According to them, these construction-related lists of wastes should be conceptually compatible with construction, persuasive and motivating for action. For these reasons, the next section provides an overall analysis of trends and existing gaps in literature pertaining to the 'concept of waste' in construction. Following this, a theoretical rationale for obtaining a more thorough understanding and wider conceptualisation of waste in construction is presented.

2.2.3 An overall analysis of the concept of waste in construction literature

An overall analysis of waste-related literature in construction reveals five critical issues. First, researchers have gradually shifted their attention and studies from merely focussing on waste-management strategies that are mainly concerned with the consequences of waste, to instead focus on waste-minimisation strategies, as a more sustainable approach able to eliminate or reduce construction material waste at its source. Secondly, most of these waste-minimisation approaches, if not all, were directed towards finding means for reducing construction material waste (physical waste) as opposed to process waste. Other important issues such as time waste and value creation are much less explicitly explored.

Thirdly, it appears that many of the problems that lead to the occurrence of waste in construction are strongly related to lean theories adopted in production management. However, it can still be argued that waste is created primarily from project-organisational and contractual problems (Williamson, 1991, pp.78-79); and as such, a focus on waste reduction in site-based production alone would be insufficient. As emphasised by Matthews *et al.* (2003), it is difficult to maximise value and minimise waste at the project level if the prevailing contractual structure hinders coordination, constrains collaboration and innovation, and sub-optimises performance and goals. Similarly, it is proposed in this study that procurement systems, as institutional arrangements, are designed to assign liabilities and authorities to people and organizations (Love *et al.*, 1998) at the project and programme levels; and thus structure the borders that shape ‘the play of the game’ (Williamson, 2000). From a production management perspective, organisation and contracts are essential parts of the production system design (Koskela and Ballard, 2012); thus it makes sense to suggest that poorly aligned (imperfect) organisational and institutional arrangements may cause waste and impact on project outcomes

Fourthly, a small but growing number of studies have attempted to investigate the influence of procurement processes on the generation of waste in construction projects (e.g. Jaques, 2000; Gamage *et al.*, 2009). However all of these studies have only focused on the relationship between different procurement systems and the generation of construction material waste. Finally, very limited, if any, waste-related studies have devoted attention to exploring performance-shaping mechanisms (i.e. systems and structural arrangements), as well as the institutional context in which human actions and decisions are constituted. To say that waste in construction is created merely due to human error is unhelpful; blame arguably fails to facilitate learning to ‘do better’ and similarly fails to lead us towards effective methods of reduction or prevention. Instead, an institutional perspective provides insight. Institutional theory focuses on the context and could enable us to reveal the underlying fundamental paradigms influencing our decision, actions and behaviours.

A comprehensive study by Wearne (2008) provided a summary on how the industry, public clients, and the project management community have learned from their previous experiences and ideas through a 30 years period. The study showed how attention has gradually shifted from focusing mainly on time and cost over-runs of delivery projects, to taking into consideration other significant issues such as quality, safety, risk management, organizational behaviour, supply-chain management, and project definition. This continuous cycle of learning and development should have increased the ability in anticipating project-related problems, and thus led to a reduction to their negative consequences. However, a recent study by Wearne (2014) reviewed the problems of project management as reported by 1,879 individuals employed in the construction, manufacturing, process, and service industries in North-West Europe over 23 years. Interestingly, when reviewing the data collected, the same categories of problems appeared to remain the main concern of project management. This finding led to the rise of the question as to why many categories of project management problems persist. The analysis of his empirical study revealed that:

“More than 75% of the problems reported by the participants are due to institutional practices within organizations rather than inherent in their projects. Many of these problems of project management could therefore be avoided, or at least reduced by early attention to their causes. As a result much of what is called “fire-fighting” in project management—urgent actions on problems that should not have been allowed to occur—could be prevented” (Wearne, 2014, p. 72).

The findings of Wearne’s (2014) empirical study support recent arguments for improvement in the ‘front end’ decisions on project objectives, plans and governance arrangements (for example, see Edkins *et al.*, 2012). Accordingly, these findings and advices support this study’s rationale for exploring the institutional factors that influence early-project decisions and condition project procurement and governance arrangements. In the construction management literature, there are hardly any studies that have sought to investigate the role played by the institutional, procurement and commercial contexts in generating and/or embedding waste in construction projects. Waste here can be in the form of monetary, time, effort or value-loss, and can exist prior to or post contractual stages.

2.2.4 A rationale for obtaining a wider conceptualisation of waste in construction

The formal adaptation and transfer of the new production philosophies into construction projects has been ongoing since the early 1990's (Koskela, 1992). These philosophies were characterised as "lean" from the study of Toyota (Krafcik, 1988), and the term 'Lean Construction' rose to prominence with the formation of the International Group for Lean Construction¹ in 1993. The concept of lean was formally recommended to the UK construction industry by a Government report (Egan, 1998). Traditionally, the term 'waste in construction' is usually limited or intuitively linked to physical (material) waste. The concept of material waste in construction has been widely addressed but the widened understanding introduced by the seven process wastes identified in the Toyota Production System (TPS) (Ohno, 1988) has struggled to be transferred. Process waste is directly associated with executing tasks and conforms to the current understanding of project management as '*a specific set of operations designed to accomplish a singular goal*' (Project Management Institute²). In this way, production is defined as transforming resources towards the finished product or project and waste can be seen as the inefficient use of resources in the execution of tasks. The disadvantage of this understanding of waste is that it drives the improvement of current processes rather than radical new system design.

Koskela (2000) advanced the definition of lean production to the combination of transformation tasks (T), flow (F) and value creation (V). This definition of production as TFV creates two additional dimensions to the conceptualisation of waste as the inefficient use of resources in tasks. The first additional TFV dimension, flow (F), reveals the interdependency of activities across the whole project process. The consideration of flow brings the supply chain and the logistics of getting resources to the point of transformation into focus. Elevating flow to a project production driver also alters the classification of process waste within tasks. For example, waiting within one task may now be necessary to expedite tasks downstream – this waiting is therefore no longer a waste and results in one task being sub-optimised in order to optimise the

¹ www.iglc.net

² www.pmi.org

project. Consequently the pursuit of waste within transformation activities can itself become a cause of waste if it disrupts flow. Erratic and disrupted flow of processes provide further sources likely to cause waste recognised within TPS in two ways - the unevenness of workflow (Mura) and the related concept of the overburden of capacity (Muri) (Liker, 2004).

The second additional TFV dimension is created by considering value creation (V) and brings the customer into focus. The construction sector typically identifies clients and more recently users and stakeholders – the term customer is not commonly used. However, the inclusion of value creation into project production moves the conceptualisation of waste towards identifying what causes value-loss, and questions from whose perspective (Koskela *et al.*, 2013). This conceptualisation will vary from project to project and from customer to customer meaning the understanding of what constitutes value and how it is created becomes an important part of the design of the project production system (delivery including logistics, design and procurement) and the project product (the physical facility or asset created and what it achieves). One important aspect of this conceptualisation, yet underexplored, is the consideration of the institutional, procurement and commercial environments surrounding the design and delivery of construction projects. It is this research gap that led the author of this study to explore whether there is anything in the aforementioned environments that is blocking radical new production system design and therefore pinning the prevailing wasteful construction model in place.

The understanding of value and value loss (or waste) within these wider organisational, commercial and institutional environments is more difficult to determine not least because it requires a critical evaluation of the activities of different professions, for example lawyers, accountants, human resource managers, quantity surveyors to name a few. These environments and the professions within them also exhibit varying cultures, structures, systems and behaviours. Such an evaluation also needs to draw upon theory from disciplines outside both construction and manufacturing such as economics and

sociology if it is to begin to explain the apparent coherence, and yet wastefulness, of the current prevailing approaches to construction project delivery.

To begin to explore the identified research gap, the study analyses theoretical explanations to the establishment, process and outcomes of several forms of institutional and organisational arrangements, in particular those provided by ‘Transaction Cost Economics’ (TCE) and ‘Neo-Institutional Theory’ of organisational studies. TCE is explored, as according to Williamson (2000) “any issue that arises as or can be reformulated as a contracting issue can be examined to advantage in transaction cost economizing terms” (p. 599, 608). Within construction procurement, TCE offers a useful mechanism to analyse conflicting interests among contracting parties (Li *et al.*, 2013) and to understand the hidden costs associated with pre- and post-contract work (See for example Li *et al.*, 2014; Rajeh *et al.*, 2015; Guo *et al.*, 2016). Additionally, an overview of institutional theory of organizational studies is provided. Institutional theory gives significant consideration to context (Oliver, 1991) and could also help to reveal the underlying cultural/cognitive assumptions that influence decisions and consequently behaviors and actions (Scott, 2008).

Next, a contextual review of construction procurement literature is presented, where construction procurement systems, is conceptualised within this study, as ‘institutional arrangements’. Subsequently, it is demonstrated in the study how neo-institutional theory, a branch of organizational sociology, has the potential to be used as an analytical lens to deliver a more explicit theory of waste relating cause and effect within the wider aspects of construction procurement systems and relationships. Following this, an outline of the concept of ‘institutional waste’ within construction is defined, and a preliminary conceptual model that consists of six guiding propositions is presented. As indicated in Chapter 1, the aim of developing this preliminary conceptual model and guiding propositions is to provide some focus and context for the research, whilst leaving the scope open for the generation of unintended findings or even new hypotheses during data collection and analysis.

2.3 Transaction Cost Economics

Transaction cost (TC) theory is part of the New Institutional Economics (NIE) paradigm (Rindfleisch and Heide, 1997; Williamson, 2000) and seems to provide insight into the relationship between construction procurement and waste or value-loss in construction projects. According to Williamson (2000) “*Any issue that arises as or can be reformulated as a contracting issue can be examined to advantage in transaction cost economizing terms*” (p. 599, 608). TCE can be used to provide insights into many of the construction industry’s challenges that occur at both pre contract and post contract stages. Areas of application included for example: providing explanations to the causes of opportunistic behaviours that often occur between project partners, especially between clients and contractors (Yong and Mustafa, 2011); offering insights into the analysis of the costs of organising the procurement of construction work in different ways (Hughes, 2003; Hughes *et al* 2002, 2003, and 2005); helping us understand how and why the practice of subcontracting is very prevalent in the construction industry (Chau and Walker, 1994); offering economical explanations of why construction project organisations are structured in such (and in different) ways (Reve and Levitt, 1984; Walker and Wing, 1999); giving insights into contractor selection methods (Lingard *et al.*, 1998); helping us to understand unnecessary and hidden transactions costs (i.e. waste) within construction commercial environments (Ancell, 2005); helping us decide on the most efficient contractual arrangement against a number of alternatives (Chau and Walker, 1994); evaluating the efficiency of construction business markets and systems in different countries (e.g. Winch, 1989; Sha, 2004).

Conversely, TCE has been criticised by various scholars, including Koskela and Ballard (2006, 2012), founders of lean construction (LC), who argued that the economic theory lacks a proper conceptualization of production and waste. Therefore, the aim of this section is to critically review the behavioural explanations provided by TCE, in relation to the establishment of institutional, organizational and commercial arrangements and how they may impact on project processes and outcomes (e.g. reduce or lead to waste). The review will start by providing a brief background to the emergence of TC theory, followed by an explanation to the theory’s conceptual framework and fundamental assumptions, governance mechanism, contextual domain of applications and levels of

analysis. Subsequently, a critical discussion upon the main critiques and limitations of TCE, as identified by this study, is provided. Finally, an overview of the basic features of NIE is presented and reflected upon.

2.3.1 Background

Transaction cost theory, emerged to overcome shortcomings of the traditional neoclassical economics (NCE) which is dismissive of institutions (North, 1994; Williamson, 2000). In neoclassical microeconomic analysis, transaction costs are assumed to be equal to zero (Walker and Wing, 1999); that is as resources and economic activities are allocated and coordinated using the pricing system based on the assumption that all actors in the market are fully informed (Williamson, 2000). This assumption is flawed because, in reality, all transactions occur within an uncertain environment; and thus there are monetary, time and effort costs associated with making a choice (Williamson, 2000; Sha, 2004). By neglecting transaction cost, NCE accordingly ignored the influence of institutional arrangements, e.g. firms, governments, and commercial arrangements (Chau and Walker, 1994) on economic performance (North, 2004). Douglas North summed this up in his Nobel-prize lecture, by emphasising to us that:

“Only under the conditions of costless bargaining will the actors reach the solution that maximizes aggregate income regardless of the institutional arrangements. When it is costly to transact, then institutions matter. And it is costly to transact” (North, 1994, p. 360).

It is Coase’s seminal article ‘*The Nature of the Firm*’ (1937) which explicitly introduced the concept of transaction costs into economic analysis. It drew to our attention that there are transaction costs that had been assumed to be zero in prior theorizing; this implied that the market mechanism is not necessarily perfect (Koskela and Ballard, 2012) and also clarified the reason for why firms exist. Coase (1991), cited in Walker and Wing (1999), however argued that in order for a firm’s existence to continue it has to perform its co-ordination function at a lower cost than what would be gained if it

were achieved by means of market transactions; and also at a lower cost than this same function could be conducted by another firm.

According to Coase (1937), without transaction costs, all else being equal, economic exchange would always take place in the market (Tate *et al.*, 2014). Coase, accordingly, proposed that firms and markets are competing governance mechanisms that differ in their transaction costs. He suggested that transaction costs were the key influence on a firm's decision to make or buy (Hughes *et al.*, 2005). In some cases, the costs of conducting economic exchange in a market may exceed the costs of managing the exchange within a firm, and vice versa (Rindfleisch and Heide, 1997). In this context, the choice between different institutional and organisational arrangements that owners have to make aims to reduce transactional (institutional) costs. According to Chau and Walker (1994, p. 2) "*transaction costs include all costs of using an institutional arrangement and are therefore sometimes referred to as institutional costs*". This assertion is based on economist Cheung's (1987, pp. 55-58) description of transaction costs in 'The New Palgrave Dictionary of Economics':

"Transaction costs may be viewed as a spectrum of institutional costs including those of information, of negotiation, of drawing up and enforcing contracts, of delineating and policing property rights, of monitoring performance and of changing institutional arrangement. In short, they comprise all those costs not directly incurred in the physical process of production".

It is important, though, to stress here that the ultimate aim of TC theory is to reduce the total costs, which incorporates both transactional (or organisational) costs and productivity costs (Rindfleisch and Heide, 1997; Perman, 2005). This point is controversial, and thus will be elaborated later on in more detail when discussing the critiques of TCE (see section 2.3.5).

In short, Coase's (1937) initial propositions has generally been applied in transaction cost analysis (TCA) from the perspective of the buying firm to decide whether it is more

economical to vertically integrate (make) or to use the market (buy) (Tate *et al.*, 2014). Coase (1960) was also the first to make the critical connection between institutions, transaction costs, and neoclassical theory (North, 1994). However, Oliver Williamson has subsequently added remarkable refinements to Coase's general arguments (see Williamson, 1975, 1985, and 2000). These included, for example, developing a theoretical model for the choice of an optimal governance structure for six different types of transactional exchanges. He also added to our attention that transactional costs consist of both 'direct costs' and 'opportunity costs' which may arise at ex-ante and/or ex-post stages (Rindfleisch and Heide, 1997). Additionally, it is widely acknowledged that the phrase of 'The New Institutional Economics' is coined by Oliver Williamson (Coase, 1998). Having provided a synopsis to the background and origins of TCE, the study now explores TCE's fundamental assumptions that have advanced over time.

2.3.2 TCE' conceptual framework and fundamental assumptions

Transaction costs are the costs of specifying what is being exchanged and of enforcing the consequent agreements (i.e. contractual arrangements) against the exchange partner (North, 1994; Ting *et al.*, 2007). Williamson (1975) categorises transaction costs into 'ex-ante' and 'ex-post' costs. *Ex-ante* costs comprise the costs of tendering, negotiating and writing the contract (Rindfleisch and Heide, 1997); while *ex-post* costs include the costs of: monitoring and measuring performance, implementing quality control systems, cost accounting, establishing layers of the managerial hierarchy, and dispute resolution processes (Rindfleisch and Heide, 1997; Lingard *et al.*, 1998). According to Dietrich (1994, p. 33) transaction costs can be classified into:

- *Information-seeking costs* – these refer to the investment of time, effort and other resources associated with researching possible alternatives (Tate *et al.*, 2011, 2014);
- *Bargaining and decision related costs* – the costs of developing an agreement, negotiating, documenting, selecting potential exchange partners and establishing a contract (Tate *et al.*, 2011, 2014);
- *Enforcement related costs* – e.g. management, inspection and monitoring costs as well as costs incurred to resolve disputes arising from the contracted work (Walker and Wing, 1999; Tate *et al.*, 2014).

According to Rindfleisch and Heide (1997), Williamson's (1975, 1985) micro analytical framework is underpinned by the interaction between two fundamental assumptions of human behaviour (i.e., opportunism and bounded rationality) and two key dimensions of transactions (i.e., asset specificity and uncertainty). The complete TCA framework also includes risk neutrality as a third behavioural assumption (Chiles and McMackin, 1996), and transaction frequency or relational exchange as a third transactional dimension (Yong and Mustaffa, 2011). However, Rindfleisch and Heide (1997) assert that both of these constructs have received limited attention in literature. Their assertion seems reliable as it was based on their review of 45 empirical TCA articles published from 1982 to 1996 in a variety of academic journals in marketing, management, strategy, law, and economics. Despite of this, these two constructs (i.e. frequency and risk neutrality) will still be taken into our consideration when analysing the limitations and critiques of TCE (see section 2.3.5)

Williamson (1985, p. 47) defines opportunism as "self-interest seeking with guile". This implies that given the opportunity, decision makers may deceitfully seek to serve their self-interests. Muris (1981, p. 521, cited in Ting et al., 2007) adds to this and argues that opportunism arises when a party "*behaves contrary to the other party's understanding of their contract, but not necessarily contrary to the agreement's explicit terms, leading to a transfer of wealth from one party to the other.*" In reality, opportunistic behaviours are part of human nature, and therefore they often exist in exchange-relationships (Ting et al., 2007). However, it can be argued that although opportunism may, initially, lead to increased outcomes for the opportunistic party, but it actually has the potential to restrict value creation and decrease revenues for both parties in a relationship (Wathne and Heide, 2000, cited in Wang and Yang, 2013); that is because considerable amounts of resources would then have to be spent on enforcing monitoring and controlling functions instead of employing those resources for productive purposes (Ting et al., 2007).

Bounded rationality simply means that decision makers act rationally but have constraints on their cognitive, analytical and data-processing capabilities, especially in uncertain and complex environments (Rindfleisch and Heide, 1999; Walker and Wing,

1999). According to Dietrich (1994, p. 19), the concept of ‘bounded rationality’ in transactions is based on two principles. First, that there are limits on human’s ability to process information without error. Secondly, that it is not wise to suggest that past experience can help in every situation encountered.

Asset specificity refers to investments (transaction specific assets) that have a ‘lock-in effect’ (Tang *et al.*, 2007) because they make it difficult to terminate a relationship and select other parties without acquiring losses (Yong and Mustaffa, 2011). Rindfleisch and Heide (1997) suggest that assets with high level of specificity can be regarded as sunk costs; that is because they have little or no value outside the focal exchange relationship (Williamson, 1985). There are six main types of asset specificity as identified by Williamson (1991, cited in Rindfleisch and Heide, 1997): (1) site specificity, (2) physical asset (e.g. plant) specificity, (3) human asset specificity (4) brand name capital, (5) dedicated assets, and (6) Temporal specificity.

Uncertainty can be defined in its simplest form as ‘what is known in comparison to what needs to be known’. According to Achrol and Stern (1988, cited in Ting *et al.*, 2007) there are three components of uncertainty:

- The adequacy of available information required for making key decisions;
- The predictability of the potential consequences of these decisions;
- The level of confidence of decision-makers when making these decisions.

During transactions (ex-ante and post-ante contractual stages), two types of uncertainty are encountered: behavioural and environmental transaction uncertainty. TC theory conceptualises ‘behavioural uncertainty’ as the amount of difficulty associated with monitoring and evaluating the performance of the exchange partners against established contractual agreements (Williamson 1985). ‘Environmental uncertainty’ is theorised as unanticipated changes in circumstances and the associated complexity surrounding the transaction context (Yong and Mustaffa, 2011).

In summary, the TC theory assumes that the greater the transaction uncertainty and asset specificity and the lower the transaction frequency, the higher is the transaction costs (Bradach and Eccles, 1989; Yong and Mustafa, 2011). It also suggests that exchange cannot be fully specified ex-ante and that contractual performance cannot be easily verified ex-post, due to bounded rationality and uncertainty factors (Rindfleisch and Heide, 1997). Therefore, Williamson developed Coase's theory further to suggest that economic agents should primarily seek to economise on transaction costs (Lingard *et al.*, 1998) by deploying efficient governance structures and strategies. Having provided an explanation to the theory's constructs and main assumptions; the next sub-section provides a discussion about the consequences of the interplay that occurs between these constructs, which in turn lead to a number of governance challenges.

2.3.3 The governance mechanism

According to the TC theory, there are three main types of governance problems that occur during transactions (Williamson, 1985). These are:

- The safeguarding problem;
- The adaptation problem;
- The performance-evaluation problem.

A '*safeguarding problem*' arises when a firm deploys transaction-specific assets and worries that its exchange-partner may opportunistically try to exploit these unique investments (Rindfleisch and Heide, 1997). Accordingly, it can be concluded that asset specificity and opportunism are the antecedents of the safeguarding problem. An '*adaptation problem*' occurs when a firm, whose decision makers are constrained by bounded rationality, struggles with modifying contractual agreements to unanticipated changes in the transaction environment (Rindfleisch and Heide, 1997). Therefore, the consequence of the interaction between bounded rationality and environmental uncertainty is an adaptation problem. Similarly, a '*performance evaluation*' problem is created when a firm, whose decision makers are constrained by bounded rationality, faces difficulties in monitoring and evaluating the degree of contractual compliance of

its transaction partners with established agreements (Rindfleisch and Heide, 1997). Therefore, the consequence of the interplay between bounded rationality and behaviour uncertainty is a performance evaluation problem.

Four types of governance structures are generally conceptualised to overcome governance problems, and thus reduce transaction costs (Williamson, 1985; Bradach and Eccles, 1989). These are:

- The ‘market’ governance structure (e.g. outsourcing);
- The ‘hierarchy’ governance structure (e.g. in-house production and internal organisation);
- The intermediate ‘hybrid’ mechanism (e.g. cooperative arrangements or using qualification procedures); and
- Plural forms’ that integrate different government structures (See Bradach and Eccles, 1989)

According to Rindfleisch and Heide (1997), the basic premise of TCA is that if those three governance problems described above are absent or low, decision-makers will accordingly favour market governance to vertical integration (the make-or-buy decision). Alternatively, if the transaction costs required for overcoming the governance problems exceed the production cost advantages of the market, firms will favour internal organization to the market solution (Coase, 1937). McNeil (1985) introduced the concept of ‘relational thinking’ in legal scholarship as a more positive and sustaining form of governance. This can be used to augment the conventional approach to transaction economising and solves governance problems through behavioural norms rather than potential sanctions (Ting *et al*, 2007). From this review to governance mechanisms, it seems useful to conclude by what Bradach and Eccles (1989, p. 99) have asserted:

“Coase's insight has been extended and refined by many scholars, but the basic argument remains the same: transactions will be governed by the institutional arrangement that is most efficient”.

2.3.4 Contextual domain of applications and levels of analysis

The TC approach has received substantial attention from scholars of various academic disciplines beyond economics, such as: marketing, political science, organisational theory, contract law, business strategy, corporate finance, and tentatively in construction management. They have applied TCA to investigate a wide range of exchange-related issues. A review by Rindfleisch and Heide (1997) to 45 empirical TCA articles indicates that these studies can be categorised within one of the following four main contextual domains:

- *Vertical integration* – these studies are the most common and focus principally on the ‘buy or make’ decision.
- *Vertical inter-organisational relationships* – similar to studies on vertical integration, but instead focus on how governance problems can be managed without complete ownership.
- *Horizontal inter-organisational relationships* – uses TC analysis to understand and explain a variety of relationships between firms that exist at the same level in the value chain.
- *Tests of TCA’s assumptions* – investigates the validity of TCE’s assumptions; for example the antecedents and consequences of opportunistic behaviour (see Wang and Yang, 2013).

With regards to the level of analysis, Williamson (1981, cited in Walker and Wing, 1999) believes that the TC approach has been applied at three levels of analysis:

- The first level looks at the overall structure of the enterprise and is concerned with how the operating parts are related to one another; that is a direct reflection of the systems approach to organisation design.
- The second level focuses on the operating parts and asks which activities should be performed within the firm and which outside it and why.
- The third level is concerned with the manner in which human assets are organized to match internal governance structures (the new institutional economics).

2.3.5 Critiques and limitations of TCE

This sub-section provides a critical discussion upon six major critiques and limitations of TCE, which have been identified through the study's critical review of the theory:

- The opportunism assumption debate
- The asset specificity critique
- The productivity vs. transaction costs argument
- Measurement concerns
- The risk-neutrality assumption critique
- The unit of analysis limitation

The opportunism assumption debate:

Opportunism is the assumption that, given the opportunity, decision-makers may dishonestly seek to serve their self-interests (Williamson, 1985). There are at least five possible consequences of entrepreneurs' opportunism: transaction costs; trust; commitment; performance; and cooperation (Ting *et al*; 2007; Wang and Yang, 2013). Thus, TCE aims to control opportunism in order to reduce waste. Nevertheless, TCE's assumption of opportunism has been subject to substantial debate (e.g. Ghoshal and Marshal, 1996; Ghoshal, 2005). It has been argued, by opponents of TCE, that opportunism takes a dismal view of human nature; that is because it implies that people will not self-enforce promises, but instead some of them lie and cheat when it suits their purpose (Ghoshal, 2005). Accordingly, TCE's focus is on "*how organisations need to be managed so as to prevent these 'bad' people from doing harm to others*" (Ghoshal, 2005, p. 85). Ghoshal and Moran (1996) argued that there is sufficient evidence that the likely outcome of such (negative) management approaches, is to support or increase opportunistic behaviours rather than reducing or controlling them. Building on the concept of double hermeneutic (Giddens, 1984) that distinguishes the link between theory and practice in social domains, Ghoshal (2005) argued that TCE's pessimistic assumptions about human nature, and like-wise theories, have had a negative influence on practice:

“Combine agency theory with transaction cost economics, add in standard versions of game theory and negotiation analysis, and the picture of the manager that emerges is one that is now very familiar in practice: the ruthlessly hard-driving, strictly top down, command-and-control focussed, share-holder value obsessed, win-at-any-cost business leader...This is what Isaiah Berlin implied when he wrote about absurdities in theory leading to dehumanisation of practice” (p. 85)

Rindfleisch and Heide (1997) disagreed with Ghoshal and Marshal's (1996) arguments. They argued that TCE does not assume that all social actors are opportunistically minded; instead it just suggests that some actors may behave opportunistically, and that it is difficult and costly to know a priori whose trustworthy and whose not (i.e. identify opportunistic partners ex ante). Compellingly, Williamson's (1985, p. 392) own response to this recurring criticism, came as follows:

“This unattractive view of human nature nevertheless generates numerous refutable implications. The view that individuals are opportunistic does not, moreover, preclude the possibility that they will forge durable alliances”.

Asset specificity critique:

Asset specificity is regarded within TCE framework as sunk costs (that have a lock-in effect), which can encourage opportunism. These assets may include, for example, investments that a client employs for the purpose of supply chain development. According to TCE, this may encourage some members of the supply chain to exploit the situation. Thus a safeguarding problem arises because the market competition no longer restrains opportunism (Rindfleisch and Heide, 1997). It can be concluded here that the higher the asset specificity, the greater the loss becomes when altering a partnership (Yong and Mustaffa, 2011). Thus, asset specificity is viewed here as a factor that increases transaction costs and potential for opportunism. However some studies have found that asset specificity is negatively correlated with opportunism (see for example, Ting *et al.*, 2007; Wang and Yang, 2013). This finding therefore indicates that asset specificity can be used as a means for reducing transaction costs. These studies suggest

that when asset specificity is within the advantage of the client, it can be used as a control mechanism to decrease opportunistic behaviour. In such situations, the investing parties tend to ensure relationship continuity, in order to secure payoffs of their transaction specific investments (Rindfleisch and Heide, 1997); this in turn enhances cooperation. Thus, it becomes obvious that the time dimension (i.e. transaction frequency) plays an important role in determining the impact of asset specificity on transaction costs.

The production costs vs. transaction costs argument

TCE has the objective of total cost minimisation (Winch, 1989; Tate et al., 2011, 2014). It aims to reduce both transaction and production costs (total costs). Williamson developed Coase's theory of the firm to suggest that economic actors should primarily seek to economise on transaction costs. It is however recognised in TCE that making decisions about governance structures encompasses a trade-off between transaction and production costs (Rindfleisch and Heide, 1997). As proclaimed by Williamson (1981):

“Although transaction cost economizing is an important and greatly neglected topic, such economizing cannot proceed regardless of the production cost ramifications. Put differently, transaction cost economizing needs to be located within a larger economizing framework and the relevant trade-offs need to be recognized” (p. 552).

In addition, there seems to be inconsistency among scholars about deciding on whether transaction or production costs have a stronger impact on the choice of governance structures (Rindfleisch and Heide, 1997). In specific industries, like construction, it may be the case where the role (and magnitude) of production costs is more significant than transaction costs. It has been argued by Koskela and Ballard (2006, 2012) that TCE lacks a proper conceptualisation of production and waste, and thus they questioned the relevance of TCE in the construction sector. According to them:

“It is hardly possible to isolate transaction costs completely from production costs, as assumed in transaction cost economics. The transaction behaviour of the supplier impacts the production costs in situation-specific and complex

ways, but this is not taken into account in transaction cost economics because production costs are considered constant” (Koskela and Ballard, 2006, P. 157).

Furthermore, it is assumed in TCE that economic actors should primarily focus on choosing an optimal governance structure, in order to ensure efficient transactions and avoidance of waste. However, it could be simply argued that that no matter how efficient the chosen governance structure could be, there is no optimal/perfect mode of governance. Thus, the extent of non-optimality is waste that needs to be tackled through economising on production activities (Koskela and Ballard, 2012). From these arguments provided above, in relation to TCE’s poor conceptualization of production and optimality assumption, it is therefore suggested that, in the construction sector, project organisation and governance structures (construction procurement arrangements) should be crafted to support production system requirements and improve flow processes, rather than being based on transactional cost and risk-averse considerations.

Measurement-related concerns

Difficulty of obtaining data is a problem often highlighted as a key obstacle to testing TC theory (Rindfleisch and Heide, 1997; Hughes et al., 2005; Klug and Pietrzak, 2006). A review of 45 empirical TC analysis studies by Rindfleisch and Heide (1997) revealed that the main data collection methods that have been used to investigate TCA are:

- Mail surveys - the most commonly used approach;
- Secondary data publications, e.g. industry trade publications;
- Records of contractual agreements (obtained from databases or through interviews with key informants);
- Experimental methodologies.

Rindfleisch and Heide (1997), however, reported that many of the studies they reviewed faced significant measurement-related challenges. Environmental uncertainty was found to be the most difficult construct to be measured amongst all TCE constructs. This

finding seems to support Klem's (1997, pp. 58; cited in Klug and Pietrzak, 2006) claim that transaction costs are difficult to measure, because TCE theory is more qualitative than quantitative. Similarly, a prolonged research project by Will Hughes and his fellows (2001, 2002, 2003, and 2005) also raised concerns about the difficulty of measuring transaction costs. Their project aimed to quantify the relationship between forms of construction procurement, project types and the costs of the commercial process. In order to achieve this objective, they divided the commercial process into four stages (marketing, establishing agreements, monitoring of works, and resolving disputes); but their study highlighted the difficulty of obtaining data as a key obstacle to testing the reliability of TCE in general, especially in the construction industry. The temporary nature, highly commercially sensitive information associated with construction tendering and contractual processes, and the fear that the data could eventually be revealed to competitors or end up in the public domain, are all reasons that make it difficult for researchers to negotiate access into firms for the purpose of collecting data (see Layea and Hughes, 2011).. According to Dalrymple *et al.* (2006), the main barriers to understanding construction tendering costs include:

- Difficulty in determining resources allocated to tendering costs,
- Difficulty or reluctance to implement,
- Greed and blatant corruption

Having all of these said, difficulties in measuring transactional costs in construction should not still be a valid reason for claiming the failure of TCA in construction, and thus ignoring its explanatory power. As Rindfleisch and Heid (1997) have shown, for example, through their comprehensive review of 45 empirical examinations of the TCE framework, many researchers from different industries have been able to test and validate the TC theory. TCE can provide fruitful insights and economical explanations to contractual and institutional issues in construction, whenever appropriate. According to Chau and Walker (1994, p. 372):

“Provided that the type of transaction costs can be identified and the way they vary under different circumstances can be specified, the transaction cost

minimization paradigm can successfully explain most real life phenomena related to the choice of institutional arrangement”

It is important, however, to stress that not all institutional and organisational arrangements are developed based on cost considerations (Rindfleisch and Heide, 1997; Klug and Pietrzak, 2006). The theory of institutional isomorphism (DiMaggio and Powell, 1983), for instance in contrast to TCE, proved that many organisational arrangements and relationships are not necessarily formed based on efficiency considerations. Instead, some are also formed due to imitation throughout an organisational field (see Section 2.4.3 below). This phenomenon of institutional isomorphism seems to explain many of the prevailing (imperfect) construction procurement practices in the UK. For example, the above-mentioned research project by Will Hughes and his fellows (Hughes et al., 2005) ended up concluding that there is no correlation between costs of tendering and the way the work is organized (i.e. procurement type). Their study found that the costs of negotiation within collaborative arrangements are almost equal to the costs of tendering and establishing deals in competitive arrangements. Despite this, competitive procurement arrangements continue to prevail, despite their widely criticised inadequacies. For these reasons, amongst others, they questioned the relevance of TCE to the construction industry by claiming that

“High transaction costs may imply that it would be economical to bring inputs in-house and avoid the costs of arranging sub-contracts. Theoretically, there should be a movement towards the internal labour market and away from sub-contracting. But in the UK the trend is the other way, questioning the relevance of TCE in the construction sector” (pp. 215-216).

Risk-neutrality assumption critique

In economic theories (i.e. game theory and neo-classical economics), three types of risk preferences are considered: risk acceptance, risk neutrality, and risk aversion (Chiles and McMackin, 1996). However, the TCE framework implies that all partners of a transaction have a neutral attitude towards risk (Williamson, 1985). Although risk preference is regarded as one of the important determinants of economic behaviour, it

has received less attention in literature in comparison to other behavioural assumptions of TCE (i.e. bounded rationality and opportunism). Williamson (1985) offered three defenses for his treatment of the risk neutrality assumption. The third and most compelling reason, according to him, for the use of risk neutrality assumption is that it allows us to focus on the core concepts of TCE, whereas an assumption of risk adversity may be misleading. He then provides a justification to his claim by explaining that:

“Risk aversion often deflects attention from core efficiency purposes and related institutional features that are more readily discerned and more accurately assessed if, at this early stage in the development of the New Institutional Economics at least, a risk neutrality assumption is maintained” (Williamson 1985, pp. 388-390).

A theoretical study by Chiles and McMackin (1996) criticised Williamson’s (1985) defense and suggested three reasons for why they believed a closer examination of risk neutrality is essential. They argued that:

- Keeping TCE’s analogy consistent with that of neoclassical economics is essential for enabling comparisons to be conducted;
- Results of psychological studies suggest that risk preferences of a single firm vary in a systematic way, influenced by a variety of contextual variables
- The governance mechanisms predicted by the TCE framework will differ according to the risk preference of the firm.

Chiles and McMackin (1996) concluded their study by arguing that many of the perceived limitations of TCE are in part a result of the inadequate treatment of risk and trust in earlier versions of the work. They offered a number of propositions that demonstrate how that risk and trust can be incorporated into TCE’s theoretical model with ease; but there have not been sufficient empirical examinations to support their arguments.

Unit of analysis limitation

One of the most significant critiques of TCE is concerned with its unit of analysis: the individual transaction. According to Rindfleisch and Heide (1997, p. 49), “*this implicit tendency of the theory to focus on single transactions and relationships ignores the temporal nature of inter-organisational relationships*”. For example, TCE does not explicitly consider how that past relationships and expectations about future transactions (i.e. path dependency) may influence the way current exchanges are organised (Rindfleisch and Heide, 1997). Accordingly, it can be suggested that perspectives from TCE and game theory could probably supplement each other. However this suggestion is criticised by Kreps (1999, P. 122), cited in Williamson (2000, p. 605), who argued that:

“If Markets and Hierarchies have been translated into game theory using notions of information economics, it is a very poor translation . . . In particular, mathematics-based theory still lacks the language needed to capture essential ideas of bounded rationality, which are central to . . . transaction costs and contractual form. Anyone who relies on the translations alone misses large and valuable chunks of the original”.

It can be argued that the ‘transaction frequency’ construct within the TCE framework addresses this individual transaction or firm limitation/critique to some extent; but as Coase (1998, p. 2) emphasised “*we cannot confine our analysis to what happens within a single firm... What we are dealing with is a complex interrelated structure*”. Coase (1998) suggested that TCE’s unit of analysis should be expanded to consider and include:

- Interactions with other firms within the supply chain;
- Institutional forces (e.g. influence of laws, culture, and social system);
- The effects of technological advances (e.g. digital revolution) which lead to a dramatic fall in information costs - a major component of transaction costs.

In short, it seems that expanding TCE’s unit of analysis beyond single transactions has significant implications. This, subsequently, led to the emergence of the concept of ‘New Institutional Economics’ (NIE). The next subsections will provide an overview of the agency theory in economics, followed by an outline of the background and the main principles of NIE.

2.3.6 Agency Theory

Agency theory is a branch of transactional cost economics (TCE) that aims to devise efficient ways to constrain the opportunistic behaviour of agents (Walker and Wing, 1999). The focal point of agency theory is the goal conflict inherent when individuals (or organisations) with different preferences, risk attitudes and division of labour engage in a cooperative effort (Eisenhardt, 1989). Hence, the unit of analysis is the contract, the theory seeks to determine the most efficient contractual mechanism governing the principle-agent relationship. According to Eisenhardt (1989), TCE and agency theory have similar dependent variables; hierarchies roughly respond to behaviour-based contracts, while markets correspond to out-come based contracts (see Figure 2.1 below). The main difference between the two theories, however, is that agency theory’s emphasis is on ex-ante incentive alignment and efficient risk bearing, while TCE is mainly concerned with governing ex-post stages of contract (Williamson, 2000). Table 2.1 summarises the similarities and contrasts between the fundamental assumptions of agency theory and other organisational theories.

Table 2.1: Comparison between agency theory's assumptions and other organisational theories (Adopted from Eisenhardt, 1989)

Assumptions	Theoretical Perspective				
	Political	Contingency	Organizational Control	TCE	Agency Theory
Self-interest	X			X	X
Goal conflict	X			X	X
Bounded Rationality		X	X	X	X
Information asymmetry		X		X	X
Pre-eminence of efficiency		X	X	X	X
Risk aversion					X
Information as a commodity					X

Agency theory broadened risk-sharing literature by attempting to resolve two governance problems in the principal-agent relationship where one party (the principal) delegates work to another (the Agent) to perform the work (Eisenhardt, 1989). At the heart of Principal-Agent theory is the trade-off between the: (a) Cost of measuring behaviour; and the (b) Cost of measuring outcomes and transferring risk to the agent. According to Walker and Wing (1999), the principal's choice would require a consideration of the cost of constraining the agent's behaviour (or of the agent's opportunistic behaviour if the cost of constraining it is higher) as well as the cost of loss in productivity and flexibility as a result of the constraint.

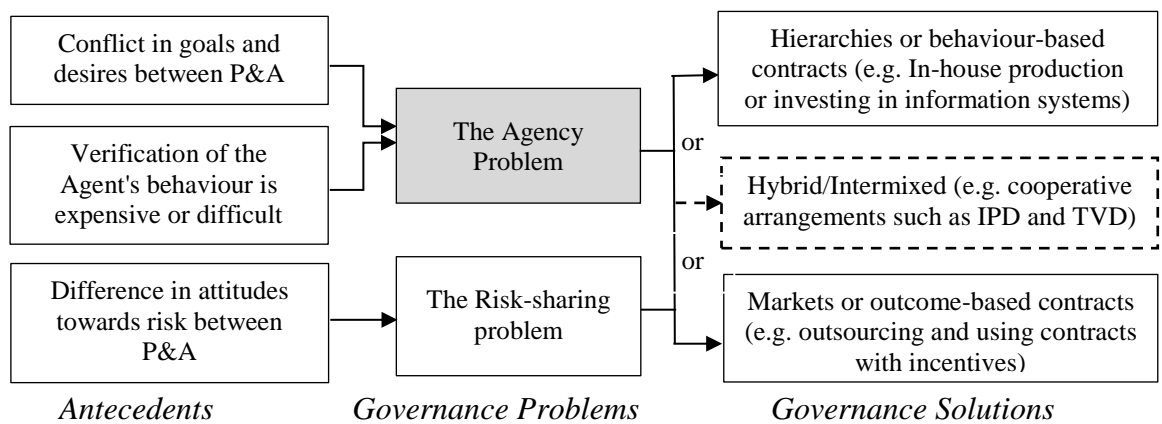


Figure 2.1: A simplified model of the Principal-Agent relationship problems

In particular, the theory seeks to identify whether a behaviour-orientated contract is more efficient than an outcome-orientated contract. Agency theory conceptualises information as a commodity that has a cost and can be purchased. Thus, the principal has two main options (Eisenhardt 1989). Firstly, to monitor and discover the agent's behaviour by investing in information systems (e.g. monitoring and reporting procedures, additional layers of management). Secondly, to contract on the outcomes of the agent's behaviour. The out-come based contractual arrangement might help to improve performance and behaviour by co-aligning the agent's interests and incentives with those of the principal, but at the price of transferring risk to the agent. Based on the principles of the Agency theory and TCE, Figure 2 below illustrates the variables influencing the principal's choice, in the form of propositions.

The Principal-Agent relationship is a typical problem that seems to be deeply institutionalised in our current prevalent construction business model (e.g. client – main contractor relationship). Further, prevailing construction procurement governance arrangements seem to be in consistence with the two options offered by Agency theory: (1) contracting on the outcomes of the agent's behaviour (outsourcing and relying on the buy-it solution); and/or (2) monitoring and controlling behaviour (i.e. relying on the use of contractual governance solutions). These transactional-based and risk-averse approaches to construction procurement prevail in the construction industry, even though it could be more appropriate and efficient to use a vertically integrated “make-it” or production-led approach, where interests are safeguarded through “in-house” or “hybrid” production (i.e. make-it solution).

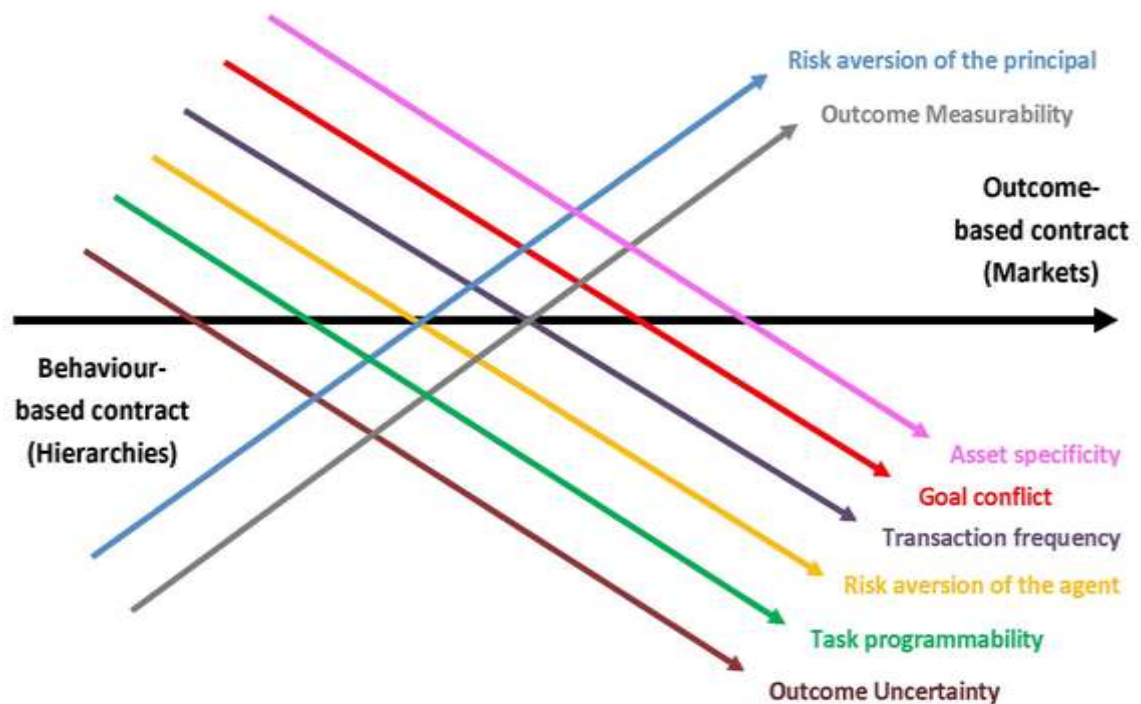


Figure 2.2: Conceptual model showing the relationship between transactional variables and governance arrangements [Modified from Esienhardt (1989)]

2.3.7 New Institutional Economics

The New Institutional Economics (NIE) paradigm was developed to enable economists to take the wider aspects of the institutional environment and arrangements into their scope of analysis. It was Ronald Coase (1960) who made the crucial connection

between institutions, transaction costs, and neoclassical theory. Additionally, it is acknowledged by Williamson (1990) that North and Davis (1971, pp. 6-7) have significantly contributed to institutional economics by distinguishing between the institutional environment and the institutional arrangements. These two branches of NIE were defined by them, as follows:

“The Institutional environment is the set of political, social and legal ground rules that establishes the basis for production, exchange and distribution...”

An institutional arrangement is an arrangement between economic units that governs the way these units can cooperate and/or compete”.

The expression of "the new institutional economics" was however coined by Oliver Williamson to differentiate the subject from the old (or original) institutional economics (Coase, 1998). The old school of institutional economics is founded on the tradition of Thorstein Veblen (1899), and suggests that institutions emerge spontaneously as the result of an uncoordinated evolutionary process (Nelson and Sampat, 2001; Parada 2002). While, the new school postulates that institutions involve conscious and coordinated planning. North (1994, p. 360) defines institutions, within the NIE paradigm, as *“the humanly devised constraints that structure human interaction”*. According to him, institutions are the admixture of formal constraints (e.g., rules and laws), informal constraints (e.g., norms and routines), and their enforcement characteristics. For a controversial review about debates related to the commonalities and distinctions of the old and the new institutional economics, see for example, Hodgson (2000), Nelson and Sampat (2001), Dequesh (2002), and Parada (2002). According to Dequesh (1998; cited in Dequesh, 2002), several institutionalists from both schools have identified at least three types of influence that institutions have on economic behaviour:

- Constraints on economic behaviour (i.e. restrictive function);
- Influence on perception or reception of reality (ie. informational-cognitive function);
- Influence on end goals that people pursue (i.e motivational or teleological function).

Williamson (2000) provided a sketch of four hierarchical and interconnected levels of social analysis (which describe the framework for the economics of institutions), where the higher level imposes constraints on the level immediately below:

1. *Embeddedness* (the highest level) – *represents informal institutions*, such as customs, norms, traditions and religion. Institutions at this level change very slowly and are often non-calculative. Thus, this level is outside the scope of institutional economics. Instead it is undertaken by social scientists and economic historians.
2. *Institutional Environment* (1st order economising) – *the formal rules of the game*, and is mainly concerned with property rights (e.g. rules, laws, policy, judiciary, and bureaucracy). At this level of analysis, the purpose is getting the institutional environment right. This can be undertaken using economics of property rights or positive political theory.
3. *Institutional arrangements or Institutions of Governance* (2nd order economising) – *the play of the game*, and is mainly concerned with contracts (i.e. aligning governance structures with transactions). At this level of analysis, the purpose is getting the governance structures right. This is undertaken using transaction cost economics.
4. *Resource allocation and employment* (3rd order economising) - prices, quantities and incentive alignments. At this level of analysis, the purpose is getting the marginal conditions right. This is undertaken using neoclassical economics and agency theory.

In summary, NIE is principally concerned with Levels 2 and 3 of the four levels of social analysis described above (Williamson, 2000). These are the levels of the institutional environment and the institutions of governance – i.e. rules of the game and play of the game, respectively. Although ‘*informal*’ institutions are important for economics, as it is believed that they define the borders that constrain the way in which rules and regulations are created and related enforcements are carried out (North, 1984, cited in Sha, 2004), they remain an underdeveloped part of NIE (Williamson, 2000). The next sections, therefore, explore the background of institutional theory and its development over time from a social scientific thinking and perspective.

2.4 Neo Institutional Theory

Having considered TCE and NIE economic explanations to the establishment, process and outcomes of several forms of institutional and organisational arrangements, the shift now moves to an exploration of ‘neo-institutional theory’—a branch of organizational sociology. This theory provides a social perspective to the formation of institutional and organisational arrangements. In particular, the theory argues that many organisational arrangements are ‘not’ necessarily formed based on efficiency considerations only. Instead, some are also formed due to imitation and mere ceremony (Meyer and Rowan, 1977), or the fact that that they are widely shared, disseminated, and taken for granted throughout an organisational field (e.g. the construction industry) (DiMaggio and Powell, 1983).

2.4.1 Background of the institutional theory

Institutional theory has a long and complex history dating back to the mid-nineteenth century and incorporates the pioneering insights of seminal scholars of the social sciences, such as Max Webber (Scott, 2005). Old institutional arguments relied on notions that ‘institutional contexts structure action’. According to Meyer (2008) *‘Individuals were seen as creatures of habit groups as controlled by customs and societies as organized around culture’* (p. 790). Theories stretched from the economic to political and religious fields, emphasising more organisational or cultural forms of control. However, in general, the nature of institutions and their forms of control over action were always subject to a lack of clarity and consensus in social scientific thinking (Meyer, 2008).

The old institutionalism was encountered by constant debates about free will and determinism; as it saw humans, groups and organisations as naturally embedded entities in broad cultural and structural contexts. In brief, the old institutionalism was marginalised by the rise of the social sciences of modernity, where conceptions were built around notions of society being comprised of empowered, fairly rational, and rather free actors (Meyer, 2008). These actors include individuals, governments, and the organisations created by people and governments. In addition, much of the work focused on institutionalism from these periods was subsumed in the storming advances

of neoclassical theory in economics, behaviouralism in political science, and positivism in sociology. Further development by John Meyer and his colleagues at Stanford University led to a significant revival for the ideas of institutionalism from 1977, with the formulation of neo-institutional theory (Scott, 2005; 2008).

2.4.2 The development of neo-institutional theory

The neo-institutional theory developed in response to specific processes and structures (i.e. causes of structural change in organisations) that were not adequately explained by prevailing rational-actor and contingency theories (DiMaggio and Powell, 1983; Mahalingam and Levitt, 2007). For example, bureaucratic organisations continued to follow rules that in some cases conflicted with the organisations' own goals. The general argument advanced by the foundational work of Meyer and Rowan (1977) was that formal organisational structures reflected institutional forces instead of technological requirements and resource dependencies. They argued that many of the models giving rise to organisations are based on rationalised myths and rule-like frameworks that depend for their efficacy on imitation and the fact that they are widely shared and disseminated.

In brief, conventional neo-institutionalism literature, in replication of the old institutionalism, emphasised the ways by which institutions constrained and directed people (now perceived as bounded, purposive and empowered actors) to behave in certain regular, relatively rational, but homogeneous and expected ways (DiMaggio and Powell, 1983). With more than 30 years of progress since neo-institutional theory penetrated organisational sociology, the theory has been subject to various developments including reformulation of some of its arguments. Next, three significant areas of development, which are most relevant to the study, will be briefly highlighted (for a fuller review, see Scott, 2008).

2.4.3 Institutional Isomorphism

In the 1970s, when research efforts were focussed on understanding the reasons for variations amongst the kind of organisations (i.e. structural features), seminal work by

DiMaggio and Powell (1983) sought to explain *homogeneity* of organisations and practices rather than their *variations*. Their contention was that "*highly structured organisation fields provide a context in which individual efforts to deal rationally with uncertainty and constraint often lead, in the aggregate, to homogeneity in structure, culture, and output*" (p. 144). They described this phenomenon as 'institutional isomorphic change', which occurs through three mechanisms:

- (1) '*Coercive isomorphism*' that results from political forces and legitimacy issues;
- (2) '*Mimetic isomorphism*' occurring due to standard responses to uncertainty; and
- (3) '*Normative isomorphism*' associated with professionalisation.

'Organisational fields' can be defined as those independent actors (i.e. persons and organisations), within somewhat circumscribed arenas, that produce similar services or products and constitute a shared culture and social sub-system (Scott, 2008, 2012). The logic for applying work at organisational field levels is that it provides us with a more systematic level of analysis; as attention is shifted from focussing merely on '*organisations in environments*' to focussing on the '*organisation of the environment*', with particular consideration to organisations as the key players of the field (Scott, 2008).

2.4.4 The move towards a comprehensive conceptual schema

Institutional theory has been widely employed among social, economic and political sciences to examine systems ranging from micro-interpersonal interactions to macro global frameworks. Despite the fact that the theory had multiple roots; there is a wide consensus that institutions matter (Peng *et al.*, 2009). Nevertheless, social scholars were adopting the theory in various ways, and there seemed to be a crucial need to move from a looser towards a tighter conceptualisation. For this reason, sociologist W. Richard Scott provided a comprehensive conceptual schema (see Table 2.2), based on his extensive survey to institutional literature, that guides directions for pursuing such a theory. Scott defined institutions as: '*regulative, normative, and cultural/cognitive systems and structures that, together with associated activities and resources, provide*

stability and meaning to social life' (Scott, 2001, p. 48). His aim was not to provide a new integrated theory of institutions, but instead to better enable us to capture both the commonality and the diversity of past and present conceptions of institutional theory (Scott, 2008).

Hence legitimacy is a primary requisite of any stable social order, the three pillars are analytically distinguished to stress that although interrelated, but they work through varying mechanisms and distinctive motives for compliance (Scott, 2012). For instance, a 'regulative' perspective evaluates legitimacy according to the extent that systems operate in conformance to relevant legal or quasi-legal requirements. Alternatively, a 'normative' view asserts a moral basis for evaluating legitimacy; while a cultural-cognitive conception refers to the orthodox and taken for granted features of social life that widely shared beliefs within a community make possible (Scott, 2012).

Table 2.2: Scott's Typology of Institutional Pillars and Carriers (Scott, 2001)

	<u>Pillars</u>		
<u>Carriers</u>	<i>Regulative</i>	<i>Normative</i>	<i>Cultural-Cognitive</i>
Symbolic Systems	Rules, laws	Values, expectations	Categories, typifications, schema
Relational Systems	Governance & power systems	Regimes, authority systems	Structural isomorphism identities
Routines	Protocols, Standard Operating Procedures	Jobs, roles, obedience to duty	Scripts
Artifacts	Objects complying with mandated specifications	Objects meeting conventions, standards	Objects possessing symbolic value

2.4.5 Strategic responses to institutional pressure

Institutional theory pays significant attention to the context (Oliver, 1991). It considers the processes by which structures including rules, norms, and routines become established as authoritative guidelines for social behaviour. Much of the early studies of institutional theory emphasised that organisations and actors, operating within a specific context, were pressurised to conform to the requirements and constraints of their institutional environment (e.g. DiMaggio and Powell, 1983). Organisations' self-

interested rewards obtained from conformance to these institutional forces include, for example, legitimacy, enhancing likelihood of survival, social support, stability, access to resources, acceptance in professions, and expedience to avoid questioning (Oliver, 1991). For these reasons, the prevalent language used was one of ‘institutional effects’, thereby inferring a determinant ‘top-down’ argument (Scott, 2005).

This unilateral perspective based on obedient organisations defocused attentions of institutional scholars away from the fact that social structures are continuously modified by the individual and collective actions of social actors. Thus, according to Scott (2008), one of the important advances to the progress of institutional theory is the introduction of agented actors and accordingly the rise of interactive arguments, which suggest that ‘institutional processes’ can operate in both ‘top-down’ and ‘bottom up’ directions. This was important because it allows us to also identify the social actors who held the widely shared beliefs, or were enforcing taken for granted norms (Scott, 2005).

It was the seminal work of Oliver (1991) who affirmed the role of organisational self-interest and active agency within institutional contexts, by cleverly integrating resource-dependence predictions of organisational strategy with the more limited responses to institutional pressures that traditional institutional models provoked. She pointed out that although acquiescence to institutional processes is the most likely response by organisations and their leaders; strategic responses could range from passive to active resistance as follows: acquiescence; compromise; avoid; defy; and manipulate. Accordingly, organisational reactions to institutional pressure towards conformity will depend on five institutional antecedents (Table 2.3).

Table 2.3: Institutional antecedents of strategic responses (extracted from Oliver, 1991)

Institutional Factor	Research Question	Predictive Dimensions
Cause	Why is the organisation being pressurised to conform to institutional rules or expectations?	<ul style="list-style-type: none"> • Legitimacy or social fitness; • Efficiency or economic fitness
Constituents	Who is asserting the institutional pressure on the	<ul style="list-style-type: none"> • Multiplicity of constituent demands;

Content	organisation?	<ul style="list-style-type: none"> • Dependency on institutional constituents
	To what norms or requirements is the organisation being pressurised to conform?	<ul style="list-style-type: none"> • Consistency with organisational goals; • Discretionary constituents imposed on the organisation;
Control	How or by what means are the institutional pressures being exerted?	<ul style="list-style-type: none"> • Legal coercion or enforcement; • Voluntary diffusion of norms;
Context	What is the environmental context within which institutional pressures are being exerted?	<ul style="list-style-type: none"> • Environmental uncertainty; • Environmental interconnectedness

Having considered the explanations provided by neo-institutional theory of organizational *sociology* and TC theory of *economics*, in relation to the formation, process and impacts of several forms of institutional and organisational arrangements, next the study explores the construction procurement context.

2.5 The Construction Procurement Context

The aim of this section is to explore literature pertaining to the construction procurement (CP) context. This commences by clarifying how this study defines a construction procurement system (CPS), before reviewing the background and evolvement of various project delivery approaches. Next an outline of major procurement arrangements (system, sub-systems and options) used in construction is illustrated. Following this, the study conceptualises CP arrangements as ‘institutional arrangements’, and explores their influence on project performance and outcomes.

2.5.1 Construction procurement systems

A common theme of construction literature is the proliferation of definitions of a procurement system (see for example, Sharif and Morledge, 1994; Love *et al.*, 1998; Masterman, 2002; Watermeyer, 2012). Both terms: ‘contractual arrangement’ and ‘procurement system’ are often used synonymously (Love *et al.*, 1998). Similarly,

procurement approaches and additional contract price provisions (e.g. lump sum, guaranteed maximum price, target cost, and cost plus) are also commonly regarded as closely related (Oyegoke et al., 2009). Interestingly, a study by Tookey *et al.* (2001) found that, in practice, clients do not adhere to rigid prescriptive procurement guidance and definitions, which regard construction procurement as a set of rationalistic decisions taking place within a closed environment (mechanistic-thinking approach); instead counterintuitive decisions are the norm, leading to the formation of hybrid structures. It is, however, important to define terms and concepts that are critical in communicating the intent and context of the research, so as to establish a common understanding between the author and his readers. Thus, for convenience and clarity, this study defines a construction procurement system as ‘a project-organisation system that arranges and governs the way that the parties involved can compete and/or cooperate in order to achieve their agreed programme and/or project goals’.

Inspired by Masterman’s (2002) fourfold categorisation of procurement methods, Love *et al’s* (1998) classification of building procurement systems, Kumrasawy and Dissanayaka’s (1998) hierarchy of procurement options, and Watermeyer’s (2011) framework for developing a construction procurement strategy, this study conceptualises major construction procurement arrangements as illustrated in Figure 2.3, and Table 2.4 below.

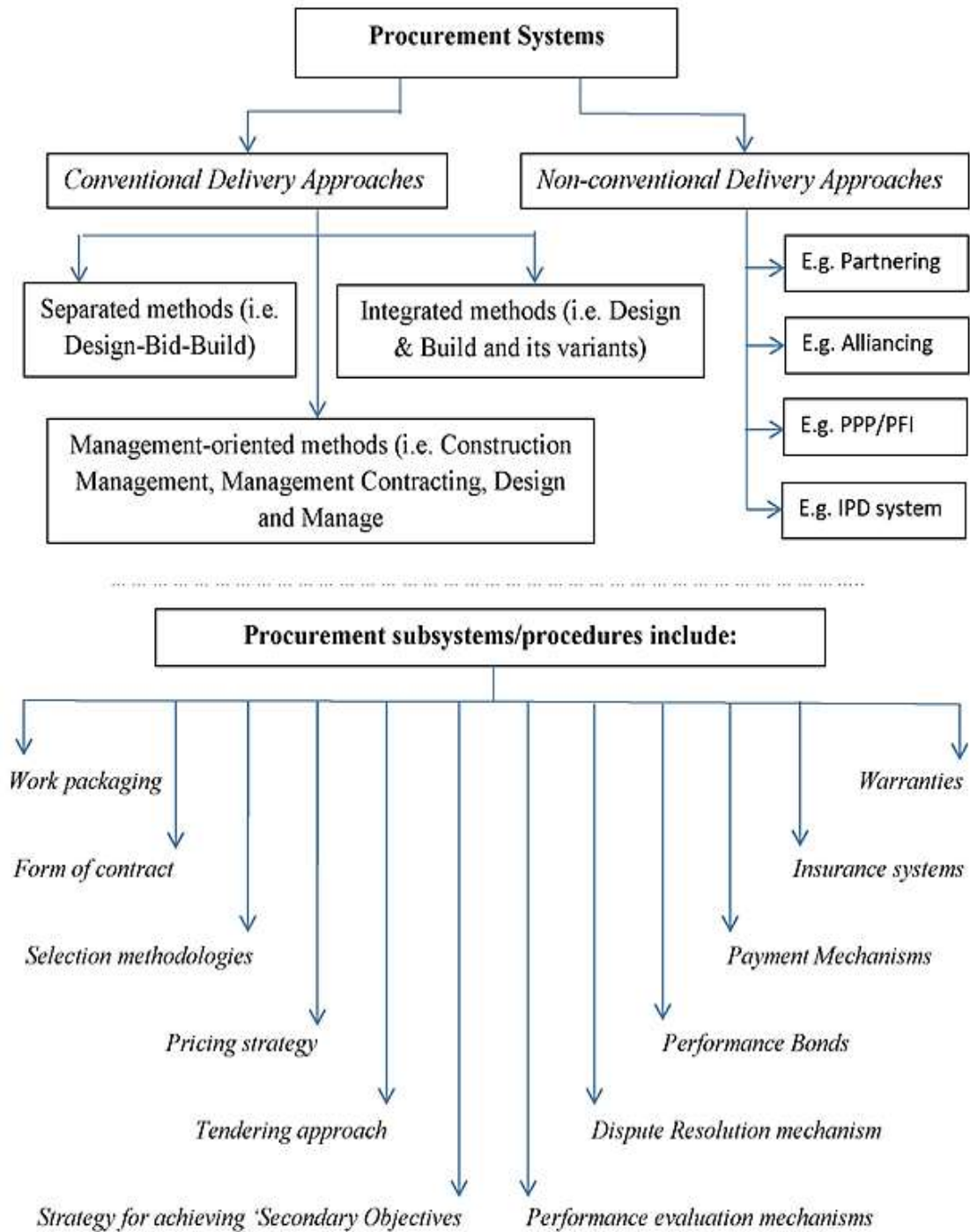


Figure 2.3: Major construction procurement arrangements (systems and sub-systems)

Table 2.4: Major options available within construction procurement subsystems

Procurement subsystem /Procedure	Possible Options
Work packaging	<ul style="list-style-type: none"> • Break down based on contract value (e.g. large packaging to be employed for the purpose of high price competition, or small packaging if specialist expertise is required) • Divisions based on geographical divisions or functional and disciplinary divisions of contracts • Design based on sequence or interdependence of activities • Design based on Project risks and the allocation of responsibilities, or project needs
Form of contracts	<ul style="list-style-type: none"> • Standard un-amended set of contract forms and conditions from recognised bodies (e.g. FIDIC, NEC3, ICE, JCT, contracts) • Amended standard forms of contract which include special conditions of contract (e.g. special risk transfer/allocation, length of guarantee and additional insurance) • Multi-party agreement forms of contract (e.g. PPC2000) • Discrete/Bespoke contracts (custom-made)
Selection methodologies (Bid-evaluations)	<ul style="list-style-type: none"> • High weight on tender price • Equal weight on price and soft parameters • High weight on soft parameters (e.g. competence, reputation, capacity, collaborative-ability, and experience)
Payment mechanism	<ul style="list-style-type: none"> • Advanced payments • Milestone payments • Interim payments (e.g. Monthly payments) • Stage payments • Incentive/disincentive payments • Shared gain/pain arrangements/Target cost
Insurance systems	<ul style="list-style-type: none"> • Traditional insurance arrangements; • Single project-insurance option

Warranties	<ul style="list-style-type: none"> • Collateral warranties; or • latent defect insurance
Tendering approach	<ul style="list-style-type: none"> • Competitive open bid procedures with or without post-qualifications (one or two stage tendering); • Selected- limited bid invitation - with or without pre-qualifications; (one or two-stage tendering) • Direct negotiation with one preferred supplier (no tender)
Pricing strategy	<ul style="list-style-type: none"> • Price-based (e.g. Lump sum; Guaranteed maximum price; Bills of quantities; Price list/schedule; Activity-based scheduling) • Cost-based (e.g. cost-reimbursement; Target cost; and Target value design) • Mixed
Performance evaluation mechanisms	<ul style="list-style-type: none"> • Output control by client - inspection of the outcome • Process control by client - ongoing monitoring • Social control - Self-control by contractor
Strategy for achieving ‘Secondary Objectives’ <i>(e.g. promoting sustainability, enhancing health & safety performance beyond statutory requirements, and poverty alleviation)</i>	<ul style="list-style-type: none"> • Through the use of incentives that are provided in the form of tender evaluation points • Through financial incentives for attaining key performance indicators • Via obligations and mandatory contractual subcontracting requirements
Dispute resolution mechanisms (DRM)	<ul style="list-style-type: none"> • Conventional DRMs (i.e. litigation, arbitration, adjudication) • Alternative DRMs (e.g. Mediation, conciliation, early neutral evaluation, Partnering)
Bondings / Financial governance approaches	<ul style="list-style-type: none"> • Performance/Surety bonds • Bank Guarantees • Standby letters of credit • Cash retentions • Parent company guarantee • No need for use of bonds as a means of safeguarding - Instead the focus is on pre-qualifications, direct negotiation, single project insurance and collaborative/relation-based delivery approaches

From ancient construction to separated delivery methods

Throughout ancient times, the construction process used to be executed from inception to completion by master builders who retained responsibility for both design and construction (Kent and Becerik-Gerber, 2010). Examples include the 'Egyptian Pyramids', that were built by the pharaoh's builders in a span of 85 years between 2589 and 2504 B.C (Bonani *et al.*, 2001); the 'Parthenon Temple' in Greece that was built in the fifth century B.C by the master builders Ictinus and Callicrates, and the 'Dome on the Florence Cathedral' constructed in the twelfth century by master builder Filippo Brunelleschi (Garrison, 2013). The increasing complexity of construction projects has initiated an era of specialization and the separation of processes that were previously undertaken - from initiation to completion - by one master builder (Oyegoke *et al.*, 2009). According to Garrison (2013), this separated method of organising design and construction is mainly influenced by the varied events surrounding the industrial revolution. Growth of cities, the need for specialised types of buildings and knowledge expertise are all factors, amongst others, that have maximised the role and need for professional architects and designers. Additionally, improved communication enabled designers to create specifications and drawings from anywhere, while builders had to remain localised (Garrison, 2013). Furthermore, Garrison states that:

"Maybe the most important effect resulted from a change in thinking that occurred during the Industrial Revolution. Frederick Taylor introduced his Scientific Management in 1911. It divided work into tasks, and because of the drastic difference between the design process and the physical work of construction, they were a target for separation" (Garrison, 2013, p.1).

Taylor's approach in principle aimed to improve economic efficiency by the means of task management (Koskela, 2000). It stemmed from the reductionist view of the world that has shaped the Western thinking at least since 17th century, when the French philosopher Rene Descartes suggested that the best way to deal with complexity is to divide a problem into separate parts and then tackle those parts one by one in a rational and linear manner (Chapman, 2004, p.18; cited in Pekuri *et al.*, 2014). These ideas served as the rationale for the transformation view of production which holds that production can be broken down into separate sub-processes, and that the total cost of the

production process can thus be optimised by minimising the cost of each sub-process (Koskela 2000a).

Consequently, the hierarchical system adopted in the construction industry became subject to reform over time. Designers became the managers of the project who dictate materials and details, leaving contractors with a very limited opportunity to bring in their expertise into design (Garrison, 2013). In the early 20th century, most projects were delivered through this separated, architect-led, procurement system using lump-sum contracts, with an exception to some limited contractor-centred approaches (i.e. design and build) developed in the private sector in attempts to improve project delivery and outcomes (Oyegoke *et al.*, 2009). Since the 1940s, Public procurement policies have greatly embraced design-bid-build (traditional procurement), making it the most widely used project delivery method in the United States (Kent and Becerik-Gerber, 2010), and most countries worldwide including the UK. This traditional approach led to the formation of multiple subcultures and stereotypes within the construction industry, causing high levels of fragmentation (Egan, 1998), intra-team boundaries (Moore and Dainty, 2001), inefficiencies and high costs of insufficient interoperability (Kent and Becerik-Gerber, 2010). Additionally, this separated project delivery approach often results in a sequential construction process, where various parties just get temporary involved at certain project phases; thereby focussing on their own part of the work rather than the whole project (Osipova and Eriksson, 2011). This point raises the question: why has the traditional procurement method gained such popularity, spread all over the world, and is still commonly used in various countries? This is a valid fundamental question, as there are substantial trends towards establishing collaborative ways of working as a means for improving project performance and outcomes (see for example, Eriksson *et al.*, 2008; Xue *et al.*, 2010; Sebastian, 2011; Walker *et al.*, 2017)

According to Watermeyer (2012), this traditional way of organising, delivering and managing construction work was originally established in the UK in 1768 by John Smeaton, who is considered as the founder of civil engineering; entrenched by Sir Joseph Bazalgette who developed a standard form of contract in the 1860's, which later on served as the model for the first edition of the Institution of Civil Engineer's standard

form of contract published in 1945 (Barnes 1999), and then passed on from the UK to its colonies. This Traditional separated procurement approach, described by Watermeyer (2012) as a "*master-servant*" model, remained in use for the majority of civil engineering projects in the UK for more than two hundred years, and is still in use till now in many projects especially in developing Anglophone countries. However, although the UK Government since 2003 stressed that traditional (non-integrated) procurement routes should no longer be used, unless it can be evidenced that they offer best value for money (OGC 2003); several research studies and UK industry-wide reports have revealed that traditional procurement systems are still very prevalent and adopted by many organisations, despite not being approved by UK Government guidance anymore (e.g. RICS, 2004; CIOB, 2010; Oyegoke *et al.*, 2009; Eadie *et al.*, 2013). Interestingly, many studies have focussed on explaining the disadvantages of traditional procurement systems (see for example, Proverbs *et al.*, 2000; Osipova and Eriksson, 2011; Love *et al.*, 2011b) and the barriers to implementing collaborative procurement approaches (e.g. Bresnen and Marshall, 2000; Phua, 2006; Eriksson *et al.*, 2008). However, very few, if any, studies have been able to offer convincing explanations, based on a sound theoretical framework, to this issue concerning the dominance and persistence of the use of (inefficient) traditional procurement routes in construction projects.

Construction management delivery methods

Separating design from construction, in terms of responsibilities and risks, was not a serious concern while buildings were relatively simple. However, technical revolutions after the Second World War created more demanding systems (e.g. HVAC, elevators and curtain walls) that required architects and engineers to manage and coordinate their efforts with the construction team (Garrison, 2013). This led to the development of a variety of newer project delivery methods to address this problem. The first of these was the Construction Management (CM) procurement method which was introduced in the 1960s as an antidote to the problems resulting from the separated delivery approach (Kent and Becerik-Gerber, 2010). According to Oyegoke *et al.* (2009), CM fully developed in the UK in the 1970s due to the economic recession at that time; where CM has been used since then as a driver to achieving value for money for owners.

Nevertheless, the use of CM has not overcome the underlying problem of fragmented project teams and information (Kent and Becerik-Gerber, 2010). For instance, within the CM delivery method, the owner often selects his preferred trade contractors and makes decisions in isolation from the construction manager, leading to inefficiencies and disputes (Ancell, 2005). Thus, this reason, amongst others, led to the rise of more collaborative and integrated forms of project delivery such as 'design and build' and 'partnering'.

Design and Build delivery methods

Contrary to Taylor's approach which led to sub-optimisation, Edwards Deming argued through his 'systems thinking' approach that if we wanted to achieve better results, we would then have to work on the entire process as a system; this obviously requires collaboration between project-parties (Seddon and Caulkin, 2007; Garrison, 2013). Deming's arguments, which started during the 1950s, led to great achievements in the manufacturing industry; but had little effect on the construction industry. According to Seddon and Caulkin (2007), the Toyota Production System (TPS) created by Ohno is the most remarkably successful example of systems thinking applied to business organization. It was not until the 1990s when design-build (DB) was developed in the US (Kent and Becerik-Gerber, 2010) as a collaborative way of project delivery. It then gained popularity all over the world. DB is characterised in its conventional form by its design and construction integration, single point responsibility and guaranteed maximum price (Griffith and King, 2003). Its primary benefits include improved build-ability of the design and thus fewer claims and disputes, more cost certainty and less risk for the client, and time savings (Love *et al.*, 1998; Al-Rashid and Kartam, 2005; Opisova and Eriksson, 2011). DB was, and probably still remains, subject to significant challenges associated with its use in the public sector. This stems from concerns about the subjective and negotiated manner of justifying the evaluation process to the public (Al-Rashid and Kartam, 2005). There have also been concerns about the sheer expense of complying with the tender and prequalification procedures associated with its use (Hughes *et al.*, 2001). However, DB is one of three procurement options approved by the Office of Government Commerce (OGC, 2008) for use among public sector departments. The OGC is an independent office of the HM treasury, which was set up

by the UK Government for improving value for money. It provides guidance and policy standards on procurement best practice in the UK, and since 2010 became part of the 'Cabinet Office' efficiency and reform group.

A procurement survey undertaken by the Royal Institution of British Architects (RIBA, 2013) among its members, revealed that although traditional contractual arrangements remain the most prevalent form of procurement used by 86% of architects' practices that responded to the survey, DB forms of procurement have grown in popularity, with 40% of responding practices indicating that they use both one stage and two stage tendering procedures. It is important however to clarify that the UK recognises several variations of DB (Konchar, 1997). In traditional DB, the contracting firm would utilise in-house design capabilities or seek outside design assistance. This approach would not differ much from separated procurement methods, if the design work is subcontracted out to external consultants with little or no follow up (Sarhan and Fox, 2012). In architect novation arrangements, once the initial project information is developed by the client's consultant (e.g. the architect) and the contractor gets selected; then from this point, the employed architect becomes novated or assigned to the selected contractor to complete the post-contract design work (Kochar, 1997; Griffith and King, 2003). However, a study by Griffith and King (2003), which adopted a grounded theory methodology to examine the dynamics of DB novation, identified various imperfect practices and arrangements that exist within this novated approach, and can lead to detrimental project outcomes. These included for example: the no-scheme-no-fee basis payment systems for pre-novated architects, dual loyalties on architects' post-contract design and communication routes, biased contractor-selection decisions, and increased contingencies in contractors' bids as a result of unfair risk allocation. Thus, they concluded by suggesting that despite the advantages of DB novation and its growing popularity, it could create considerable fragmentation and value-loss in what is supposed to be an integrated procurement approach. Thus, DB novation was regarded by them as an imperfect solution to overcoming problems associated with the use of separated procurement methods.

Partnering arrangements

Partnering and framework agreements, based upon the concepts of teamwork, integrated teams and collaborative working arrangements, became more prominent in the UK during the late 1990s and early 2000s (Oyegoke *et al.*, 2009). Partnering, in particular, was endorsed by the Egan's Report (1998) that was heavily influenced by the principles of lean production (see Womack and Jones, 1996). This led to a major shift in the nature of the relationship between clients and their supply-chain. For instance, parties working under a partnering arrangement commit themselves to more openness and transparency, in working as a one team, from the forefront of the project. This is supported by the use of alternative (non-adversarial) dispute resolution mechanisms (Mante *et al.*, 2012). The selection of architects and consultants for the supply of design services, based on direct negotiation rather than competitive tendering, implied longer and repeated relationships (Winch, 2000b). The main difference between partnering arrangements and D&B is that clients play a more active role in the procurement and delivery of the project. Clients and key project team members are brought together under a single multi-party contract; this can help to reduce transaction costs through eliminating the need for clients to sign different bilateral contracts. Partnering projects are delivered based on shared risk and reward mechanisms, thereby increasing the motivation for innovation and collaboration between project team members. Indeed, the whole concept behind this collaborative way of working is to align everybody in the project's best interest, as opposed to the silo individual interest of traditional procurement arrangements. In other words, it could be regarded as a move away from a transactional-based procurement to a relational-based procurement.

The industry has seen, in the early 2000s, an increasing number of leading Tier-1 contractors professing that most of their work was being delivered through partnering arrangements. However, there was no real evidence that this actually included an improvement in relationships and behaviours. For this reason, a study by Greenwood (2001) was conducted during that time to investigate whether there have been any real change in attitude of main contractors to their subcontractors and suppliers through the use of partnering. Interestingly, the results of the study revealed that typical contractor – subcontractor relationships remained traditional, cost-driven, and relatively adversarial. In general, the benefits and challenges associated with partnering implementation have

been well documented (see for example, Bresnen and Marshall, 2000; Eriksson et al., 2009). It comes with its own problems, costs and risks. The UK Government, being one of the main advocates of the relational agenda and partnering gradually retracted from the partnering agenda. However, framework arrangements became the more desirable collaborative approach for public sector procurement, and they are still being used by some of the major players like the NHS and Highway England. As a result, the UK industry has seen partnering agreements losing its momentum and going back to lowest price tendering (Walthamstow *et al.*, 2009), especially during the recession period between 2008 and 2009. This fact seems to support the findings of Greenwood's (2001) empirical study, which argued that some main contractors were adopting sub-contractor partnering approaches mainly for mere-ceremony purposes (Meyer and Rowan, 1977), rather than being based on efficiency incentives.

2.5.2 Construction procurement subsystems and options

Procurement subsystems or/and procedures are identical terms that are commonly used in literature. Previous studies have integrated specific procurement sub-systems to their hierarchy of procurement systems, when investigating the relationship between procurement systems, project parameters, and certain aspects of project-performance such as: time, cost, quality, work environment, and innovation (Kumaraswamy and Dissanayaka, 1998; Love, 2002; Eriksson and Laan, 2007; Eriksson and Westerberg, 2011). For example, the main procurement sub-systems conceptualised by Kumaraswamy and Dissanayaka (1998) are: work packages; functional groupings (i.e. separated, integrated and management-led); payment modalities; standard sets of contract forms or conditions; and selection methodologies. Similarly, Watermeyer (2012) suggested that procurement and contracting arrangements comprise: procurement selection strategy; procurement evaluation strategy; contracting strategy (functional groupings); pricing strategy; and form of contract.

In a conceptual study by Eriksson and Westerberg (2011) which developed a hypothetical procurement framework that examines how various procurement-related factors affect project performance criteria, procurement procedures at the buying stage

were divided into three categories according to their relation to: competition, co-opetition and cooperation. These procurement procedures consisted of: design; tendering; bid evaluation, subcontractor selection; payment; use of collaborative tools; and performance evaluation. Thus, for instance, subcontractors' selection-decisions made by either the contractor or the client would be related to competitive procurement procedures; joint selection with single responsibility would be a co-opetitive procedure; while joint selection with shared responsibilities would be regarded as cooperative.

Very limited studies in construction management have explicitly considered and integrated, as part of their hierarchy of procurement systems, other critical procurement subsystems such as: insurance arrangements, bonds, collateral warranties, and alternative dispute resolution mechanisms, despite their significant importance and influence on project-teamwork performance. Building on the work of Wordley (1991); Kumaraswamy and Dissanayaka (1998), Love *et al.* (1998); Hughes *et al.* (2000); Sherif and kaka (2003); Eriksson and Laan (2007); Ghassemi and Becerik-Gerber (2011); Masterman (2011), Eriksson and Westerberg (2011); Mante *et al.* (2012); Ndekugri *et al.* (2013); and Pasquire *et al.*, (2015), Table 2.3 provides the major options available within procurement sub-systems, as conceptualised within this study.

There is no doubt that the deployment of efficient procurement arrangements (i.e. procurement systems, sub-systems and options) may increase the likelihoods of 'project success' and overall client satisfaction in a particular project context (Kumaraswamy and Dissanayak, 1998). However, in order to optimise the whole, it is important to consider the influence of the interactions between the sub-systems on the output of the main procurement system (Kumaraswamy and Dissanayak, 1998). It is also critical to ensure the compatibility of the chosen procurement options from within each sub-system with the selected project delivery system, client and project needs, and other contextual conditions that bear on the project (Kumaraswamy and Dissanayak, 1998). For instance, it may be unsuitable to choose a cost-reimbursement pricing option for a traditionally procured project (Love *et al.*, 1998). Similarly, it would be inefficient to adapt a bid evaluation strategy based on lowest tender price for the selection of project team members of a partnering project (Eriksson *et al.*, 2008). Thus, it is suggested that

procurement arrangements should be crafted to support production system requirements and improve flow processes, rather than being based on cost and risk-averse considerations that may lead to sub-optimisation. The premise here is based on 'optimising the whole' rather than 'optimising the parts'.

Based on these arguments, it is thus ironic how that an empirical survey (Zaghloul and Hartman, 2003), that was conducted in the Canadian and the United States construction industries, revealed that inappropriate risk allocation through disclaimer (exculpatory) clauses in contracts is still the general traditional practice in the construction industry; and that their use is prevalent to an extent that they continue to be utilized in some of the newer contractual agreements such as partnering/alliances. Similarly, it is of interest how that clients of many projects that have been procured using an integrated project delivery (IPD) or a Building Information Management (BIM-enabled) system still rely on the use of performance/surety bonds and traditional insurance arrangements, despite the latter in particular being identified by many academics and leading industry professionals as one of the main obstacles for the adoption of IPD to its full capacity (for example see, Kent, and Becerik-Gerber, 2010; Ghassemi and Becerik-Gerber, 2011; Eadie *et al.*, 2014). That is because it was found that traditional insurance products impose liability issues on each project-party separately and thus make collaboration complicated. The same has been asserted by expert construction professionals in the UK who suggested that conventional arrangements for providing insurance cover add unnecessary costs to constructions projects, and can also obstruct collaboration between supply chains (Ndekugri *et al.*, 2013). According to Mossman *et al.* (2010, p. 11)

"If each party to a relational agreement is required to have its own insurance and there is a claim during design or construction, an insurance company could force parties to sue one another in order to trigger insurance coverage, threatening relationships".

These examples suggest the existence of serious disparities in bargaining-power within the construction market place; this in turn allows actors with bargaining-power, and who may have vested interests for the wide-spread use of some imperfect procurement

arrangements, to dictate the rules of the game - the way we do business (Sarhan *et al.*, 2017). Winch (2000a) suggested a number of different factors, yet often working in combination, which could allow some actors in a business system to become relatively powerful compared to others. These were identified by him as those possessing the following capabilities:

- *Ability to solve complex problems for the client* - e.g. the traditional role of the architect and the consultant engineer in the British system which provides them with the privilege to solve complex problems for the client through the briefing process.
- *The blessing of the state (e.g. statutory protection)* - For instance, in many countries (e.g. France and Germany) only the architect can apply for building permissions.
- *Ability to manage risk for the client* - This includes control actors, such as the quantity surveyor, in the UK, whose role was developed to mediate the power of the general contractor on behalf of the client.

2.5.3 The significance of procurement as institutional arrangements

Construction business systems are regarded as institutions (Winch, 2000a&b; Sha, 2004) that are created in countries to specify ‘*the rules of the game*’, and regulate the relations and interactions between the different parties involved in the industry. The evolution of these business systems are path dependent and also heavily reliant on the cultural and regulative context within each country (Sha, 2004; Matos-Castano *et al.*, 2014). In other words, the national context leads to the formation of specific business systems, which in turn influence the orientation, strategies and performance of individual firms in nationally distinctive ways (Winch, 2000a). Similarly, this study argues that procurement systems, as institutional arrangements, are designed to assign liabilities and authorities to people and organizations (Love *et al.*, 1998) at the programme and project levels; and thus structure the boarders that shape ‘*the play of the game*’ (Williamson, 2000). Inappropriate procurement arrangements may lead to time and cost overruns, adversarial relationships between project parties, and ultimately the failure of projects (see Kumaraswamy and Dissanayaka, 1998; Mante *et al.*, 2012; Watermeyer, 2012; Sarhan *et al.*, 2017). Thus, there is a wide agreement among scholars and many clients on the fact that getting the construction procurement context right is central to project success (see for example, Latham, 1994; Love *et al.*, 1998;

Tookey *et al.*, 2001; Eriksson and Laan, 2007; Oyegoke *et al.*, 2009, Osipova and Eriksson, 2011; Vilasini *et al.*, 2011; Pekuri *et al.*, 2014; Sarhan *et al.*, 2017).

The construction industry has been subject to substantial criticism for its opportunistic relationships, with conflicts and disputes, and lack of trust, collaboration and customer focus often cited as significant amongst its various shortcomings (Egan; 1998; Rooke *et al.*, 2003; Eriksson and Laan, 2007; Love *et al.*, 2010). Hence, traditional procurement arrangements (e.g. separated methods) are potential root causes for the opportunism and lack of cooperation that characterise many construction projects (Eriksson and Laan, 2007; Osipova and Eriksson, 2011), the industry has been urged to start using new and less familiar procurement systems (e.g. partnering, alliancing and IPD) that are believed to be capable of enhancing collaboration, commitment and trust between project parties (Egan, 1998; Rahman and Kumrasawy, 2004; Eriksson and Westerberg, 2011; Zimina *et al.*, 2012; Ballard and Tommelein, 2012).

However, despite the strong advocacy for the use of partnering and of the potential benefits that it could attain, its implementation in the construction industry generally remains patchy rather than widespread (Phua, 2006; Eriksson *et al.*, 2008; Challender *et al.*, 2017; Hosseini *et al.*, 2018). The same applies to other innovative delivery approaches such as the integrated project delivery (IPD) system (Kent and Becerik-Gerber, 2010; Rowlinson, 2017). This leads to the rise of the question as to why traditional procurement arrangements remain very prevalent in the construction industry (RICS, 2004; CIOB, 2010; RIBA, 2013), and have not, yet, been replaced by collaborative/relation-based procurement arrangements (e.g. partnering, alliancing and IPD) that are thought to be more efficient. Even when partnering is utilised, the relationship between contractors and subcontractors is often seen as ‘*mere ceremony*’ (Meyer and Rowan, 1977), and instead aimed at signalling legitimacy to key observers (Greenwood, 2001). Thus, the question raised, in relation to reasons for the prevalence of traditional procurement practices, is fundamental; that is because it supports the current and substantial trends towards promoting collaborative ways of working as a means for improving project performance and outcomes (See for example Dainty and Brooke, 2004; Eriksson *et al.*, 2008; Xue *et al.*, 2010; Sebastian, 2011; Zimina *et al.*,

2012; Gottlieb and Haugbølle., 2013; Namadi *et al.*, 2017; Daniel *et al.*, 2017; Walker *et al.*, 2017).

An empirical survey study of 87 professional construction clients in Sweden was conducted by Eriksson *et al.*, (2008) to identify the critical barriers to partnering; and to analyse the correlations between clients' perceptions of these barriers, and their actual behaviour in the form of procurement procedures. The study found that the clients' desired objective of increasing cooperation between project parties does not affect the way they deploy their procurement procedures. Clients perceive partnering and cooperative arrangements to be significant and beneficial, but still heavily rely on the use of procurement procedures that foster competition and adversarial relationships. The authors offered two possible explanations for this contradiction between desires and actual decisions and actions. First, that clients may not be aware of how their procurement decisions and procedures can affect their likelihoods of creating a cooperative environment (Eriksson *et al.*, 2008), and thus impact on project performance and outcomes. Secondly, that clients may not be incentivised enough to adapt less familiar procurement arrangements that are potentially more efficient than conventional approaches (Eriksson *et al.*, 2008).

This lack of incentive for the use of partnering in particular and other collaborative modalities in general (e.g. lean construction) has been attributed by scholars to several factors such as: inadequate awareness and understanding (Eriksson *et al.*, 2008; Sarhan *et al.*, 2013; Tezel *et al.*, 2018), lack of top management commitment (Sarhan and Fox, 2013), and the fact that the construction industry operates in a very competitively cost-driven environment (Bresnen and Marshall, 2000). This issue could also be linked to the phenomena described by Bresnen and Haslam (1991) as "habituation", which occurs as experienced clients establish a 'close-minded' approach to building, thereby merely utilizing those procurement procedures that are most familiar to them (Love *et al.*, 1998). Additionally, it could be argued that many clients conform to conventional procurement procedures, due to institutional pressure (DiMaggio and Powell, 1983). Most construction clients are inexperienced or one-off procurers of construction projects (Love *et al.*, 2010); and as such, they invariably rely on professional advice from

consultants, financiers and legal advisers. These professional advisers may have a vested interest (i.e. social and/or economic motivations) for the wide-spread use of specific procurement arrangements that may be inefficient in comparison to other newer alternatives.

Apart from purely economic-based determinants, very few studies in the construction management literature have been conducted to investigate the role played by institutional determinants in predicting the establishment of project-organisational arrangements, of which partnering as a collaborative procurement system is one. To fill this gap, Phua (2006) carried out a survey study completed by 526 firms covering various industry disciplines in Hong Kong, in order to shed some empirical light on the reason for the apparent limited use of partnering arrangements in the construction industry. More specifically, the study focussed on investigating whether using an institutional framework could help to provide some useful explanations as to when partnering is likely to occur. Compellingly, the findings have shown that '*institutional forces*' far outweigh the significance of '*economic forces*' in determining whether or not firms will adopt partnering. It was found that none of the financial incentives in terms of increased profitability, competitiveness or likelihood of increased resource acquisition and reallocation had any significant impact on firms' decisions to adopt partnering at all. Instead, the results showed that the majority of construction firms have not adopted partnering as an alternative to traditional procurement methods, due to the lack of strong institutional partnering norms in the industry. According to Phua (2006, p.622):

"Because the benefits or more precisely the economic and management advantages that firms could gain from using partnering are still debatable and difficult to measure, there is no a priori reason to expect firms to favour its use over other procurement methods other than the fact that there are obvious institutional norms that propel firms to use it".

The premise of institutional theory (as presented in section 2.4) is that individual (i.e. persons) and collective (i.e. organisations) social actors are expected to comply with institutional forces imposed on them, because those that conform 'are rewarded through increased legitimacy, resources, and survival capabilities' (Scott, 1987, p. 498). When

the same institutional forces continue to exist over time, firms within relatively circumscribed fields that are bounded by shared understandings and mutual dependence (Scott, 2012) become more homogenous (DiMaggio and Powell, 1983); and thus a dominant organisational arrangement, or 'proto-institution' (Lawrence *et al.*, 2002), is likely to occur (Phua, 2006). Thus, as a corollary, it is argued that the extent to which actors are inclined to the use of imperfect procurement arrangements (e.g. traditional procurement systems), that are deemed to be inefficient in comparison to other more innovative and collaborative approaches, is a function of how deeply entrenched the institutional environment is with respect to rules, technologies, norms, beliefs and expectations that are associated with the concerned practices.

Having explored literature pertaining to the construction procurement context, defined what the study means by a construction procurement arrangement (system, subsystems and options within each sub-system), and highlighted the significance of conceptualising construction procurement as institutional arrangements; the focus now shifts to introducing an outline of the concept of 'institutional waste' in construction.

2.6 The Concept of Institutional Waste within Construction: An outline

Based on the rationale provided by the study—that there are systems, structural arrangements and cognitive undergirding assumptions that support and encourage wasteful activities in construction (refer to Chapter 1, for background details)—and building on the seminal studies of DiMaggio and Powell's (1983) institutional isomorphism, Scott's (2001) three pillars of institutionalism, and Oliver's (1991) topology of strategic responses; this study conceptualises '*institutional waste*' as:

‘the regulative, normative and cultural-cognitive institutions that the construction industry, as an organisational field, accedes to in the form of habitual, imitation or compliance, in order to achieve legitimacy, security and/or survival at the price of production efficiency and effectiveness’.

Effectiveness refers to the extent to which a right target is achieved with resources applied (i.e. value and client satisfaction). *Efficiency* is the evaluation of how economically the resources are utilised to meet client requirements, based on production

flow perspectives (Koskela, 2000). By *habitual*, here, the study means: adhering to invisible, widely shared and taken for granted norms that have been historically repeated; by *imitation*: consciously or unconsciously mimicking what other more successful organisations do and strictly following imperfect advice from consulting firms and professional institutions; and by *compliance*: obeying imperfect institutional requirements. This could include imposing more control in contracts and structural arrangements, for example, as a response to problems of a lack of trust. To elaborate and demonstrate the conceptualisation of ‘institutional waste’ within the context of construction, the following preliminary conceptual model (Figure 2.4) and guiding propositions have been formulated.

Proposition 1: *The higher the degree of social legitimacy, stability, and/or survival capability conceived by social actors, to be attainable from acquiescence to imperfect institutional pressure, the greater the likelihood of waste to be institutionalised within construction.*

An example of institutional waste (or institutional sources of waste) could be the adherence of the construction industry to using short time-frame and price-competitive tendering processes, as a widely shared and taken for granted practice, despite it being associated with many flawed risk assumptions and criticised cost estimations (Laryea, 2011). Adding to this, is the use of extensive, time consuming and unnecessarily expensive prequalification procedures (Hughes *et al.*, 2001) in public projects, e.g. questionnaires (PQQ), that may lead to wasteful activities such as cover-pricing. In particular, the use of PQQs for procuring projects below the European Union threshold (approximately £100,000) restrains many SMEs from applying for public contracts (i.e. waste of human potential) and substantially increases tendering costs and time (HM Government, 2013). This also includes the textual complexity and unnecessary formality in contract wordings of some contract conditions (i.e. FIDIC, 1999 and NEC, 1993) that are very difficult to read, and require at least college-level reading skills to correctly interpret them (Rameezdeen and Rajapakse, 2007; Rameezdeen and Rodrigo, 2013). It is important to emphasise here that lawyers and specialist surveyors are not the primary users of a contract; it is the project

parties' ability to capture their meaning which is fundamental for contract performance (Rameezdeen and Rodrigo, 2013).

Proposition 2: *The higher the degree of financial benefit, protection and guarantee, and/or vested interest rationalised by social actors, to be attainable from conformance to imperfect institutional processes, the greater the likelihood of waste to be institutionalised within construction.*

Examples of institutional waste include the heavily reliance of construction parties on the deep-rooted practice of using standard forms of contracts (Eriksson and Laan, 2007) as safeguards. The heavy reliance on the use of these standard contracts bring with it lots of formality and rigidity that stifles cooperation and focuses on the individual parties and their responsibilities; thereby driving a distance between project parties and encouraging opportunistic behaviour (Cox and Thompson, 1997; Eriksson et al. 2008). Other examples include the traditional use of disclaimer (exculpatory) clauses in construction contracts (Zaghloul and Hartman, 2003). This unfair risk allocation approach leads to increased costs of projects in the form of unnecessary contingencies and insurances (i.e. cost wastage), restricted bid-competitions (i.e. waste of human potential), and potential disputes (i.e. time waste). Similar imperfect procurement arrangements include the use of high rates of cash retentions on short contracts (Hughes *et al.*, 2000); and requirements for performance bonds that are often disproportionate and may restrict SMEs aiming to bid for public contracts (HM Government, 2013). More obvious examples include architects' and quantity surveyors' biased preferences for the use of traditional lump-sum procurement systems with provisional quantities (Love *et al.*, 1998).

Proposition 3: *The higher the degree of dependency of social actors on imperfect institutional processes, the greater the likelihood of waste to be institutionalised within construction.*

An example of institutional waste in construction could be associated with how many organisations depend on obtaining their funding through bank loans, and as a result may pay more attention to their funders' requirements rather than their customers' needs (Chiang and Cheng, 2010). Another example could be

clients' over-reliance on conventional insurance arrangements which add unnecessary costs to constructions projects and can also obstruct collaboration between supply chains (Ndekugri *et al.*, 2013). This could also be associated with the way that clients' advisors often set the 'rules of the game' (i.e. procurement type and construction periods stated in tenders) and then everyone else has to work within these rules, which could sometimes be dysfunctional. This problem is often a result of discrepancies in bargaining power that exist among major players in the industry and within project coalitions (Winch, 2000a).

Proposition 4: *The higher the degree of consistency of organisational goals and purposes with imperfect institutional pressures and norms, the greater the likelihood of waste to be institutionalised within construction.*

It is *not* unusual for construction organisations, because of competitive pressure, to rely on making their profits solely through commercial processes and manipulating roles with others, rather than struggling to improve production efficiency (Zimina and Pasquire, 2011b). Thus, the dependence of making profits in construction through commercial activities rather than production improvement, could be classified as an example of institutional waste. As an interviewee in a study by Chiang and Cheng (2010) commented, contractors could only make profits, in this highly price-competitive industry, if they concentrated their efforts on three issues: (1) procurement of building materials; (2) cash flow management with their downstream supply chain; (3) planning for and application of claims. Thus, this suggests that it is important, for further studies, to identify clients' and construction organisations' characteristics, strategies and tactics, that make them more or less obedient to imperfect institutional processes.

Proposition 5: *The higher the degree of voluntary diffusion of imperfect institutional rules, routines or norms, the greater the likelihood of waste to be institutionalised within construction.*

This proposition is mainly associated with mimetic institutional waste. An example could be the (inefficient) norms, job duties and responsibilities diffused by professional institutions and trade associations, with which its members are requested to conform. In such cases of very widely taken-for-granted understandings of what constitute genuine practices, it is highly likely that practitioners will conform because it does not occur to them to do otherwise (Oliver, 1991). Labour/trade unions are also powerful actors that influence the culture in the construction industry. They were identified in an empirical study by Eriksson *et al.* (2008) as industry barriers to change in general, and increased cooperation in specific, due to their conservative and defensive culture that encourages upholding of the status quo. An example of imperfect institutional pressure diffused by trade unions, as identified by Eriksson *et al.* (2008), was their requirement for fixed piece rates, regardless of time, for blue-collar workers, which in turn undermined collaboration between different crafts. Another example of mimetic institutional waste could be associated with how decision makers tend to simply copy what others have thought to work for them (e.g. traditional procurement methods or critical-path planning technique which is described by Koskela *et al.* (2014) as a push-system technique); thereby restricting innovation.

Proposition 6: *The higher the degree of environmental uncertainty, the greater the likelihood of waste to be institutionalised within construction.*

Environmental uncertainty in the construction industry can include, for e.g., fluctuations in the state of the economy comprised of factors such as inflation, changes to government macroeconomic policies and periods of instability of funding. Under such conditions, it is more likely for organisations to adhere to imperfect institutional regulations, norms & requirements imposed on them by governmental management, funders, professional association and public media pressure for the sake of survival, legitimacy, and protection from environmental turbulence (Oliver, 1991).

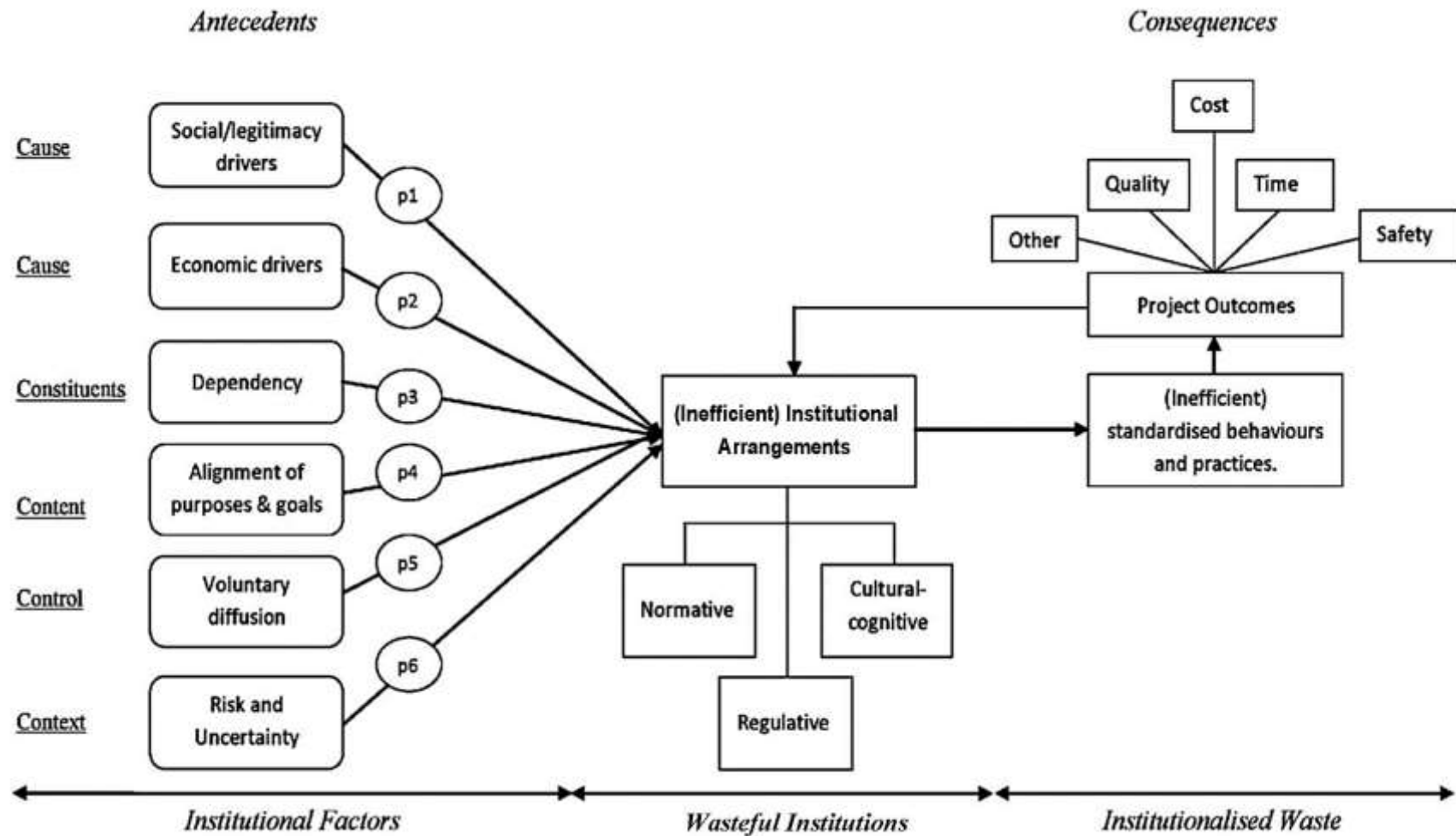


Figure 2.4: Preliminary conceptual model for the study

2.7 Summary of Chapter

This chapter provided a theoretical context for the study. It started by critically reviewing the ‘concept of waste’ in construction’. An overall analysis of waste-related literature revealed five main issues: (1) research efforts aimed at understanding the concept of ‘waste’ are relatively limited when compared to other topics in construction; (2) most academic and industry efforts are directed towards finding means for reducing construction material waste (physical waste); much less attention has been given to other important factors such as time waste and value-loss; (3) Focusing on waste reduction in production (design and construction stage) is insufficient; there is a need to minimise waste caused by poor project-organisational and contractual arrangements as well; (4) very few studies have attempted to investigate the relationship between construction procurement and waste in construction; however, most of these studies, if not all, have limited their attention to physical (material) waste as opposed to process waste and value creation or loss; and (5) very limited, if any, waste-related studies have devoted attention to exploring performance-shaping mechanisms (i.e. systems and structural arrangements), as well as the institutional context in which human actions and decisions are constituted.

Consequently, it was argued that there is a crucial need for obtaining a wider understanding and conceptualization of waste in construction. One aspect of this conceptualisation is to consider the wider institutional, procurement and commercial environments that surround the design and delivery of construction projects. The understanding of waste or value-loss within these aforementioned environments is, however, more difficult to determine not least because it requires a critical evaluation of the activities of different professions, for example lawyers, accountants, human resource managers, quantity surveyors to name a few. These environments and the professions within them also exhibit varying cultures, structures, systems and behaviours. Such an evaluation also needs to draw upon theory from disciplines outside both construction and manufacturing such as economics and sociology if it is to begin to explain the coherence and yet wastefulness of the current prevailing approaches to construction project delivery.

For these reasons, two principal theories were reviewed and conceptually analysed within this chapter (i.e. TC theory of economics and neo-institutional theory of organisational sociology), in order to seek explanations for the establishment, process and outcomes of several forms of institutional arrangements. This allowed the study to: (1) develop a conceptualisation of construction procurement governance problems and solutions; and (2) demonstrate how neo-institutional theory has the potential to be used as an analytical lens to deliver a more explicit theory of waste relating cause and effect within the wider aspects of construction procurement systems and relationships. Subsequently, an overview of literature pertaining to the construction procurement context was conducted. This enabled the study to define the major constituents of a construction procurement arrangement (system, subsystems and options within each sub-system), and highlight the significance of conceptualising construction procurement arrangements as ‘institutional arrangements’ (rules of the game) that may influence project-performance and outcomes.

As a result, these research steps and findings summarised above enabled the study to outline the concept of ‘institutional waste’ in construction. In addition, six (guiding) propositions were formulated and a preliminary conceptual model was developed, in order to provide focus for the research and to guide the researcher during data collection, whilst leaving the scope open for the generation of unintended findings or even new hypotheses. The next chapter (Chapter 3) will critically discuss the research philosophy and methodology underpinning this study, including a detailed explanation of the research methods and procedures used for data collection and analysis.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

A research methodology is much more than just fitting research methods to a particular study. Indeed, research methods cannot be viewed in isolation of the rationale and philosophical assumptions that underlie the study – the epistemological and ontological positions adopted by the researcher (Dainty, 2008; Creswell, 2009). 'Ontology' is concerned with what constitutes reality (Scotland, 2012), while the term 'Epistemology' refers to what should be considered as acceptable knowledge (Knight and Turnbull, 2008). 'Methodology' could be defined as the strategy which underlies the choice and use of particular methods (Crotty, 1998). 'Methods' are the specific techniques, tools and procedures used to collect and analyse 'qualitative or quantitative' data (Spencer, 2012). Figure 3.1 provides a summary of the four main components of a research paradigm. It is of vital importance for researchers to understand the impact that alternative research paradigms may have on their contribution to knowledge, and the way the research is going to be designed and conducted (Dainty, 2008). Therefore, the aim of this chapter is to explain and justify the research philosophy, methodology and methods adopted for this study.

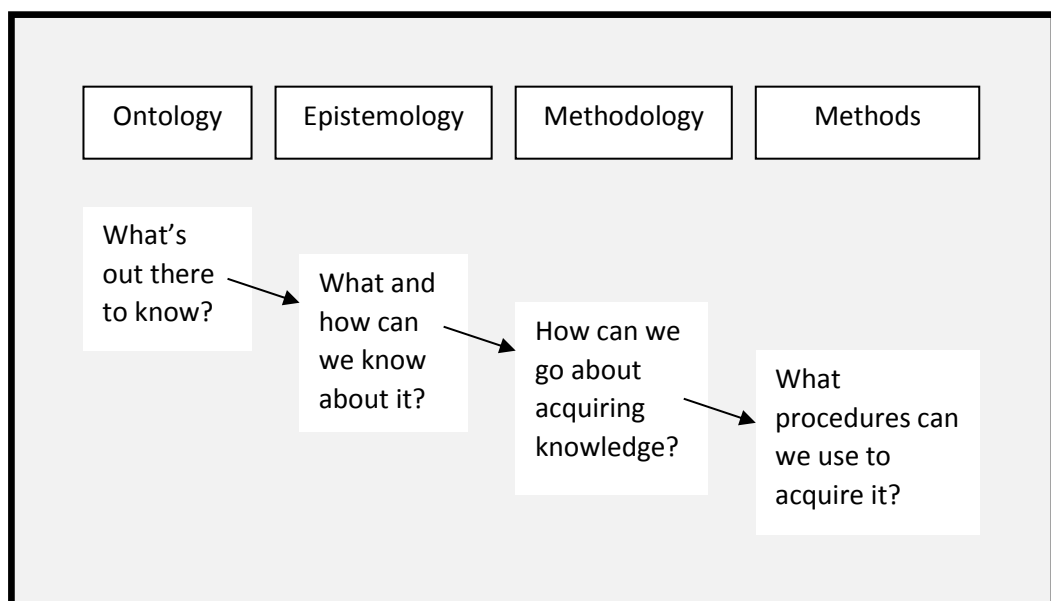


Figure 3.1: Components of a Research Paradigm [Adapted from Hay (2002)]

3.2 Research Philosophy

Researchers need to take a stance regarding their philosophical assumptions and perceptions of reality (ontology), how they know something (epistemology). Their ontological and epistemological assumptions create a holistic view of how they view knowledge, how they see themselves in relation to this knowledge, and the methodological strategies they use to discover or construct it (Guba, 1990). It is essential for researchers to ensure that their methodology and combination of methods are consistent with the theoretical perspective that they chose to take (Crotty, 1998). Thus, research philosophies need to be identified and discussed, as they set the context for the research study (Ponterotto, 2005), and enable us to recognize others' positions and defend our own contribution to knowledge (Knight and Turnbull, 2008).

3.2.1 Ontology

The philosophical term 'Ontology' generally refers to the nature and conceptions of reality or what exists (Runeson and Skitmore, 2008). Knight and Turnbull (2008, p.64) state that ontology is "*concerned with existence or being and what we assume to exist clearly has implications for what we claim to know, and vice versa*". In other words, ontological assumptions are concerned with what constitutes reality (Scotland, 2012). According to Dainty (2008), discussions of social ontology mainly revolve around whether social entities should be regarded as 'objective realities' that exist independently of social actors, or 'social constructions' where reality is subjective and only exists in our minds as a construct, and thus is subject to constant revision depending on who views it. These two perceptions generally fall into the two following positions: 'Objectivism or Realism' and the 'Constructivism or Relativism' position. 'Objectivism' is the view that social phenomena and their meanings have an existence that is independent of social actors (Bryman, 2012). It claims that reality exists independently of the researcher, and thus requires 'discovery' using appropriate means (Scotland, 2012). On contrast, 'Constructivism' is the view that social phenomena are 'constructed' by the social actors concerned with their existence (Bryman, 2012). Thus, it assumes that there is no single reality or truth.

The term 'Constructivism' is used interchangeably with 'Social Constructionism'. According to Andrews (2012), the two philosophical terms tend to be subsumed under the generic term 'constructivism' particularly by Charmaz (2000, 2006). They do share a common heritage, but they saliently differ on whether construction of knowledge is an individual cognitive or a social process (Young and Collin, 2004; Andrews, 2012). Social Constructionism, however, makes no ontological claims, restricting itself to the social construction of knowledge, and thus confining itself to epistemological arguments only. This study takes a stance more close to 'Constructivism' which views society as existing both as objective and subjective reality. The subjective view of society is based on the concept of multiple realities (Crotty, 1988). However the objective view of reality is influenced by Berger and Luckmann (1991) ideas related to the nature and construction of knowledge. Their view of society as 'subjective and objective reality' is described by Andrews (2012, p.41) in a simple way, as follows:

"The former is brought about through the interaction of people with the social world, with this social world in turn influencing people resulting in routinisation and habitualization. That is, any frequently repeated action becomes cast into a pattern, which can be reproduced without much effort. This frees people to engage in innovation rather than starting everything anew. In time, the meaning of the habitualization becomes embedded as routines, forming a general store of knowledge. This is institutionalised by society to the extent that future generations experience this type of knowledge as objective".

The ontological term 'Constructivism' is also commonly associated with the term 'Subjectivism'. However, it is argued that a 'Subjectivism' perspective presents a complete denial of any objective reality, while 'Constructivism' portrays that social actors try to make sense of the situation they are in, and therefore construct or create their own subjective representations of objective reality. Gray (2009, p. 18) describes this as follows:

"In contrast to constructivism, for subjectivism, meaning does not emerge from the interplay between the subject and the outside world, but is imposed on the object by the subject. Subjects do construct meaning, but do so from within"

3.2.2 Epistemology

The term 'Epistemology' refers to what should be considered as acceptable knowledge (Dainty, 2008). It is mainly concerned with theories which attempt to provide answers to questions surrounding the nature of knowledge, its limits and how we attain it (Knight and Turnbull, 2008). In other words, epistemology refers to a person's view of social reality, what can be known about, and how it can be acquired reliably (Loosemore, 1999; Hay, 2002). Researchers must specify their epistemological stances, as it clarifies whether their aim is to test or generate theory (Loosemore, 1999). Additionally, their epistemological view influenced by the ontological assumptions, will frame their knowledge-seeking approach. For example, if the researchers believe that knowledge is governed by laws of nature, they will take an objective approach to measure and discover reality. However, if they believe that there is no single reality or truth and that reality needs to be interpreted, they will interact with what they are researching in order to explore the underlying meanings of social activities.

Knight and Turnbull (2008) specify two dominant traditions of epistemology: the 'normative tradition' and the 'naturalistic tradition'. According to them, the naturalistic tradition is associated with positivism, while the normative tradition is associated with foundationalism or coherentism. In construction management research, epistemological perspectives are generally expressed in relation to 'positivism' and 'interpretivism' (Dainty, 2008; Runeson and Skitmore, 2008). 'Positivism' is an objective approach which directly applies methods of natural science to studies of social phenomena, independently of the knower and his perspective (Denscombe, 2010). It is often referred to as quantitative research (Runeson and Skitmore, 2008). The researcher in such case is considered an 'outsider' (Creswell, 2012). In positivist research, theory is the source of hypotheses and propositions, which are then tested using empirical data (Schweber, 2015). According to Skitmore (1999, p. 10)

“Those adopting a positivist stance see reality as an inert amalgam of facts which can be released by the right methodology. They believe that there is one best methodology to do this and their aim is to get as close to it as possible. Their structured view of the world creates a belief that theories can be tested

with complete certainty. That is, the assumption is that all intervening variables can be controlled”.

On the contrary, 'interpretivism' stresses the importance of understanding and considering the subjective influence on findings related to social processes (Dainty, 2008). Interpretivists avoid rigid methodological frameworks as they believe that reality is multiple and relative. According to them, objective reality should be seen in a subjective way. The researcher, therefore, needs to interact with the object of investigation as an 'insider' (Creswell, 2012), so as to explore underlying motives, meanings, reasons and social experiences (Hudson and Ozanne, 1988) through constant dialogue and interpretation (Ponterotto, 2005). It is often referred to as qualitative research (Runeson and Skitmore, 2008). In essence, the ultimate goal of interpretivists is to understand and interpret the meanings in human behaviour so as to generate theory, rather than to test theory and predict causes and effects (Hudson and Ozanne, 1988; Skitmore, 1999). According to Schweber (2015, pp. 845), "*in interpretivist research, theory is a tool to displace the researcher's own common sense and to draw attention to processes and meanings which, while hidden from view, are essential to understand observed outcomes*". Having discussed the main approaches for knowledge acquisition, the next section provides a summary of prevailing reasoning and inference approaches.

3.3 Theorising and Reasoning Approaches

One of the important features of research design is the approach to reasoning that it incorporates. Theorising approaches in social science are anchored to three main reasoning approaches: deductive, inductive and abductive (Dubois and Gadde, 2002; Reichertz, 2004; Pries-Heje et al., 2011; Timmermans and Tavory, 2012). Theorizing here refers to the process of constructing a theory (Weick, 1989). In general, a theory can be defined as a set of systematically interrelated concepts, definitions and propositions, which predicts and/or explains social phenomena (Turner, 1982). In his model of engaged scholarship, Van de van (2007) argued that multiple reciprocal cycles of the three aforementioned types of reasoning are needed to build a theory. Asvoll (2013) showed how that integral relationships between the three reasoning concepts,

could be relevant and useful to interpretative case studies. These assertions are also supported by Gregory and Muntermann (2011, p. 8) who claim that:

"Most scholars from the social sciences would probably agree that any type of theorizing involves to some degree induction, deduction, and abduction. The differences among theorizing methods and approaches can be explained by the sequence in which these three types of reasoning or inquiry are carried out and the dominance of any one of the three approaches".

Deductive and inductive reasoning are, arguably, the most two dominant theorising approaches in many research disciplines (Reichertz, 2004; Thomas, 2006; Pries-Heje *et al.*, 2011). The main difference between them is that deductive research approaches aim to test theories, while inductive ones tend to generate theories emerging from data. Deduction begins with a universal view of a situation going to particulars (deductive proof); in contrast, induction moves from fragmentary details to an abstract and generalisable view of a situation (Inductive discovery) (Gray, 2009) In many cases, it might be useful for a research study to use or integrate both approaches (see for example, Ali and Birley, 1999; Thomas, 2006; Fereday, J. & Muir-Cochrane, 2006).

Abduction reasoning seems to be less prevalent in literature in comparison to deduction and induction, but is argued to play an important role in any theorising strategy (Locke *et al.*, 2008; Gregory and Muntermann, 2011; Asvoll, 2013). Abduction is a creative type of inference that assigns special status to explanatory considerations (Park, 2015; Douven, 2017). Abduction is most often associated with design-science research (see for example, Pries-Heje *et al.*, 2011; Gregory and Muntermann, 2011). The use of abductive inference is also becoming more popular in grounded-theory studies (see for example, Richardson and Hans-Kramer, 2006; Charmaz, 2008; Reichertz, 2010; Timmermans and Tavory, 2012).

3.3.1 Deductive approaches

Deduction has a long history in the philosophy of science, where it was seen as a way for establishing natural laws in science (Gray, 2009). The origin of deductive reasoning

dates back to ancient philosophy, Plato, who argued that logical deduction is the only valid method for developing theory (Pries-Heje *et al.*, 2011). In the methodological literature of social science, Miller and Brewer (2003, p. 67) define 'deduction' as:

"An approach to data analysis, explanation and theory that sees empirical social research as conducted on the basis of a hypothesis derived from social theory which is then tested against empirical observations and then subsequently used to confirm or refute the original theoretical propositions. This approach is called deduction because research hypotheses are deduced from theory by a process of logical reasoning. It is associated with positivism and natural science models of social research and is the inverse of induction".

Deduction involves going from generals to particulars, deriving conclusions based on a process of logical reasoning (Miller and Brewer, 2003; Gregory and Muntermann, 2011). The general form of deductive reasoning involves inferring that if:

"All A are B.

C is A.

Thus, C is B" (Timmermans and Tavory, 2012, p. 171).

Deduction is regarded as a 'top-down' approach to theory building (Gregory and Muntermann, 2011). Theorists using a deductive approach tend to deduce hypotheses from existing predetermined theories and concepts (Dubois and Gadde, 2002; Daniel *et al.*, 2017), and then to move forward towards hypothesis testing (Gray, 2009). At the heart of deductive reasoning is the principle of 'refutation' (Miller and Brewer, 2003), which suggests that a theory can never be proven to be right, but only be shown to be wrong and thus rejected. Theorists, therefore, attempt to falsify or confirm their firm-ed-up hypotheses in a variety of settings and scenarios, where surviving ones are deemed to be more complete. This structured analytical process allows for the generalisation of findings. Deductive research approaches, however, have been criticised for their limited ability to explore new ideas and concepts in social life (Timmermans and Tavory, 2012) because researchers restrain their data to pre-existing concepts and assumptions (Glaser and Strauss, 1967); thereby finding only what they expect to find (Thomas, 2006).

3.3.2 Inductive approaches

Induction was recognised by Aristotle as a valid approach for generating knowledge (Pries-Heje et al., 2011); it involves working from observations towards an inference. Inductive reasoning evaluates or constructs inductive arguments based on specific observations (Gregory and Muntermann, 2011). In essence, the premise of an inductive theoretical approach is inferring a general conclusion from a particular observation. According to Miller and Brewer (2003, p. 154):

"Induction is an approach in social research which argues that empirical generalisations and theoretical statements should be derived from the data...Induction is associated with qualitative research and naturalism, where the intent is to be 'true to the data themselves', allowing the data 'to speak for themselves'...As an approach to theory building, it is associated with 'Glaser and Strauss' formulation of grounded theory in which theory is the outcome of the research. As an approach to qualitative data analysis, it is expressed by the idea of 'analytical induction' in which empirical generalisations develop from the data instead of being used to interpret findings".

In contrast to deductive approaches, induction starts with specific observations (raw data as opposed to existing knowledge), and proceeds by examining the collected data to find any emerging patterns and relationship between variables (Fereday and Muir-Cochrane, 2006; Gregory and Muntermann, 2011). Based on these observations and interpretations, it may be possible to generate general conclusions and theories (Thomas, 2006; Gray, 2009). Thus, with 'induction', raw data are collected and a theory may be discovered or generated as a result of the data analysis. The general form of inductive reasoning involves inferring that if: "All observed A are C. Thus, all A are C" (Timmermans and Tavory, 2012., pp. 171). To ensure a degree of reliability and more certainty, and avoid hasty inferences or conclusions, the researcher often relies on the use of multiple cases or instances (Gray, 2009; Timmermans and Tavory, 2012).

Inductive reasoning is exploratory in nature and is regarded as a 'bottom-up' approach to theory building; that is because abstractions and theories stand at the end of the research

process, rather than the beginning (Gregory and Muntermann, 2011). It could be argued that the use of inductive reasoning is appropriate when new knowledge needs to be explored whereas deductive reasoning could be used to test and modify existing knowledge (Pries-Heje et al., 2011). The primary principle of the inductive approach is to allow research findings and theory to systematically emerge from data (Dubois and Gadde, 2002), without the restraints imposed by rigid methodologies (Thomas, 2006) or the influence of existing knowledge (Timmermans and Tavory, 2012). As explained by Miller and Brewer (2003, p. 154) "*a priori assumption and theoretical ideas should not be used to interpret data, rather the social meaning inherent in the data alone should be used as the basis for any empirical generalisation or theoretical statement.*"

Qualitative inductive approaches allow us to find in collected data, new versions of what is already known (Reichertz, 2010). Thus, one of the most important features of inductive reasoning is its potential to extend our current knowledge or understanding of a social phenomenon, by deriving general conclusions or concepts that are more than a refinement of the premises of existing theories (Timmermans and Tavory, 2012). In other words, inductive reasoning has the potential to construct or generate new theory. It overcomes the limitation of deductive reasoning where specific conclusions are based on the general, thereby restraining the potential of building new theory. Another main advantage of inductive approaches is that it allows the researcher to get close to the social phenomena under investigation; so it allows for the generation or construction of theory that 'represents reality' and is perceived to be highly 'relevant' by the researched stakeholders. On the other hand, it has been argued that inductive reasoning leads to probable forms of inference, rather than logical ones (Reichertz, 2010). Thus, the limitations of induction include the challenge of reaching generalization and prediction based on the observation of particular instances, cases or events (Timmermans and Tavory, 2012).

3.3.3 Abductive approaches

Both deduction and induction are two dominant ways of generating research hypotheses, either from theory or observations respectively (Miller and Brewer, 2003). Abduction is a third method of reasoning that was proposed by the American

Philosopher, Charles Sanders Peirce, to overcome the limitations of deduction and induction (Krupnik and Turek, 2014). Peirce described abduction as the “*process of forming an explanatory hypothesis*” (Peirce 1934:171). Within the context of research, 'abduction' refers to a creative inferential process aimed at producing new hypotheses and theories based on surprising research evidence (Timmermans and Tavory, 2012). Its purpose is not to deduce a hypothesis from the existing body of knowledge and then test it in a closed system (deductive theorising); nor does it intend to induce a general conclusion or theory from observation in an open system (inductive theorising). Instead, 'abduction' encourages researchers to look for causes and plausible ways for explaining their observations. In other words, the logic of abductive theorising is to infer satisfying explanations for surprising observations (Aliseda, 2007); thereby generating new knowledge. According to Peirce (1903, p. 205):

“All the ideas of science come to it by the way of Abduction. Abduction consists in studying facts and devising a theory to explain them. Its only justification is that if we are ever to understand things at all, it must be in that way”

In literature, the term ‘abduction’ is generally used in two related but different approaches: traditional and modern versions (Douven, 2017). In both approaches, abduction refers to some sort of explanatory reasoning. However, in the traditional version which represents Peirce's logic abduction, explanatory reasoning is used for '*generating*' hypotheses. In this case, abduction is viewed as a "leap of faith" from observations to hypotheses (Morgan, 2007). This form of abduction is commonly used as a logic of discovery in grounded-theory studies (see for e.g. Richardson and Hans-Kramer, 2006; Charmaz, 2008; Reichertz, 2010). In this sense, abductive reasoning invokes imaginative interpretations of the observed data (Charmaz, 2008), and thus helps the researcher during the coding process to reach higher levels of abstraction (Reichertz, 2004). This is described by Charmaz (2008, p. 57) as follows: "*the researcher imagines all possible theoretical accounts for the observed data and then forms and checks hypotheses until arriving at the most plausible interpretation of the observed data*". On the other hand, abduction in modern versions refers to the place of explanatory reasoning in '*justifying*' hypotheses. This sense of abduction seems to be associated with design-thinking related studies, in which the researcher makes-sense of

a set of observations through drawing inference to the best explanation. The researcher in design science is usually confronted with a large number of possible explanations for phenomena; abductive reasoning, therefore, helps the researcher to decide on which possible explanation to look at first. Action is then taken to test that inference, based on making deductions on it, until a satisfying solution for a particular design problem is reached. Another example for the use of modern versions of abduction is Morgan's (2007) pragmatic approach to social science research, at which abduction reasoning moves back and forth between induction and deduction.

The logic of abduction, however, is distinct from induction and deduction. Abduction starts with consequences and then constructs reasons. This is described as follows:

"The surprising fact C is observed.

But if A were true, C would be a matter of course.

Hence, there is a reason to suspect that A is true". (Peirce 1934, p. 117)

In other words, abduction starts with surprising observations and then produces reasons that would explain those observations. According to Peirce (1958, pp. 217–18), abduction seeks a theory, while induction seeks for facts. In a discussion with Professor David L. Morgan on the main difference between induction and abduction, the following answer was received:

"A lot of social scientists misuse the logic of induction, which should be "I have observed this; therefore, I conclude that...", where the conclusions are stated entirely in terms of the observations...Abduction, in contrast, relies on a conclusion that is outside the strict range of observations, so that it includes a "leap" of insight to interpret the observations. Hence, almost all of the reasoning in qualitative coding is actually abductive"¹.

¹ A reply by Professor David. L. Morgan to a question asked by the author on a social networking site for scientists and researchers to share papers, ask and answer questions and find collaborators. The question raised was titled: *What is the difference between an "Integrated (deductive-inductive) research approach" and an "Abductive approach" in social science? - Page 2*. Available from: https://www.researchgate.net/post/What_is_the_difference_between_an_Integrated_deductive-inductive_research_approach_and_an_Abductive_approach_in_social_science2 [accessed May 11, 2017].

Abduction, as noted by Peirce, provides less certainty than induction; but abduction has more innovative potential than deduction and induction (Timmermans and Tavory, 2012, p. 171; Tavory and Timmermans, 2014, p. 38). Abductive inference is seen by many researchers as a systematised creativity or an intuitive leap in research to develop new hypothesis or theory (for e.g. see Taylor *et al.*, 2002; Dubois and Gadde, 2002; Kovács and Spens, 2005; Richardson and Kramer, 2006; Suddaby (2006); Charmaz, 2008; Reichertz, 2010; Krupnik and Turek, 2014). According to Morgan (2007), knowledge can only be produced by testing that inference. This requires "actions" based on deductions from it; but those "actions" may consist entirely of thoughts about the proposed hypothesis. It is important, however, to stress that although "*deduction is the only mode which guarantees the truth of the conclusion given the truth of the premises*" (Svennevig, 2001, p. 4), but abduction is the "*only logical operation which introduces any new idea*" (Peirce, 1903, p. 216).

Abduction is often described as inference to the best explanation (IBE); however this sense of abduction is debated on the basis that there is no consensus on what counts as the best explanation (Douven, 2017). A critical review study on the classifications of abduction (Park, 2015, p. 215) argued that Peirce's original abduction is for generating hypotheses or theories, while IBE is for their evaluation as well as generation. Interestingly, the study tentatively concluded that "*IBE is induction rather than abduction*" (Park, 2015, p. 215). On this debate up on the classifications of abduction, Aliseda (2007) suggests that abduction can be taken either in its weaker or stronger sense. The latter is reasoning is to the minimal or best explanation, while the former is reasoning from the fact to one of its potential explanations. Similarly, Magnani (2001) provided two distinct classifications of abduction: 'selective' and 'creative'. As a metaphor, Magnani used the contrast between 'medical diagnosis' where a hypothesis is selected from a well-defined hypotheses space, as an example of 'selective abduction'; while 'medical research' where new diseases and their causes are discovered was considered to be a result of 'creative abduction'.

Abduction, as Peirce argued, can be considered as the first step in any methodological process of scientific inquiry. The aim of abductive reasoning is to understand surprising research evidence in a new way, and to suggest a novel theory in the form of new

hypotheses or propositions (Kovács and Spens, 2007). Abductive reasoning is used in research in different ways. For example, Dubois and Gadde (2002) called for 'theory matching', in which data is collected simultaneously to theory building. This process allows the study to interpret and understand a surprising observation from the perspective of a new conceptual framework. Asvoll (2013) suggested the use of two alternative strategies for interpretative case-study research, namely: abduction–deduction–induction (A–D–I) and deduction–induction–abduction (D–I–A). The latter can be dictated by theory-testing, while the former by theory-building. According to him, the A–D–I strategy can be extended to an A–D–I–A strategy to ensure explicit forms of abduction. Kovács and Spens (2005) conducted a literature review on abductive research approaches, and proposed a framework for adopting abduction in logistics research (Figure 3.2). They stressed, however, that abductive reasoning concludes with theory suggestion, as the last step can be characterised as a deductive part of the research process (Kovács and Spens, 2005, p. 139).

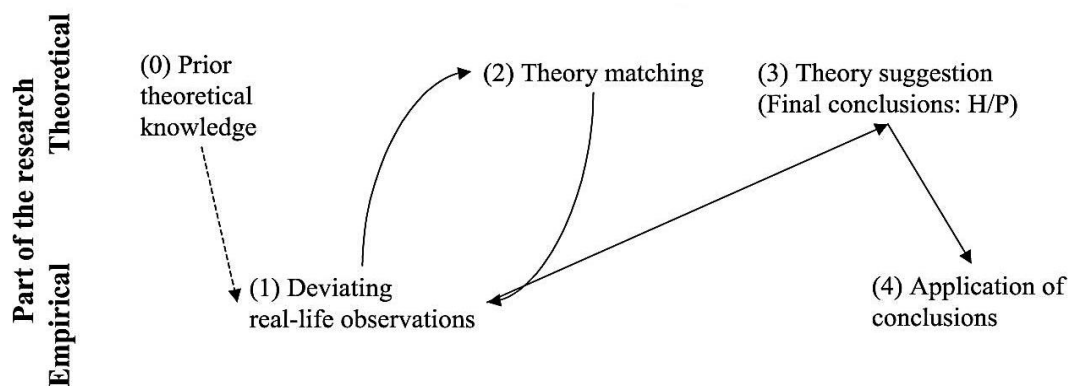


Figure 3.2: A proposed abductive research process (Kovács and Spens, 2005)

3.4 Modes of Producing Scientific Knowledge

An important step in the design of any research project is to determine the overarching objective of the research, in terms of mode of producing scientific knowledge. According to Voordijk (2011), two kinds of scientific research in construction management can be distinguished: 'descriptive' and 'prescriptive'. The former is a 'knowledge-producing' activity that is aimed at understanding different aspects of construction management and is mainly associated with natural and social sciences. Prescriptive, on the other hand, is a 'knowledge-using' activity that corresponds to 'design science', which aims at improving practice by designing solutions to complex practical field problems. These two approaches have created a debate among scholars

over what constitutes legitimate science in the field of construction management (Voordijk, 2011). Recognising the difference between these two research types can provide several significant benefits to the researcher, including selecting the right type of research approach for the situation and avoiding the use of inappropriate methodologies (Koskela, 2008).

Design science is a well-established approach that is widely used in information technology (IT) research. Interestingly, IT research is concerned with studying artificial phenomena in contrast to natural phenomena (March and Smith, 1995). Therefore, IT research has a dual nature; that is because artificial phenomena can be both studied and devised. Scientists contribute to these two conflicting activities through adapting two distinctive, but rather complementary, types of scientific research: (1) Design science research (DSR); and (2) Natural science research (NSR). Koskela (2008) has argued that the use of DSR in construction management can help to solve many problems facing this discipline, including the problem of relevance, while simultaneously contributing to knowledge. Koskela mentioned, however, that 'explanatory' construction management studies would definitely remain to be significant. Similarly, Voordijk (2009) suggested that design science should be the common ground on which research in construction and management meet. It appears from literature that the use of DSR in construction management research has grown in popularity, especially among proponents of lean construction, in an attempt to strengthen the link between theory and practice (see for example, Rocha *et al.*, 2012; Brady *et al.*, 2012 & 2013; Smith, 2015).

Despite the distinctive differences associated with each approach (Table 3.1), it is, however, important to appreciate their interactions and complementary role. For instance, DSR creates artifacts giving rise to phenomena (e.g. BIM) that can be the targets of studies for natural (social) science researchers. Similarly, NSR creates theories and scientific knowledge which design science researchers could utilise to improve practice and technology. The complementary research cycle between DSR and NSR stems from a pragmatist philosophy that claims that reality (justified theory) and utility/value (artifacts that are effective) are two sides of the same coin; and thus practical relevance and rigour of scientific research should be evaluated equally (Hevner *et al.*, 2004).

Table 3.1: Comparison between Natural (Social) Science and Design Science Research

Criterion	Natural (Social) Science Research	Design Science Research (DSR)	Source of information
Research Domain	Traditional research in physical, biological, social and behavioural domains	Design Science in IT, engineering, Medicine, & design-related fields	Venable (2006); March and Smith (1995)
Research Motivation	To study and understand how and why things are	The desire to know how to improve the way things are	Hevner (2007); March and Smith (1995)
Research Aim/Objectives	Explaining, understanding and predicting reality	Creation of artifacts to solve real-world problems	Hevner (2007); March and Smith (1995);
Object of Study	Natural and Artificial Phenomena	Artificial Phenomena	March and Smith (1995); Niehaves (2007)
Research Intent	Descriptive/Explanatory (Problem-understanding paradigm); Basic or Applied science	Prescriptive (problem-solving paradigm); Applied science	March & Smith (1995); Hevner <i>et al.</i> (2004)
Research Approach	Hypothetico-deductive, inductive or both (integrated)	Situational, Hypothetico-deductive	Ali and Birley (1999); March and Smith (1995);
Ontological perspective	Objective reality or constructivism	Objective reality (Pragmatic philosophy)	Dainty (2007); Hevner (2007);
Epistemological position	Positivism or Interpretivism	Positivism or Interpretivism	Dainty (2007); Niehaves (2007)
Relation to Knowledge	Knowledge-Producing	Knowledge-Using	March and Smith (1995)
Main Research Activities	Discovery and Justification	Build and Evaluate	March and Smith (1995)
Research Output(s) / Product(s)	Laws, causality models, hypotheses and theories	Solution concepts (technological rules), methods or systems	March and Smith (1995); Voordijk, (2009; 2011);
Evaluation of Research Outputs	Evaluated against norms of truth, or explanatory power	Evaluated for their situated utility and effectiveness	Venable (2006); March and Smith (1995)

3.5 Rationale and Philosophy Underlying this Research

A research design process involves reciprocal connections between philosophical stances, strategies of inquiry and research methods adopted in a study (Creswell, 2012). This study aims to explore the influence of imperfect institutions and paradigms, if any, on the deployment and persistence of wasteful procurement arrangements in construction. Therefore, a 'Constructivist or Relativist' ontological position, outlined in section 3.2.1, is seen appropriate for the social phenomena under investigation. Constructivism assumes that there is no single truth or reality (Bryman, 2012); instead, social actors tend to make-sense of situations that they experience by constructing their own subjective interpretations of objective reality (Gray, 2009). This constructivist ontological stance also supports the qualitative nature of the study. At the same time, this study hopes to explore the impact of the widely accepted use of inefficient construction procurement arrangements on performance, behaviour and outcomes, based on the real-life experiences of professional buyers and suppliers.

Thus, an 'interpretivist' epistemological position, described in section 3.2.2, is deemed to be essential in this case, so as to enable the study to discover the underlying motives and meanings in human actions and behaviours. It also allows for a better understanding of contextual factors (Gaddon, 2010). This interpretivist epistemological stance aligns with the constructivist ontology of meaningful reality (Crotty, 1988) adopted for this study. The philosophical positions outlined above dictated the use of a qualitative research strategy, which adapts a constructivist/interpretivist approach to grounded-theory (Staruss and Corbin, 1998; Charmaz, 2008). This approach aligns with the exploratory nature of the research and responds to widespread criticisms related to the extensive use of quantitative methods, associated with positivism, in construction management research (for example, see Seymour and Rooke, 1995; Seymour *et al.*, 1997; Koskela, 2017). Explanations about the choice and justification of the adapted methodology shall be outlined in detail in the following sections.

Based on the discussion above on modes for producing knowledge (section 3.4) and the comparison between N(S)SR and DSR presented in Table 3, within the context of our

proposed study of institutional waste, it has been concluded that an exploratory SSR approach is deemed to be more appropriate for our proposed research study. Social research projects can be broadly classified into three categories: exploratory, explanatory and descriptive. However, an individual study may sometimes have multiple purposes. Exploratory research typically seeks to create hypotheses rather than test them. The goal of exploratory research is to formulate problems, clarify concepts, and form hypotheses; it does not intend to offer final and conclusive solutions to existing problems (Sanders *et al.*, 2012).

This study adopted an Abductive-Deductive-Inductive-Abductive (A-D-I-A) approach to theory building (Asvoll, 2013), instead of a classical inductive approach, or a static theory-directing Deductive-Inductive (D-I) strategy (Asvoll, 2013). In other words, this study used abduction besides a deductive-inductive strategy, so as to provide pre and post theoretical hypotheses during the empirical research process. Researchers generally distinguish between inductive and hypothetico-deductive research based on the presence or absence of theory (Ali and Birley, 1999).

The decision to use abduction besides a D-I approach, rather than using abduction besides induction only, was based on arguments that assert that it is impossible to isolate theory from research (See for example, Strauss and Corbin, 1990; Pink *et al.*, 2010). These arguments imply that empirical investigations cannot be understood or interpreted without theory and vice versa (Dubois and Gadde, 2002). It has been stressed by Strauss and Corbin (1990) that it is not viable to enter into research situations with a blank mind; instead they asserted that some 'technical knowledge' is necessary. Theory in interpretative research can help the researcher to separate between what could be classified as speculations or opinions and what could be considered as empirical facts. According to Åsvoll (2013, p.300) "*observations independent of theory will impede the researcher from making observations early on in the research process*". That is because the use of theory can help to direct attention to important processes and meaning which might be hidden from view (Schweber, 2015).

At the same time, excessive use of theory can lead to a dominant deductive strategy, which may not lead to the construction of new theories or hypothesis. Therefore, one of the important cautions of adapting an integrated (D-I) approach is specifying relationships between variables. By referring to our six guiding hypotheses (propositions), it is clear that they are composed of ‘constructs’ rather than ‘variables’. To simplify this important distinction between the two terms, a study by Ali and Birley (1999), which adapted an integrated approach to investigate the ways in which entrepreneurs use trust to mediate customer perceived risk, used ‘performance’ as an example of a ‘construct’ and ‘sales or return on investment’ as a ‘variable’. Therefore using our six propositions (guiding hypothesis), as a priori specification of constructs, could potentially provide the study with the following advantages (Ali and Birley, 1999):

- Enable the researcher to discover issues or effects which have not been considered before the investigation began.
- Provide a guiding focus for the research but also leave the scope open for generating unintended findings or even new hypotheses.
- Allow the study to makes sense of the disparate information provided by various respondents during analysis stages.

However, the use of Abduction as part of a deductive-induction approach to theory building can be considered as a 'safeguard' against the theoretical hypotheses becoming too constraining or leading during data collection and interpretative processes (Asvoll, 2013). The use of abduction paves the way for contextual choices of theory due to observation of surprising or interesting facts, in compared to pre-determined selection of theories in case of a D-I approach. In this study, the fact that 'much of the waste produced in construction is similar to many projects and keeps recurring' motivated the study to look for new or different explanations to this phenomenon. A few explanations related to these phenomena have already been offered through the use of theories of production as an analytical lens. In particular, Bølviken and Koskela (2016) have offered eight possible reasons so as to why waste-reduction has not conquered construction. The use of abduction as a starting point of the inquiry strategy (A-D-I-A), allowed the study to go beyond previous investigations, and to seek different

explanations drawing up on theory from disciplines outside both construction and manufacturing such as economics and sociology. Thus, leading to a more abductive exploratory logic which aligns with project motives and objectives rather than a deductive confirming logic. As a consequence, a primary research question was formulated, which influenced the selection of literature and theory to review:

'Is there anything in the commercial and institutional environments surrounding construction that is blocking radical new production system design and therefore pinning the prevailing wasteful system in place?'

Furthermore, extending the inquiry strategy from A-D-I to A-D-I-A has enabled the study to go beyond inductive empirical findings and facts and to seek novel explanations; thereby ensuring that the theoretical world is developed further in line with the empirical one (Asvoll, 2013). This will be demonstrated in the Data Analysis and Discussion Chapters.

The study starts by using a 'selective abduction' reasoning approach (Magnani, 2001), which allowed the study to select appropriate theories that were seen to have the potential to provide useful guidance and explanations to the research problem. Four theories were targeted and reviewed for this purpose, namely (1) the concept of waste in construction; (2) Construction Procurement; (3) Neo-institutional theory of social science; and (4) Transaction cost theory of economics. Considering that the researcher's background as a site engineer with limited prior practical and theoretical knowledge related to pre-construction activities and processes, the use of theory, tentatively, at this stage was seen to be important to aid the researcher during data collection and analysis stages. According to Schweber (2015, p. 845), the role of theory in 'interpretative' research is to:

"displace the researcher's own common sense and to allow them to see things differently than either their subjects or they would have without it. Similarly, the role of data (while partly informed by theory) is to push back against the researcher's own common sense, limiting what can and cannot be claimed. In

both cases, this depends on the researcher's awareness of their own assumptions and the way in which they shape the analysis (reflexivity)".

So, the role of 'abduction' was to pave the way towards the contextual choice of theories and literature to review. Following this, deduction enabled the study to formulate six propositions (guiding propositions) and to develop a preliminary conceptual model (Figure 2.2 in Chapter 2) prior to data collection. The study then used a qualitative research strategy, which adapts a constructivist grounded-theory methodology (Strauss and Corbin, 1990; Charmaz, 2006) for data collection and interpretation. Consequently, the preliminary conceptual model got substantially modified and developed, mainly as a result of unanticipated empirical findings, but also due to theoretical insights gained during the process. As explained by Charmaz (2008, p. 157):

"Grounded theory starts with an inductive logic but moves into abductive reasoning as the researcher seeks to understand emergent empirical findings. Abductive reasoning aims to account for surprises, anomalies, or puzzles in the collected data. This type of reasoning invokes imaginative interpretations because the researcher imagines all possible theoretical accounts for the observed data and then forms and checks hypotheses until arriving at the most plausible interpretation of the observed data"

The type of abductive reasoning mentioned by Charmaz (2008) in the quotes above aligns with what Magnani (2001) classified as 'creative abduction', as it leads to the formulation of novel theories or hypotheses. This reasoning method has been adopted in this study following Peirce's logic abduction approach for generating hypotheses. The hypotheses were then deduced and tested 'implicitly' through analytical reflections and thoughts, and 'explicitly' through an evaluation exercise that was conducted with a small sample of academic and industry experts. Having discussed the philosophical and theoretical assumptions underpinning this study, the next section will provide detailed explanations and justifications to the choice of research methodology and methods used for this study.

3.6 Research Methodologies

In general, research designs tend to be either: qualitative, quantitative, or mixed. Creswell (2009) provided a useful distinction which is useful in choosing and when adopting an approach, as summarised in Table 3.2.

Table 3.2: A comparison between research approaches (Creswell, 2009)

	Qualitative approaches	Quantitative approaches	Mixed-methods approaches
Use these philosophical assumptions (Knowledge claims)	<ul style="list-style-type: none"> ▪ Constructivist ▪ Advocacy ▪ Participatory 	<ul style="list-style-type: none"> ▪ Post-positivist 	<ul style="list-style-type: none"> ▪ Pragmatic
Employ these research methodologies	<ul style="list-style-type: none"> ▪ Phenomenology ▪ Grounded theory ▪ Case study ▪ Ethnography ▪ Narrative 	<ul style="list-style-type: none"> ▪ Surveys and experiments 	<ul style="list-style-type: none"> ▪ Sequential, ▪ Concurrent ▪ Transformative
Employ these methods	<ul style="list-style-type: none"> ▪ Open-ended questions ▪ Emerging approaches, ▪ Text or image data 	<ul style="list-style-type: none"> ▪ Closed-ended questions, ▪ Predetermined approaches, ▪ Numerical data 	<ul style="list-style-type: none"> ▪ Both open and close-ended questions ▪ Both emerging and predetermines approaches ▪ Both qualitative and quantitative data analysis

A qualitative research approach is typically suitable for studies aiming for an in-depth understanding of the subject or problem under investigation. It is mainly concerned with exploring the meanings embedded in people's experiences rather than testing predictions (Bryman, 2008). Thus, an exploratory qualitative research approach was considered most appropriate, as it also aligns with the philosophical assumptions underpinning this study (see section 3.5). Although different qualitative research methodologies exist, this study focused on considering the five main qualitative

research traditions identified by Creswell (2009), because they are the most commonly used in social science research. A comparison between these five main research methodologies is summarised in Table 3.3

Table 3.3: Qualitative research methodologies (Creswell, 2009, 2012)

Type of research methodology	Ethnography	Case Study	Grounded Theory	Phenomenology	Narrative Case Study
Focus	Describing and interpreting a cultural or social group	In-depth exploration of single or multiple cases	Developing an abstract theory that is grounded in empirical data collected from the field	Investigating the essence of human experiences about a phenomenon, as described by participants	Studying the lives of individuals
Disciplinary origin	Cultural anthropology	Political science	Sociology	Psychology	Anthropology
Data collection	Observations and interviews during extended fieldwork (e.g. 6m-1yr)	Multiple sources including documents, interviews, artefacts	Interviews with 20-30 individuals to saturate categories and detail a theory	Statements, meanings, themes, general descriptions	Interview and documents
Data analysis	Description, analysis, interpretation	Description, themes, assertions	Open, axial, selective coding, and constant comparison of data	Statements, meanings, themes, general descriptions	Stories, epiphanies, historical context
Narrative form	Description of cultural behaviour of group or individual	In-depth study of case or cases	Theory or conceptual model	Description of essence of experience	Detailed picture of individual's life

The methodology to be adopted for this study should lead to a holistic explanation of the underlying motives and behaviors associated with the use of imperfect construction procurement and commercial arrangements, along the extended construction industry supply chain. This pointed the study towards qualitative methods and a choice between the use of grounded theory and multiple case studies. The case study approach was discounted because of several reasons. First, commercial studies can be notoriously difficult to mine truth from, especially if attempted through direct observation of live procurement processes. People are sensitive about the issues they disclose and the

implications for their immediate or future commercial positions. The author negotiated access of a case study with ongoing local public projects, but the Strategic Director of the projects refused due to commercial sensitivity reasons. A similar response was obtained from a major tier-1 UK contractor. The company was hesitant to allow the author gain access to any of their commercial or supply-chain contractual practices. As mentioned by one of the interviewees of this study:

“This may be a key area of ‘Waste’ in that ‘Accurate Shared Learning’ is rarely obtainable in relation to commercial issues...People will share good news but not necessarily the bad. And the links between cause and effect in the case of both are rarely accurately assigned” (Fellow of the Institute of Civil Engineers (FICE), Senior Consultant, UK, 8th September, 2015, E-mail message).

Secondly, a case study route would have confined the study to a limited number of projects agreed upon at the outset by either clients or main contractors. Additionally, there is the risk that participants in the down-stream supply-chain would not remain anonymous when investigating links between causes and consequences, unless project parties were willing to collaborate in sharing lessons learned. Thus, a grounded theory (GT) approach avoided these issues by allowing the coverage of a wide variety of projects while at same time ensuring that all informants remain anonymous.

GT is a useful means to study a topic of interest or problem area that is under-explored (Strauss and Corbin, 1998). It is, therefore, particularly appropriate to this study, as little is known in existing literature about the imperfect institutional factors influencing the choice and deployment of wasteful construction procurement practices (as discussed in chapter 2). A GT approach can also facilitate an in-depth understanding of the impact of the use of imperfect procurement arrangements on project-team performance and behaviour, grounded in the interpretations of the participants’ construction procurement experiences in the UK; thereby ensuring that the developed theory or conceptual model provides a close representation of social context. The next section provides a background to the grounded theory methodology (GTM) and a discussion upon the fundamental guidelines common in three main variants to GTM. Following this, a detailed description of the research methodology adapted for this study is provided. The

subsequent sections define the research methods and procedures for data collection and analysis of this study.

3.6.1 Grounded theory methodology

Grounded theory (GT) originated in the 1960s in the fields of health and nursing studies by Barney Glaser and Anselm Strauss. Their influential book *'Discovery of Grounded Theory'* challenged predominating quantitative research paradigms at the time, by catalysing a methodology which aims for 'creating new theory' rather than 'testing existing theories' (Glaser and Strauss, 1967). A grounded theory methodology (GTM) is exploratory in nature and typically seeks to generate a theory, through inductive reasoning, that is grounded in the empirical data from which it has been derived (Gasson, 2004). A GT, however, is not attained passively, but through an interactive, exhaustive and ongoing process where the researcher keeps moving back and forth between data collection and analysis. This process continues until a conceptual theme is developed from empirical facts in a way which provide a clear representation of social reality (Loosemore, 1999). In this sense, GT tends to involve the researcher in a journey of discovery rather than a confirmatory process of linking pre-conceived hypotheses with reality (Glaser and Strauss, 1967). Strauss and Corbin (1998, p. 40) describe the essence of when it is mostly appropriate to use GTM for a research study, as follows:

"If someone wanted to know whether one drug is more effective than another, then a double blind clinical trial would be more appropriate than grounded theory study. However, if someone wanted to know what it was like to be a participant in a drug study, then he or she might sensibly engage in a grounded theory project or some other type of qualitative study."

Marshall and Rossman (1999) stated a number of characteristics that GTM has in common with other qualitative approaches. These include:

- Inquiry as an interactive process between researcher and respondents
- Valuing participants' perspectives and relying on people's words
- Focus is on real life experiences

However, GT is of particular value when the research challenge is to interpret complex social processes where holistic explanations are lacking (Hinton and Hamilton, 2015). In other words, GT is appropriate for use when the researcher hopes to develop a conceptual overview of the social phenomena under investigation. The inductive focus of GT makes it suitable for exploring a topic of interest or a substantive problem area that there is little known about it (Strauss and Corbin, 1998). It positions research problems in a social context, and provides a useful means for learning about individuals' perceptions, behaviours and actions regarding the particular problem or subject under exploration (Glaser and Strauss, 1967; Charmaz, 2008). Nevertheless, in GT, the unit of analysis is not the individuals themselves, but incidents in the data (Glaser and Strauss 1967). Theoretical sampling and constant data comparison are examples of techniques used within the GTM to support a systematic generation of theory, grounded in the data.

GT has evolved over time in the past five decades, and has become a widely utilised and accepted qualitative approach, in particular within social science disciplines (Mills *et al.*, 2006; Fernie and Tennant, 2013) Development in GT took place due to a spiral of philosophical arguments and methodological advancements (Mills *et al.*, 2006). This section provided an overview of the background of GT and its main characteristics, and its purposes for use. Apart from choosing GT to guide this study, in light of the different philosophical stances underlying GT, it is therefore necessary to take a look at three critical variants of GTM.

3.6.2 Variants of grounded theory methodology

GTM has been subject to continuous development since its origination in the 1960s in the United States. This led to the development of three distinct versions of GT that vary in their philosophical underpinnings:

- Glaser and Strauss' (such as 1967, 1978) 'classical/traditional GTM',
- Strauss and Corbin's (such as 1990, 1998) 'evolved GTM', and
- Charmaz's (e.g. 2006, 2008) 'constructivist GT approach'.

The Classical GTM

Grounded theory was first articulated by Glaser and Strauss (1967) as a general qualitative methodology that seeks to generate theory through inductive analysis of data. Their influential work emphasises that the researcher should start collecting data with a 'blank mind'. This means that data-collection is initiated without reviewing literature to avoid preconceptions, and thus ensure an inductive approach to theory-building. This original version of GT, therefore, suggests that theory is contained in the collected data and just needs to be 'discovered'. This 'discovery' nature of this classical GT approach assumes "*the researcher uncovers something that is already there*" (Charmaz, 2008, p. 45). This implies that the researcher should somehow take a passive stance during data analysis; thereby allowing the theory to emerge from the empirical data, without any previous theoretical input that might be of little relevance. According to this stance, the researcher only has to discover the theory inherent in the data by means of appropriate methods and inductive analysis. This perspective, therefore, assumes that different researchers would make same observations to facts in the data and reach same conclusions, as the theory will eventually become apparent to every researcher in some form of objective reality.

Thus, despite the qualitative nature of the classical GTM, it has been criticised by many scholars to remain close to positivism and objectivism paradigms (see for example, Pidgeon 1996; Bryant, 2003; Charmaz, 2008; Reichertz, 2010). However in recent writings by Glaser, he argued that classical GTM does not necessarily assume the objectivity of the researcher, instead the rigorous application of the methodology, for example through writing memos and constant comparisons of incidents, plays a crucial role in revealing biases and enabling the researcher to take corrective actions; thereby reducing as much variation in the data as possible (Glaser 1998). Additionally, Glaser (2002) classified classic grounded theory as a perspective methodology; however perspectives are not explored through an interpretative approach, but with the aim of raising these perspectives and ongoing patterns of behaviour to a conceptual level.

The Evolved GTM

In Strauss and Corbin's (for example 1990, 1994, 1998) writings, they disagreed with Glaser's assumption of a 'pre-existing reality out there'. Instead they developed an evolved version of GT which assumes that 'truth is enacted' (Strauss and Corbin, 1994, p. 279). As discussed earlier, the classical GT assumes that 'theory is discovered', and thus the same pattern of facts inherent in the data should appear to every researcher, if the right methods and procedures are utilised. However, the evolved version of GT argues that the researcher has to actively obtain theory from data. In research practice, it is most likely that each researcher will tend to focus on different aspects of the collected data depending on their background, previous experiences and values.

The main differences between the evolved and classical versions of GT seem to be centred around the relationship between GTM and existing literature, and the role of the researcher during data collection and analysis. Classical GT gives significant consideration to ensuring and maintaining theoretical sensitivity during collection and analysis. Thus Glaser argues that researchers should avoid reading relevant literature, as it may influence lead to 'forcing of data'; thereby limiting the researcher's their innovation while conducting initial coding of data. Once data collection reaches a developed state, extant literature can then be used to validate the emergent theory grounded from the data (Hunter and Kelly, 2008). In contrast, Strauss and his student Corbin believe that researchers construct theory as a result of their interpretation of the participants' words and narratives (Mills *et al.*, 2006). They also argue that "*we all bring to the inquiry a considerable background in professional and disciplinary literature*" (Strauss and Corbin, 1990, p. 48). Thus, data verification should be accomplished as an ongoing process, through continuous iteration between data collection and extant literature, until a theory is constructed. Furthermore, Strauss and Corbin (1998) emphasised the need to follow a set of procedures and formal coding schemes that they defined, as a way of reducing bias and ensuring consistency and quality of findings.

It has been argued by various scholar that the evolved version of GT (Strauss and Corbin, 1998) sits into a post-positivism *inquiry* paradigm, and that it is located in a

mixed philosophical stance: an 'objectivist' approach which aims to inhibit bias during data collection and analysis, and a 'constructivist approach' which acknowledges the researcher's role in concept or theory construction (Charmaz, 2003; Mills *et al.*, 2006). Critics of the evolved GT orientation argue that Strauss and Corbin's (1998) structured approach and heavy emphasis on the application of strict procedures during the coding process, may lead to the 'searching or imposing of data', and so by this way distract the GT researcher from the original intent and the emergent and inductive characteristics of GTM (Glaser, 2002a, 2002b).

The Constructivist GTM

Constructivist grounded theory can be implicitly traced from the work of Strauss and Corbin (1990, 1994, 1998), as underpinned by their belief that theory is constructed as an outcome of the researcher's interpretation of the voice of the participants (Mills *et al.*, 2006). However, Charmaz (2000, 2006, and 2008) is the first researcher to explicitly describe and confirm her constructivist intent. This approach to GT acknowledges that theory is constructed through interaction between participants and the researcher rather than being discovered or objectively emerging (Hinton and Hamilton, 2015). According to Charmaz (2006, pp. 130–131):

“The constructivist approach means learning how, when, and to what extent the studied experience is embedded in larger and, often, hidden positions, networks, situations, and relationships”

In line with constructivist paradigms, researchers adopting a constructivist grounded theory approach view truth as becoming apparent through their construction of people's experiences, interpretations of the experiences and the subjective meanings they give to these experiences (Guba and Lincoln, 1994). Thus, this strand of GTM assumes that the interaction process between the researcher and participants *“produces the data, and therefore the meanings that the researcher observes and defines”* (Charmaz, 1995, p. 35). A constructivist GT approach, therefore, requires researchers to go beyond the surface in terms of seeking meaning in the data, by questioning tacit meanings and searching for underlying values, motives and beliefs (Mills *et al.*, 2006). For this reason,

Charmaz emphasised in her recent writings the importance of adopting abductive reasoning (see for example Charmaz, 2008) as part of a constructivist GTM. According to her:

“Grounded theory begins with inductive analyses of data but moves beyond induction to create an imaginative interpretation of studied life. We adopt abductive logic when we engage in imaginative thinking about intriguing findings and then return to the field to check our conjectures” (Charmaz 2009:137–38).

As such, abduction allows for ‘constant comparison’ recommendations of classical and evolved versions of GT, where researchers are advised to move back and forth between data and theory iteratively. However, Charmaz’s perspective positions abduction as secondary to induction, and thus can be criticised for limiting abduction’s potential to foster theoretical innovation from the beginning of the research inquiry (Timmermans and Tavory, 2012).

3.7 The Methodological Approach Adapted by this Research Study

This study uses a qualitative research approach, which adapts a grounded theory methodology (Strauss and Corbin, 1998; Charmaz 2008). As stated by Mills *et al* (2006), within the GTM tradition, there are various points of departure along a spiral of methodological development; the stance taken among the different variants of GT should therefore depend on the researcher’s ontological and epistemological beliefs. Based on the philosophical assumptions underlying this research (see section 3.5), the strategy chosen for this research draws upon the legitimacy of the evolved approach to GT, and the abductive intent of the constructivist GTM. In this sense, the study acknowledges the influence of literature during research initiation; nevertheless, the author would claim to remain sensitive to the danger of ‘forcing of data’

The study supports the theoretical strand of evolved GTM, which argues that previous knowledge about the world and scientific theories (prior to data collection) are useful (Reichertz, 2010). Data analysis was also informed by Strauss and Corbin’s (1998)

formal coding scheme (open, axial and selective coding procedures). The study was guided by the interpretative stance of both evolved and constructivist approaches to GT that recognise the role of the researcher in theory building. Additionally, the research was inspired by Charmaz's (2008, 2009) explicit adoption of abductive logic during data collection and analysis stages. However, this study adopted an A-D-I-A approach to theory building (see section 3.5), at which abduction was adopted during data collection and analysis to foster theoretical innovation, but also used during research initiation to pave the way towards the contextual choice of topic guides (see Figure 3.3).

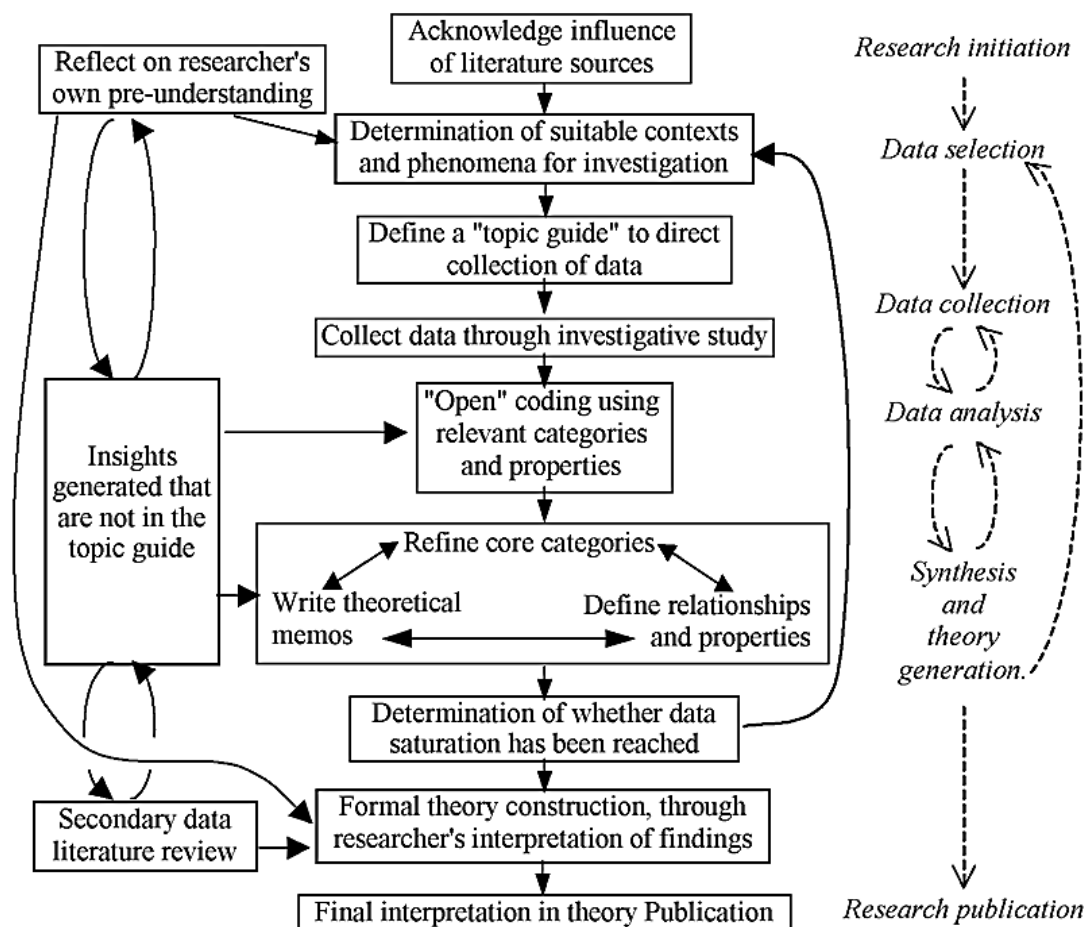


Figure 3.3: A Reflexive Grounded Theory Approach (Gasson 2004)

The debate between classical and developed versions of GTM (evolved and constructivist) seems to be centred up on whether the researcher believes that their work should be *defended* from a positivist or interpretive perspective. It has also been suggested by Reichertz, (2010) that the controversy between Glaser and Strauss can be partially characterised as one between induction and abduction. The researcher

disagrees with Glaser and Strauss' (1967) positivist stance and emphasis on avoiding literature prior to data collection. As argued by Timmermans and Tavory (2012, p. 170):

“Their commitment to an inductive approach created an epistemological and practical dilemma: Researchers were admonished to generate new theory without being beholden to preexisting theories, but they still required theoretical sensitivity based on a broad familiarity with existing theories to generate new theories”.

Various scholars have debated classical GT's stance on ignoring prior knowledge. Whilst admitting their appreciation for inductive GT, they have also raised their concern on ignoring literature. For example, Strauss and Corbin (1998) argued that theoretical pre-knowledge inevitably flows into the data's interpretation. In other words, they claimed that observation and theory development are necessarily always already theory-guided (Reichertz, 2010). From the same perspective, Andersen and Kragh (2010) questioned that researchers can ever engage in any inductive research, whether it is GT or not, with an 'empty head' or from a 'blank state'. Similarly, Dey (2007) has cautioned qualitative researchers not to confuse an *“open mind with an empty head”* (p.176). Based on these arguments, Pigeon (1996) suggested that some tentative use of existing theory is needed, in order to aid the researcher with understanding of the phenomena under investigation, and to guide the researcher in what data to collect. According to him, the emergence of theory results from constant interplay between data (partly informed by theory) and the researcher's emerging conceptualisations (deductive ↔ inductive reasoning). This perspective resembles with Schweber's (2015) arguments related to the role of theory in interpretative research.

In a study by Loosemore (1999) that aimed to develop a grounded theory of construction crisis management, an *'indicator model'* was constructed from existing literature prior to data collection. According to the author, the value of that abstract model was that it indicated preliminary propositions which helped to guide the research effort, through refinement, to the development of a grounded theory. In another study by Hinton and Hamilton (2015) which sought to understand how and why the construction industry in New Zealand persists with competitive tendering, despite the

known inefficiencies of that procurement model. The first author acknowledged the existence of early influencers (i.e. extensive pre-experience in the construction industry), and thus they adopted a constructivist GTM as it values the role of the researcher (including pre-existing knowledge) during data collection and analysis. These arguments thus support this study's justification for the tentative use of literature and guiding propositions as part of its interpretative A-D-I-A GTM. The next sections explain the research methods and procedures adopted for data collection and analysis.

3.8 Research Methods

This section details how the principles of the grounded theory approach are practically applied in this study. It begins with the illustration of data collection procedures including the research scope and ethical considerations, sampling and data collection methods. The coding processes and data analysis and interpretation issues follow as well as a critical discussion on the choice and use of Nvivo– A qualitative data analysis software package. Finally a summary and a reflection on the limitations of GTM is provided.

Grounded theory is more distinctive than other qualitative approaches, due to its emergent, comparative and interactive attributes (Charmaz, 2008). Based on an extensive literature review of grounded-theory studies, work by Sbaraini *et al.* (2011) identified a number of fundamental components of a grounded theory study, as shown in Table 3.4. These components will be discussed in the following subsections.

Table 3.4: Fundamental components of a GT study [adapted from Sbaraini *et al.* (2011)]

Component	Stage
Openness	Throughout the study
Theoretical sampling	Sampling and data collection
Analysing immediately	Data collection and analysis
Coding and data comparison	Analysis
Memo-writing (sometimes also drawing diagrams)	Analysis
Theoretical saturation	Sampling, data collection and analysis
Production of a substantive theory	Analysis and interpretation

3.8.1 Research scope and setting

The scope of this study is commercial and industrial construction as well as smart-motorway infrastructure projects. The fragmented nature of the industry meant that a large number of cases would be needed. However, it is important to stress that a qualitative study guided by GTM does not seek representativeness to achieve statistical generalisability but instead aims to explain and sometimes perhaps predict phenomena based on empirical data. In a GT studies, data collection typically encompasses the use of in-depth interviews but can also include other sources of data such as existing research literature, focus groups, supporting documentation, and even quantitative data. In GT “all is data” (Glaser, 2007); it is up to the GT researcher to figure out what data they need to acquire (Glaser and Holton, 2004).

The primary method of data collection used in this study was in-depth semi-structured interviews. These 19.2 hours of interviews (with 24 senior professionals within the UK construction industry) were recorded and transcribed into around 340 pages of primary qualitative data. Interviews lasted from 100 minutes to 15 minutes, with an average of 48 minutes. Initial interviews lasted longer and centred on wide-ranging issues relating to typical examples and causes of process waste and value-loss encountered in projects, and imperfect construction procurement and contractual experiences and their consequences. As concepts emerged and approached saturation, interview questions became more specific and targeted.

3.8.2 Ethical considerations

This research adheres to the guidelines for the ethical conduct of research set by the Nottingham Trent’s Graduate School. Ethical approval was obtained from the Research Ethics Committee at Nottingham Trent University (NTU). The author was informed on 16th October 2015 that the Joint Inter College Ethics Committee (JICEC) at NTU was happy to confirm that in its judgement there were no outstanding ethical concerns that required further discussion or exploration prior to data collection related to the research study. The study ensured that participation was voluntary and that participants are free to withdraw at any time. This was clearly stated in the invitation sheet sent to research participants (See Appendix 1), which clearly stated what the research was about, what it

involved, and ensured data protection. Informed consent for participation and recording of interviews was taken by email from respondents willing to participate and then verbal acceptance was taken once again prior to recordings of interviews. In addition, all information collected for this study was kept strictly confidential and full anonymity of participants was ensured during the collection, storage, analysis, and publication of research material in accordance with NTU's policies and procedures.

3.8.3 Preliminary purposive sampling

Grounded theory studies are characterised by the use of theoretical sampling, but this has to be based on some initial data collection and analysis. The sampling process, therefore, has to start purposively, as in most qualitative studies, in order to allow the study to adopt a theoretical sampling strategy (Sbaraini et al., 2011). Thus, this study initially used a generic purposive sampling approach (Bryman, 2012) before theoretical sampling was possible. Purpose sampling is a non-random technique that does not demand a set number of participants (Etikan *et al.*, 2016). Instead, it puts the research questions under investigation at the forefront of sampling considerations (Bryman, 2012). Through this approach, the researcher decides what needs to be known, and deliberately chooses suitable participants who can and are willing to provide the information by virtue of their knowledge or experience. Based on these considerations, a set of open-ended questions were formulated for semi-structured interviews (See Appendix 2). The interview guide was examined by the Joint Inter College Ethics Committee (JICEC) at NTU and obtained ethical clearance prior to data collection (Appendix 3). The set of questions included in the preliminary guide was structured to achieve the three following objectives that were also mentioned in the invitation sheet:

1. Exploring the factors influencing the selection of construction procurement arrangements
2. Investigating the influence of procurement arrangements on project-team interaction, behaviour, and performance;
3. Seeking evidence for practical examples of waste or value-loss arising from construction procurement and commercial practices.

Prior to data collection, a pilot study was conducted with professional industry practitioners. An invitation sheet was sent to six reviewers by e-mail, at which four of them responded back on time (two contractors and two consultants). The reviewers were asked to:

- Provide feedback up on the 2-page cover/invitation sheet for interviews which included the research project information as well as ethical information.
- Review the proposed set of questions prepared for interviews (interview guide). While doing so, the reviewers were requested to pay particular attention to the following:
 - Whether they believe or not that the set of questions included could enable help the study to achieve its objectives? Any suggested questions to be added, removed or rephrased?
 - If the language/questions used are relevant and simple so that industry practitioners would easily understand?
 - If they think that any of the proposed questions are leading, biased or my make interviewees feel uncomfortable?
- Recommend, if possible, potential participants whom they think might be interested in contributing to the study.

Feedback received was positive and helped to improve the relevance and clarity of the terms and questions included in the semi-structured interview guide. An example of feedback received is as follows:

“I looked at your research and interview questions. They seem pretty good and should provide some exploratory data for your research...The procurement methods may dictate: responsibility, liability, payment, governance structure, on-boarding time, ability to communicate, etc. I think that the governance structure, liability, payment, and inability to communicate may be the factors that directly lead to waste in a project... I suspect that it may not be the procurement system themselves that cause waste but the practices that they may intentionally or unintentionally advocate...There are other context factors such

as the owner, complexity, and size of the project that influence the choice of a procurement method” (Consultant, 30th September, 2015, E-mail message).

In addition, from feedback received, it appeared that the term ‘procurement’ has various meanings in the minds of construction professionals, and that is commonly limited to the procurement of materials and goods. To overcome this issue, a supporting appendix which includes a diagram that defines the study’s wider understanding of construction procurement systems (CPSs) was devised. This virtual definition provided was regarded as important, as it helps to establish shared understanding between the researcher and interview participants around an important theme within the topic under investigation. Following this, the study initially targeted four industry experts with at least 13 years of extensive relevant practical experience in construction, as part of a generic purposive sampling strategy (Bryman, 2012).

The first interview was conducted on the 13th October 2015 with an experienced turnaround project manager. The second interviewee is a senior consultant and a fellow member of the Institution of Civil Engineers (ICE). The third is a president of a lean consultancy company, while the fourth works as a certified senior project manager. The average duration of these three in-depth interviews was around 1 hour and 15 minutes. ‘Memo-writing’ took place ‘immediately’ after each interview was completed. This ‘memoing’ process included reflections on how the interview went, and taking notes on critical themes and topics discussed during interviews. Subsequently, full transcription of each interview was carried out by the researcher, and data was then qualitatively analysed using NVivo 10 software.

3.8.4 Theoretical sampling and interviewing technique

One of the distinctive features of grounded theory is that its sample relies on theoretical considerations rather than statistical considerations (Bryman, 2012). This means that the sample size cannot be pre-determined in advance. Instead an on-going and iterative sampling technique called ‘theoretical sampling’ is employed. Glaser and Strauss (1967, p. 45) define theoretical sampling as a “*process of data collection for generating theory*

whereby the analyst jointly collects, codes, and analyses his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges". After initial data collection and analysis was completed, the study employed theoretical sampling to determine who to sample next and what questions to ask during interviews, until theoretical saturation was achieved. Therefore, at this stage, the researcher did not adhere to the semi-structured interview guide used for initial data collection any longer. Questions were continuously modified or altered based on prior data analysis and depending on information needed for data comparison and saturation of categories. Table 3.5 provides an overview of the sample characteristics of this study.

In addition, the selection of potential interviewees was not pre-determined. Instead data collection was controlled by emerging theoretical categories, in the course of analysing data that have been collected. So for example, interviewee no. 4 (in Table 7) is a project manager who was asked to talk to the researcher about practical examples of waste or value-loss that he as a project manager believes are challenging, repeated or are typical in projects that he is engaged in. So his response was as follows:

"There is one point which in my experience that each and every construction site suffers. It is about recesses...Recesses in walls, in brick works, ceilings and so on. So it is exactly the interface between the technical parts of the building and the civil works or the plastering works or whatsoever. And during the planning stage, the design and planning team is stinging-off the pipes and the cablings and so on. And building up and designing special ways. Usually they are not able to put the recesses in aright order or in the right size. And usually they are making them much bigger. And when it comes to the execution, in some cases they are either in the wrong place because the contractors coordinated their works on-site with the construction management, and then they shifted some parts of the installations, and so recesses are not in the right place" (Certified senior project manager, 3rd November, 2015, Skype interview).

As a result, the researcher asked more probing questions in relation to the context of the situation, consequences of the incident, and possible root-causes of the problem from

the interviewee's perspective. When asked about whom he believes to be mainly responsible for the occurrence of this typical example of value loss relating (i.e. inaccurate design and installation of wall recesses), his answer was as follows:

“I would say that the answer is of the designer. Once there is a problem on site and I tell him it was your fault as you did not consider that and that and that, and he would say (the usual answer is) I did not have that information at that point in time. This is the most common answer I would get; and, and in most cases, he is right! And that is what the partnering and collaborative methods try to minimise - That these information are really lacking at that point, at that moment, the design documents are prepared” (Certified senior project manager, 3rd November, 2015, Skype interview).

The data collection, coding and analysis there guided the researcher to decide to interview a senior designer for deeper investigation and data-comparison purposes. Therefore, based on theoretical sampling principles, the following interview was arranged and conducted with a senior architect and a director of framework arrangements in a leading construction company. The interviewee was informed about the story related to the design and installation of recesses and asked whether he experienced a similar situation. The interviewee's response came as follows:

“Yeah, yeah I would say that's fairly common. I would push it a lit bit further back. It is not the designers that are the problem; it is the client. The client is not prepared to pay for the detailed design and investigation that might be needed to be able to get things right. I think part of the problem as well is lack of integration in the team. So I'll split into two issues: one is design coordination and the other one is actually incomplete design” (Head of Innovation and Director of National Frameworks (Senior Architect), 8th November, 2015, Skype interview).

Consequently, the rest of the semi-structured interview with the senior architect focussed on investigating factors that lead to poor design coordination and incomplete design from the participant's point of view, in addition to a number of other questions

that emerged from data analysis of previously collected and coded data. This evolving process of interviewing and coding and analysis of data continued till the study reached a state of theoretical saturation.

Table 3.5: Sample information

Seq.	Professional Role / Title	duration (mins)	Data collected
1	Turnaround Project Manager	100	S+E
2	Senior Consultant (FICE)	69	P+E+D
3	President of a lean consultancy company	60	S
4	Certified Senior Project Manager (PMP, MRICS)	65	S+E
5	Head of Innovation and Director of National Frameworks (Senior Architect)	57	S
6	Project manager - Subcontractor	51	S
7	Head of Supply-chain at a leading contractor	60	S
8	Senior Procurement and Performance Consultant (PhD)	90	P
9	Managing Director and Principal Consultant at a Rail consultancy company	50	S
10	Senior QS at a leading contractor	39	P
11	Site manager working for small contractor and Lean Specialist	75	S
12	Senior Cost Consultant (MRICS)	56	S
13	Director and Project Manager at a specialist subcontractor (Trenchless drainage repairs)	33	P
14	Senior Design Coordinator at a leading contractor	45	P+D
15	Business Development Manager at a major contractor	30	P
16	ECC Project Manager (CEng, MICE)	36	P
17	Senior Architect & BIM Manager (MCIAT, PMP)	45	S
18	Site Agent (CEng) at a leading contractor	40	P+F+D
19	Associate Director at a leading cost consultancy and QS company – Financial governance	35	P+D
20	Deputy ECC Project Manager (CEng, MICE)	33	P+E
21	Sub-agent at a leading contractor	27	(S+E+D)
22	Project Planner agent at a leading contractor		
23	Principal Design Engineer	40	P
24	Senior Project Manager and Consultant	15	P

* Seq.= sequence; S= skype video interview, P= phone interview, E= follow-up questions by e-mail, F= follow-up by phone, D= supporting documents sent by e-mail

This study relied on the use of qualitative semi-structured interviews, as part of an adapted grounded theory methodology, instead of participant observations. Each of these two contrasting methods has its own merits and demerits. However, there are a number of issues which can make qualitative interviewing exhibit advantages over participant observation. For instance, in this study, there are various issues that are simply not amenable to observation, so that asking participants about them represents the only possible means for finding about them within a qualitative research approach. Examples of these include issues associated with commercial sensitivity, reasons for inclusion of special contractual clauses, opportunistic practices, contingency values and so on. Other important factors include: ethical and confidentiality considerations, allowing for reconstruction of events, avoiding reactive effects due to observation, and greater breadth of coverage in terms of access to wider variety of situations and people (Bryman, 2012, pp.495-496).

The two main options for conducting qualitative research interviews are face-to-face or by telephone. The former is the most common, and probably the best, mode in which to conduct interviews (Oltmann, 2016). However, telephone interviewing is likely to have certain advantages when compared to face-to-face interviewing (Irvine *et al.*, 2010); most obviously, minimal travel time and cost. Furthermore, using telephone interviewing can be a more effective mode when asking sensitive questions, as it can help interviewees to feel less intrusive or distressed about answering when the interviewer is not physically present (Bryman, 2012, p. 488). However, there are a few concerns related to lack of ability to access visual or non-verbal cues and technical issues associated with quality of phone line (Irvine *et al.*, 2010).

At the same time, advances in technology and internet-based methods of communication are becoming increasingly important and popular in qualitative social science research. According to Sullivan (2012), the use of video conference can allow researchers to interview a wide range of geographically dispersed individuals with a recorded interaction that at least mimics face-to-face interactions. Based on these considerations, this research study conducted interviews via telephone and Skype video-conferencing rather than face-to face-meetings, as shown in Table 3.5 above. Skype

video conferencing was the favoured approach; however telephone interviews were conducted when this was not possible.

On some occasions, follow up questions were sent to participants by e-mail or discussed through the phone, when needed, to ask for clarifications on the accuracy of unclear parts of transcriptions or when the researcher needed the interviewees to probe on some of their answers provided during interview. Although, Forbes and Henderson (2005) advise researchers to take careful considerations about the ethical and epistemological implications of sharing transcripts with participants, the experience in this study has been quite different and positive. First of all, the researcher did not share full transcripts with participants. Instead, participants were only asked to check the accuracy of the researcher's transcription to very few words or sentences. Therefore, the aim in this case was to avoid guessing, and thus ensure accuracy of meanings and interpretations. On other case, the aim of these follow ups was to ask participants for more detail or to request for supporting evidence or documents. This practice is encouraged by Charmaz (2006) as it aligns with her recommended intensive interviewing technique for grounded theory studies. Examples of supporting documents received from participants include:

- Form of agreement and contract data of an ongoing infrastructure project (268 pages)
- Samples of planning sheets related to resource quantities and scheduling
- Samples of weekly work plans and consolidated as-built Percentage Plan Completed (PPC) charts and diagrams, including analysis of reasons for non-completion (RNC).
- Template of tool-kit used for measuring supply-chain performance
- Power-point presentation about a leading consultant firm's strategy and major commercial services

3.8.5 Coding procedures

Coding is one of the core processes in grounded-theory (Bohm, 2004; Holton, 2007). It entails analysing the data that we have collected and assigning meaningful codes to

parts of it (keywords, terms, phrases) that seem to be of theoretical significance and/or appear to be salient within the social context of the phenomena under investigations (Bryman, 2012, pp. 568). As described by Charmaz (1983, pp. 186), codes serve as “*shorthand devices to label, separate, compile, and organise data*”. In terms of stance toward coding, Charmaz (2006, p. 50) recommends grounded theorists to remain open, stay close to data, and compare data with data. This study followed Strauss and Corbin’s (1998) three stages of coding: open, axial and selective coding. These stages gradually cluster codes in collected data and refine emerging theoretical concepts and categories (Gasson 2004) through continuous memoing and constant comparison until theoretical saturation is achieved, as illustrated in Figure 3.4. A more detailed illustration of the coding analysis is provided in Chapter 4, 5 and 6 (Data analysis)

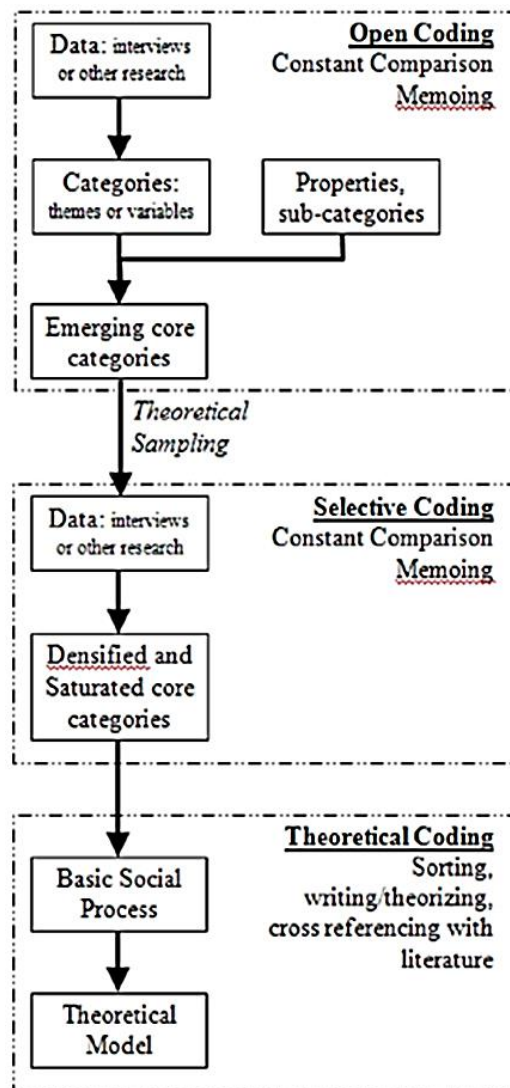
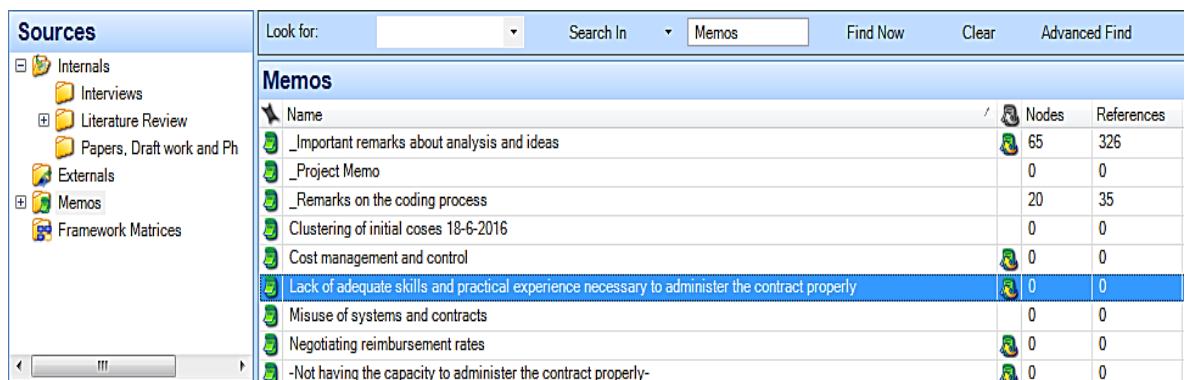


Figure 3.4: Coding processes in grounded theory (Jones and Alony, 2011)

3.8.6 Memo writing

Memo-writing (Memoing) is an ongoing technique that allows grounded theorists to record and reflect on their understandings of and insights into the data. This reflective technique helps to refine emerging categories and to systematically guide theory development (Charmaz, 2006). Memos were written throughout the data collection and analysis processes of this study. It enabled the researcher to record his analytical thinking and to reflect up on the context within which the study's conceptual model was developed. This included writing memos about reflections on interviews, ideas about codes and their relationships, analysis of evolving categories and the relationships between cases and categories as the study progressed. In these memos, the researcher raised questions that need to be answered in following interviews, and also made comparisons between cases, codes and categories in order to find relationships. Figure 3.5 provides a snapshot screen of some of the memos that the researcher created within NVivo.



Name	Nodes	References
_Important remarks about analysis and ideas	65	326
_Project Memo	0	0
_Remarks on the coding process	20	35
Clustering of initial cases 18-6-2016	0	0
Cost management and control	0	0
Lack of adequate skills and practical experience necessary to administer the contract properly	0	0
Misuse of systems and contracts	0	0
Negotiating reimbursement rates	0	0
-Not having the capacity to administer the contract properly-	0	0

Figure 3.5: Snap shot of memos

3.8.7 Data Comparison and Theoretical Saturation

Grounded theory is developed through constant comparison of data collected from theoretical sampling, which entails this methodological approach its analytic power and grounds the developed theory in the data (Charmaz, 2006). The constant comparative method enables the researcher to develop categories and concepts by coding and analysing data simultaneously (Kolb, 2012). As themes and categories start to accumulate, constant comparison compels the researcher to reflect on the data and emerging conceptual models, usually through writing memos (Jones and Alony, 2012). Figure 3.6 illustrates the process of constant data comparison.

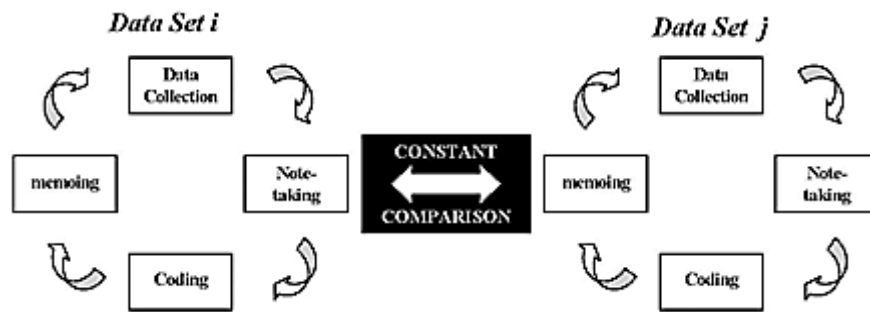


Figure 3.6: Constant Data Comparison (Jones and Alony, 2012) [Derived from Glaser, 1978; 1992; 1998; 2001; Glaser & Strauss, 1967]

Throughout data collection and analysis of the study, data comparison was constantly conducted at each coding level and across different levels until the conceptual model was developed and saturated. This entailed comparing the raw data during the initial (open) coding process within interviews and between interviews. The purpose of this sense-making comparison process was to identify any trends, similarities and differences, in order to form meanings and to develop theoretical concepts and categories (Strauss and Corbin, 1998). It was also used to compare between data selection within categories and check whether selected data fit to existing categories or not.

‘Theoretical saturation’ is achieved when the data collected for the study no longer suggests new dimensions of theoretical categories or new insights to emergent theory (Bryman, 2012, pp. 421). In this study, data was collected and analysed in an iterative and ongoing process until the study reached a point where new data were no longer leading to the formation of new categories or providing new insights to the developed conceptual model.

3.8.8 The choice and use of NVivo as a CAQDAS for this study

Data analysis in qualitative research entails systematically organising and making sense of raw data that is collected by the researcher to gain a better understanding of the phenomenon under investigation (Wong, 2008). The process of analysing qualitative data basically involves coding large amounts of interview transcripts, observational

notes or other non-textual material (e.g. pictures and videos), followed by searching for significant patterns in the data, and subsequently identifying themes and developing categories. Traditionally, data coding and categorising was conducted manually with the use of coloured pens, papers, note cards, and a pair of scissors to mark, cut and sort the data. Other traditional processes for qualitative data analysis included manually counting the frequency of words or collections of words (King, 2008). In general, such manual processes could be very time consuming and complicated.

Over recent years, researchers increasingly make use of computer assisted qualitative data analysis software (CAQDAS). The use of CAQDAS is seen as significant in terms of increasing the efficiency and speeding up the process of categorising and retrieving coded data— something that has been previously manually daunting (King, 2008; Salmons and Kaczynski, 2016), especially when dealing with large amounts of qualitative data. It is also regarded as useful in aiding the researcher in keeping record and providing an audit of the entire data analysis process (Bringer *et al.*, 2006); thereby enhancing the transparency and quality of the research (Welsh, 2002; Salmons and Kaczynski, 2016). Nevertheless, it is important to stress that CAQDAS programs do not analyse the data for the researcher (Denzin and Lincoln, 2005; King, 2008). It is the researcher who decides what to code, collate, categorise, and draws meanings from the data, rather than the software program used (Wong, 2008; Leech and Onwuegbuzie, 2011).

There are however some concerns and downfalls associated with the use of CAQDAS. For instance, the time investment needed in order to learn and become familiar with the CAQDAS package is a significant factor worth consideration (Welsh, 2002; Salmons and Kaczynski, 2016). That is because CAQDAS may not be appropriate for use when dealing with small amounts of data (The University of Northampton, 2017). There is also the danger of researchers ‘getting too close to the data’ without giving the distance needed to reflect and consider the bigger picture (King, 2008); a phenomenon that is described as the ‘coding trap’ (Gilbert, 2002). The main concern here is that overreliance on the CAQDAS may lead to overuse of coding and thus losing perspective (e.g. by taking extracts or quotes out of context) (King, 2008; The

University of Northampton, 2017). In addition, there is also a concern that overreliance on CAQDAS may lead researchers to focus merely on procedural criteria (e.g. providing an audit trail and checklists as a safeguard) without due consideration of the underlying philosophical and methodological criteria (Salmona and Kaczynski, 2016). For example, Kelle (1997) argued that many researchers claim to be adopting a grounded theory methodology for their studies, when in fact they are just applying a ‘coding paradigm’ using a CADQAS. It is therefore important for researchers to focus on providing a transparent account of both their analytical and methodological processes (Bringer *et al.*, 2004), so as to enhance the quality and credibility of their research work (Salmona and Kaczynski, 2016). As recommended by King (2008):

“it is important to remember that CAQDAS is not an end in itself and if users become overly focused on the software itself in a misguided attempt to find a ‘right’ way of analysing data, it is likely that they will become entrenched in the detail and potentially reduce the ability to build theory. As building theory is the ultimate goal of most qualitative research we need to ensure that we continue to operate at a deeper level and consider the methodological and philosophical issues relating to the research design” (p. 141).

The decision about whether to use CAQDAS, or not, is ultimately that of the researcher. It is important, though, that researchers recognise the value of both manual and computer assisted methods in qualitative data analysis (Welsh, 2002). Accordingly, it is suggested that researchers should remain open to, and make use of, the advantages of each (Welsh, 2002). The University of Northampton (2017) provides a basic guide that could help researchers to decide if they should use a CAQDAS (e.g. NVivo), or not, for analysing their qualitative data (Table 3.6)

Table 3.6: A guide for helping researchers to choose between the use of CAQDAS or manual methods [Adapted from The University of Northampton (2017)]

Question	CAQDAS	Manual Analysis
The amount of data you are collecting?	Big amount – More than 10-15 interviews/ texts / images, etc.	Small amount – Fewer than 10 interviews/ texts / images etc.
Length or size of your pieces of data (interviews/ texts /	Interviews last at least 45 minutes or an hour each / text	Interviews under 30 minutes / text under 2-3 pages each /

images)?	over 5 pages each / large complex images	small simple images
Collecting different types of data?	Yes – e.g. video, images, audio, observation notes, and interviews	No – just interviews OR texts
Richness or complexity of the collected data?	Each interview/ text / image has loads of key themes and interesting points I want to pick up on	Each interview / text / image has one or two key themes or points for my analysis
Will your analysis require linking different parts of the data together?	Yes, different themes will probably come up under different questions / topics	No, I can just deal with each question / topic separately

* The numbers provided within the Table are rough estimates only

Considering the large amount, different types, and richness of data collected for this study (see section 3.8.1 and Table 3.5) as well as the holistic characteristic of the topic under investigation (i.e. Institutional waste within the UK construction industry), it was decided to use a CAQDAS to help the researcher with managing and organising the qualitative data collected for this study, while following the grounded-theory guidelines and procedures (outlined in sections 3.7 and 3.8).

A wide range of CAQDAS packages are nowadays available for researchers, such as: Atlas.ti, MAXQDA, NVivo, HyperRESEARCH, QDA Miner, Qualrus and Leximancer (King, 2008; Gibbs, 2013; Sotiriadou *et al.*, 2014). According to Gibbs (2013), almost any of the popular CAQDAS programs could be utilised for any research project entailing straightforward coding and thematic analysis (Gibbs, 2013). However, an informed assessment of the different software choices would need to be made, if the research project requires additional features (e.g. the ability to share projects in a team). There are, however, other factors that frequently serve to influence the researcher's decision as to which software package to use. These factors include the researcher's cost and time constraints, the software package that the researcher's university is already using, what help and expertise is available for the researcher, recommendations offered by colleagues, and the philosophical and methodological assumptions taken by the researcher as well as the analytic approach adopted for the research project (Welsh, 2002; King, 2008; Gibbs, 2013; Sotiriadou *et al.*, 2014; Salmona and Kaczynski, 2016).

The qualitative data analysis program NVivo 10 program (QSR, 2014) was chosen as the CAQDAS program to be used for this study for various reasons. Firstly, because “*it is designed to facilitate common qualitative techniques for organising, analysing and sharing data*” (QSR International, 2014, pp. 5); thus it is suitable for a researcher aiming to develop new concepts or hypotheses using a ‘grounded theory’ approach (Bringer *et al.*, 2006; Hutchison *et al.*, 2010) — as is the case for this study. Secondly, NVivo is the main qualitative analysis software already in use at Nottingham Trent University (NTU). So, the author of this study was able to attend a training course for academic members of staff and doctorate students at NTU to learn how to use the NVivo software program. Thirdly, the second supervisor of this study had prior experiences with conducting thematic analysis using NVivo. This was useful as his expertise with the use of NVivo was used to interrogate how the researcher coded, synthesised and interpreted meanings from the data (see section 3.10.1). Fourthly, QSR International (Melbourne, Australia), the developer of NVivo, provides a wide range of tutorials, guides, forums, and resources for self-help on their website. Fifthly, NVivo is one of the most commonly used CAQDASs that is mentioned in published academic studies (see for example, Welsh, 2002; Bazeley, 2007; Wong, 2008; Wiltshier, 2011; Leech and Onwuegbuzie, 2011; Sotiriadou *et al.*, 2016). All of these above-mentioned reasons combined together to drive the decision to use NVivo 10 in assisting the researcher with managing and analysing the qualitative data collected for this study.

The use of Nvivo 10 helped the researcher to take the qualitative data analysis much further than it would have been possible manually, in the time available. For example, NVivo helped the researcher in:

- *Organising and managing a large dataset systematically* – Nvivo enabled the researcher to import different types of data into the research project (e.g. interview transcripts, follow-up email texts, supporting documents) and group them in different ways using folders and cases; thereby allowing the researcher to access, organise and manage raw data easily. Nvivo also allowed the researcher to view which parts of the raw data have been coded, and retrieve them, whenever needed at a glance. It also made it possible for the researcher to create ‘thematic nodes’, which

act as coding containers. These nodes were then organised and merged to create hierarchies using parent and child nodes; thus by this way supporting the development of themes and categories. Additionally, the use of NVivo enabled the researcher to explore the content of any node (i.e. coded references and the name of the source that was coded) whenever needed; thereby allowing for an efficient review of coded data.

- *Data linking* – NVivo allowed the researcher to easily connect relevant data segments and documents to each other using hyperlinks. More specifically, Nvivo enabled the researcher to attach external files, links, and internal annotations to any piece of text in the transcripts or coded data, to record referential information that may be significant for context. This data-linking ability also made it possible for the researcher to create more seamless links between literature review notes, coded data, and reflective commentaries and ideas recorded in memos.
- *Carrying out such a search electronically* – This tool helped the researcher to locate keywords or segments of texts easily, leading to more reliable and accurate search results than doing it manually simply because human error is ruled out. The search tool was also useful in terms of enabling the researcher to interrogate and gain an overall impression of the data, whenever required. For instance, while conducting ‘constant data comparison analysis’ (Glaser & Strauss, 1967; Strauss & Corbin, 1998), it helped the researcher to find relevant information and codes throughout the large dataset of this study in a speedy manner.
- *Using queries to explore and analyse coded data* – Nvivo allows the researcher to conduct various queries, such as: (i) Coding Query; (ii) Matrix Coding Query; (iii) Coding Comparison Query; (v) Compound Query; and (vi) Group Query (see QSR International, 2014). This study exploited the ‘Matrix Coding Query’ tool, which enabled the researcher to interrogate the data, ask questions, and to seek explanations based on the resulting patterns in the data (see Table 8.1 and Figure 8.7).
- *Creating models or generating graphs to visualise connections in the data* – This option is significant, as it helped the researcher to explore and make-sense of

connections in the data, and to visualise and present the findings and conclusions in the form of models or charts.

- *Sharing the research project using NVivo Server and managing secure backups in multiple locations* – The sharing option is significant as it allowed the researcher to share his work with his supervisor. This allowed the supervisor of this study to gain immediate access to the work whenever needed by the researcher. The use of Nvivo as a CAQDAS also meant that the researcher felt less stressed about any losses or damages to the research project in case of merely using a manual analysis approach, as the software allows for saving and storing backups in multiple locations (e.g. computer folders as well as Dropbox).

3.9 Limitations

This chapter has sought to illustrate how openness was maintained throughout the study, and to justify all decisions and choices made in relation to the research design. However this research study is not without limitations. This study has been conducted within time and cost constraints, both of which have had some implications on the size of the research sample and generalisability issues. However, it is important to stress that:

- The purpose of this study was to develop theory, not to test it; thus theoretical sampling is suitable (Eisenhardt and Graebner, 2007) and has helped to overcome bias in sampling and to enhance sample coverage (Barbour, 2001).
- The study focussed on identifying instances and cases that provide ‘explanatory sufficiency’ rather than ‘comprehensiveness’. Thus, it is argued that it is “*the quality of the theoretical inferences that are made out of qualitative data that is crucial to the assessment of generalisation*” (Bryman, 2012, pp. 406)

Grounded theory methodology (GTM) has limitations like any other research methodology. For instance GTM is known to be very complex and time-consuming due to the tedious coding processes, constant comparison and memo writing associated with data collection and analysis (Bryman, 2012, pp. 574). This study has dealt with this practical difficulty by using computer-assisted qualitative data analysis software (i.e.

NVivo 10) to speed up and help with the organisation and analysis of data. Other limitations of evolved and constructivist versions of GTM include critiques related to the interpretative and subjective influence on coding, data analysis and theory development. However, a number of techniques have been employed in this study to overcome these concerns. First of all, the study provided a clear explanation and justification for the underlying philosophy supporting the adapted research methodology (see section 3.5). This has been essential for explaining why an interpretative and qualitative approach is appropriate for this particular study, illustrating how the research inquiry will be conducted, and indicating how the findings and quality of the study should be assessed.

In addition, the researcher has acknowledged how that the tentative use of theory and abductive reasoning as part of a GTM has helped to enhance creativity while limiting what can and cannot be claimed. The use of an A-D-I-A grounded theory methodology (GTM) has helped to mitigate concerns associated with the deductive-conforming logic of positivist approaches (e.g. fitting data to prior theories). Instead the adapted version of GTM has helped the study to develop existing theory and to construct novel hypotheses. Furthermore, the study explicitly followed Strauss and Corbin's (1998) guidelines for data collection, coding and analysis, so as to enhance the reliability of the findings. The reflexivity and openness employed thorough the research inquiry of this study contributes to the overall credibility of the study. More details about procedures taken for improving the rigour and quality of the study is provided in the following section.

3.10 Rigour and Quality in Interpretative Grounded Theory Research

The application of quality criteria to qualitative research is a widely debated subject (Hammersley, 2007). Nevertheless, many scholars accept the need for clear and transparent criteria for judging the quality of research (Seale, 1999). By all means, it is logic to ascertain that qualitative research should not be assessed based on the positivist notion of validity (Lincoln and Guba, 2000). This assertion is justified on the basis that the positivist worldview is incommensurable with the interpretive assumptions of reality

(Gasson, 2004); and thus alternative perceptions of research legitimacy for interpretive studies is essential (Figure 3.7).

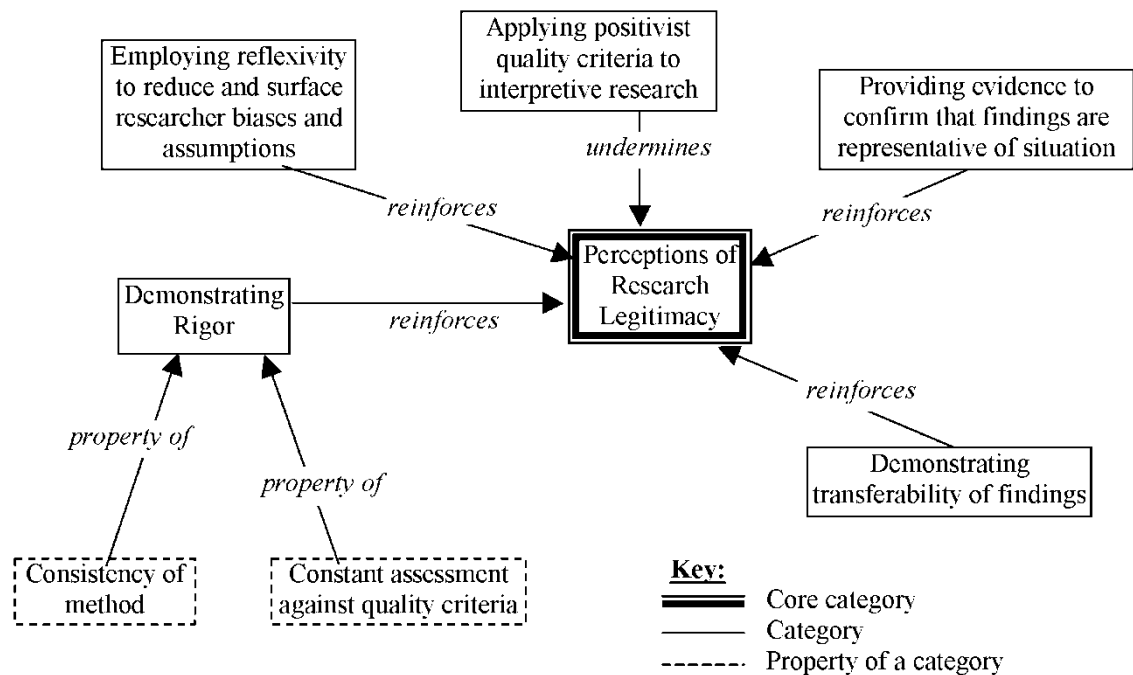


Figure 3.7: Research legitimacy in interpretative GT research (Gasson, 2004)

There is not, however, any consensus amongst scholars on universal quality criteria for qualitative studies. In other words, there is not a single set of quality criteria that is possible for application across all types of qualitative research (Hammersley, 2007). As explained by Patton (2002, p.542), variances in philosophical stances or theoretical underpinnings and strategies for inquiry generate different criteria for judging quality and rigour in qualitative research. Thus, in light of the underlying philosophy and underpinning methodology of this research, the study adopted the four quality criteria recommended by Charmaz (2006, p. 181-183) for grounded theory studies. These are: credibility, originality, resonance and usefulness. According to her, a combination of 'credibility' and 'originality' enhances the other two criteria of 'resonance' and 'usefulness'. The next sections summarise how these four criteria of grounded theory research were used to evaluate the findings and the explanatory sufficiency of the developed conceptual model of this study. Chapter 7 (Conceptual Model Evaluation) revisits these four criteria and addresses how each criterion has been met by this study.

3.10.1 Credibility

‘Credibility’ is the criterion to evaluate whether the findings of qualitative research represent a convincing and believable interpretation of the collected data (Charmaz, 2006). It entails providing sufficient evidence to confirm that findings are representative of the situation. In this study credibility was addressed in four different ways. Firstly, the researcher discussed the study’s research design in a detailed and transparent manner early in this chapter, to allow the reader to form an independent assessment of the study. In addition, a detailed illustration of how data analysis was conducted is presented in the following chapter (Chapter 4, 5 and 6). Secondly, the use of ‘constant data comparison’ and ‘theoretical sampling and saturation’ techniques has allowed the study to investigate incidents and cases from different sources; thus by this way enabling the study to consider and provide different perspectives and angles to the phenomena under investigation. Furthermore, the supplementary documents provided by the interviewees of this study have been useful in terms of providing evidence or better explanation to claims and arguments raised during interviews. The use of more than one data source, resource or method is classified as ‘triangulation’, which helps to improve the credibility of qualitative research (Bryman, 2012).

Thirdly as an independent audit trail, a review of the coding and analysis of collected data was conducted by the researcher’s academic supervisors at various stages throughout the research study. The aim of this audit was to reduce and surface the researcher’s biases and assumptions during data interpretation and coding stages. This included checking and ensuring that data was not forced to fit to predetermined codes and categories; instead concepts and categories were inductively generated from the raw data. Fourthly, research evaluation was conducted with various UK industry experts to evaluate the study’s developed conceptual model of ‘institutional waste in construction’ in terms of its relevance, reflection of the situation in real practice, and explanatory sufficiency. The participants were also asked through structured qualitative interviews to evaluate the main findings of the study. More details about the research evaluation exercise will be presented in Chapter 7 (conceptual model evaluation).

3.10.2 Originality

‘Originality’ in Charmaz’s (2006) criteria for grounded theory refers to originality of research findings, including an evaluation of whether the developed categories offer new insights, the social and theoretical significance of the work, and the extent to which the developed theory or conceptual model challenges current ideas, concepts and practices. Originality in this study was evaluated by three different ways. First, the researcher returned to literature to compare research findings with current knowledge in the field, and to identify insights within the developed conceptual model that didn’t exist in the topic guide, preliminary conceptual model or in the wider literature. Secondly, research evaluation was conducted with industry and academic experts in the field, in order to evaluate the originality of the findings and insights offered within the developed conceptual model. The outcomes of these assessments are presented within the discussions provided in Chapter 7 (Conceptual Model Evaluation), Chapter 8 (Discussion and Integration of Extant Literature), and Chapter 9 (Conclusions and Recommendations). Thirdly, originality was also assessed through publications of this study’s theoretical insights and research outcomes into leading peer-reviewed conferences and journals (see Section 9.6).

3.10.3 Resonance

The ‘resonance’ criterion implies evaluating how well the developed conceptual model portrays fullness of the studied experience, makes sense to the participants, and offers deeper insights about their social world and practices (Charmaz, 2006). The concepts and categories of this study emerged inductively from the raw data collected from the field. The use of abductive reasoning helped to establish relationships between categories. The findings and the final developed conceptual model were tested through research evaluation (Chapter 7), at which participants acknowledged that the model provides a clear and comprehensive representation of reality.

3.10.4 Usefulness

The ‘usefulness’ criterion is an evaluation of the research’s contributions to knowledge, impact on practice, and ability to spark further research (Charmaz, 2006). This was

assessed through research evaluation. The study provides a road map for future research directions and various recommendations Chapter 8 and 9.

3.11 Summary

This chapter critically discussed the philosophical stances and methodological approach underpinning this study. An 'interpretivist' epistemological position supported by a 'constructivist or relativist' ontological position, have been argued and adopted by this study. Accordingly, these aforementioned philosophical positions dictated the use of a 'qualitative' research strategy. This qualitative approach aligns with the 'exploratory' nature of the study. Exploratory research typically seeks to create hypotheses rather than test them. The goal of exploratory research is to formulate problems, clarify concepts, and form hypotheses; it does not intend to offer final and conclusive solutions to existing problems (Sanders et al., 2012). The qualitative research design of this study also responds to widespread criticisms related to the extensive use of quantitative methods, often associated with positivism, in construction management research (see Seymour and Rooke, 1995; Seymour et al., 1997; Koskela, 2017).

The methodology to be adopted for this study should lead to a holistic explanation of the underlying motives and behaviors associated with the use of imperfect construction procurement and commercial arrangements, along the extended construction industry supply chain. This pointed the study towards a choice between five main qualitative research methodologies that are commonly used in social science (Creswell, 2009). Accordingly, a grounded theory (GT) methodology was chosen. GT is a useful means to study a topic of interest or problem area that is under-explored (Strauss and Corbin, 1998). It is, therefore, particularly appropriate to this study, as little is known in existing literature about the relationship between institutions, project-procurement arrangements and the generation of waste or value-loss in construction (as discussed in chapter 2). A GT approach can also facilitate an in-depth understanding of the impact of the use of imperfect procurement arrangements on project-team performance and behaviour, grounded in the interpretations of the participants' construction procurement

experiences in the UK; thereby ensuring that the developed theory or conceptual model provides a close representation of social context.

Within the GTM tradition, there are various points of departure along a spiral of methodological development; the stance taken among the different variants of GT should therefore depend on the researcher's ontological and epistemological beliefs. Based on the philosophical assumptions underlying this research, a reflexive grounded theory methodology was adopted and adapted for this study. It draws upon both the legitimacy of the evolved approach to GT (Strauss and Corbin, 1998), and the abductive intent of the constructivist GTM (Charmaz, 2008). In this sense, the study supports the theoretical strand of evolved GTM, which argues that previous knowledge about the world and scientific theories (prior to data collection) are useful (Reichertz, 2010). In addition, the study takes the interpretative stance of both evolved and constructivist approaches to GT, which recognises the role of the researcher in theory building. The study also follows Strauss and Corbin's (1998) formal coding scheme (open, axial and selective coding procedures), as a means of reducing bias and ensuring consistency and quality of findings. Furthermore, the research is inspired by Charmaz's (2008, 2009) explicit adoption of abductive logic during data collection and analysis stages. However, this study adopted an A-D-I-A approach to theory building (Asvoll, 2013), at which abduction was adopted during data collection and analysis to foster theoretical innovation, but also used during research initiation to pave the way towards the contextual choice of topic guides

The chapter also provided a detailed description of how the principles of the grounded theory approach have been practically applied in this study. This encompassed an illustration of data collection procedures, the research scope, ethical considerations, sampling and data collection methods. This also included a detailed explanation of the coding processes, data analysis and interpretation issues. Furthermore a reflection on the limitations of the GTM and the steps taken for overcoming these challenges has been presented. Finally, in light of the underlying philosophy and underpinning methodology of this research, the study defined four quality criteria recommended by Charmaz (2006, p. 181-183) for assessing the rigour and quality of interpretative

grounded theory studies. This included a summary of how these four criteria were used to evaluate the findings and the explanatory sufficiency of the developed conceptual model of this study (Chapter 7 revisits these four criteria and addresses how each criterion has been met by the study). The next chapters (in particular, Chapters 4, 5 and 6) present the data analysis and findings that led to the development of the study's conceptual model of 'institutional waste' within the UK construction industry.

CHAPTER FOUR: PREVELANT INEFFICIENT PROCUREMENT PRACTICES IN CONSTRUCTION

4.1 Introduction

The previous chapter presented a critical discussion about the philosophical and methodological positions underlying the research study. It also provided a justification for the research methods employed for data collection and analysis. Chapters four, five and six will illustrate the data analysis of the study, and provide explanations to the various key themes and categories that emerged from the collected primary data, leading to the development of the study's conceptual model of 'institutional waste within the UK construction industry' (see Figure 4.1).

As explained in section 3.8.4 (in Chapter 3), the conceptual model development was based on evolving processes of coding and analysis of data collected through in-depth interviews with 24 professional practitioners within the UK construction industry. The research sample included participants covering various roles, industry sectors and supply-chain levels (e.g. contractors, designers, consultants, sub-contractors, supplies, owners, and client representatives). These participants were selected based on a combination of purposive and theoretical sampling techniques. All participants were provided with an invitation sheet, which outlined the research project's details, ethical issues, research aim and objectives, and potential practical contributions. The interviews were iterative, semi-structured, exploratory in nature, and controlled by the concepts and theoretical categories that emerged through the analysis of the collected raw data.

Chapters Four to Six, therefore, present the 'Results and Data Analysis' of the study. They illustrate the analytical processes that led to the development of the study's conceptual model that is grounded in the data. Through these three chapters, it is also demonstrated how inductive and abductive reasoning approaches have allowed the study to move beyond the relatively limited preliminary conceptual model (Figure 2.4 in Chapter 2) into a more useful and holistic conceptual model (Figure 4.1).

In chapters four, five and six, the four main categories and the constituent sub-categories of the developed conceptual model will be systematically analysed in detail. Whenever possible, direct quotes from the raw data will be drawn up on to demonstrate the logical connection between the developed categories and the collected primary data. This chapter (Chapter 4) focusses on illustrating how the category of ‘Inefficient Procurement Practices’ was developed. Subsequently, Chapter 5 presents the ‘effect’ of these inefficient procurement practices on project-team behaviour, performance and outcomes; thereby focussing on two categories of the conceptual model, which are ‘Inefficient Performances and Behaviours’ and ‘Consequential Wastes’. Following this, Chapter 6 explores the institutional ‘causes’ for the prevalence and persistence of the inefficient procurement practices identified in Chapter 4. The main findings of the data analysis (covered in Chapter 4, 5 and 6) will however be discussed in detail with reference to relevant extant literature in the ‘Discussion Chapter’ (Chapter 8).

4.1.1 A note on the place of the developed conceptual model within the structure of the thesis

This study adopted an A-D-I-A approach to theory building (see section 3.5). Typically, it would be expected in many qualitative studies, particularly inductive ones, to place and present the main outcome of the study (e.g. theoretical or conceptual model) towards the end of or following the data analysis. The advantage of such an approach is that the key outcome or final product of the study gets presented in a place that relatively fits the logical presentation of the study and aligns with how the actual research was conducted. However, in this study, it has been decided to present the developed conceptual model of the study at the beginning of the results and data analysis chapters (following the introduction to Chapter 4), due to two main reasons. Firstly, a large amount of qualitative data were collected, coded and analysed in this study, which consequently led to the emergence and development of a wide-range of categories and subcategories (as shown in Figure 4.1). Instead of presenting the processes and outcomes of the data analysis of this study within one excessively long chapter, it was decided to create three chapters within the structure of the thesis (Chapters 4, 5 and 6) to serve that purpose. The point of this decision was to make the presentation of the data coding and analysis processes more manageable and

comprehensible for the reader. Accordingly, it was also decided to introduce the final conceptual model that has been developed in this study at the beginning of Chapter 4, in order to enhance the focus of the reader (e.g. by reducing the chances that the readers gets lost as they progresses through the chapters).

Secondly, it was decided that providing the reader with the big picture in the first place, would allow them to see the patterns and overarching categories of the developed conceptual model of ‘institutional waste’ as a whole (i.e. big-picture reading), while at the same time motivating them to take a deeper look (i.e. close reading) at the detailed analytical processes and content that led to the development of the conceptual model, in particular the subcategories of the model. Having explained the reasons for presenting the developed conceptual model of this study in the introduction to this chapter, next an overview of the conceptual model of ‘institutional waste within the UK construction industry’ (Figure 4.1) is provided.

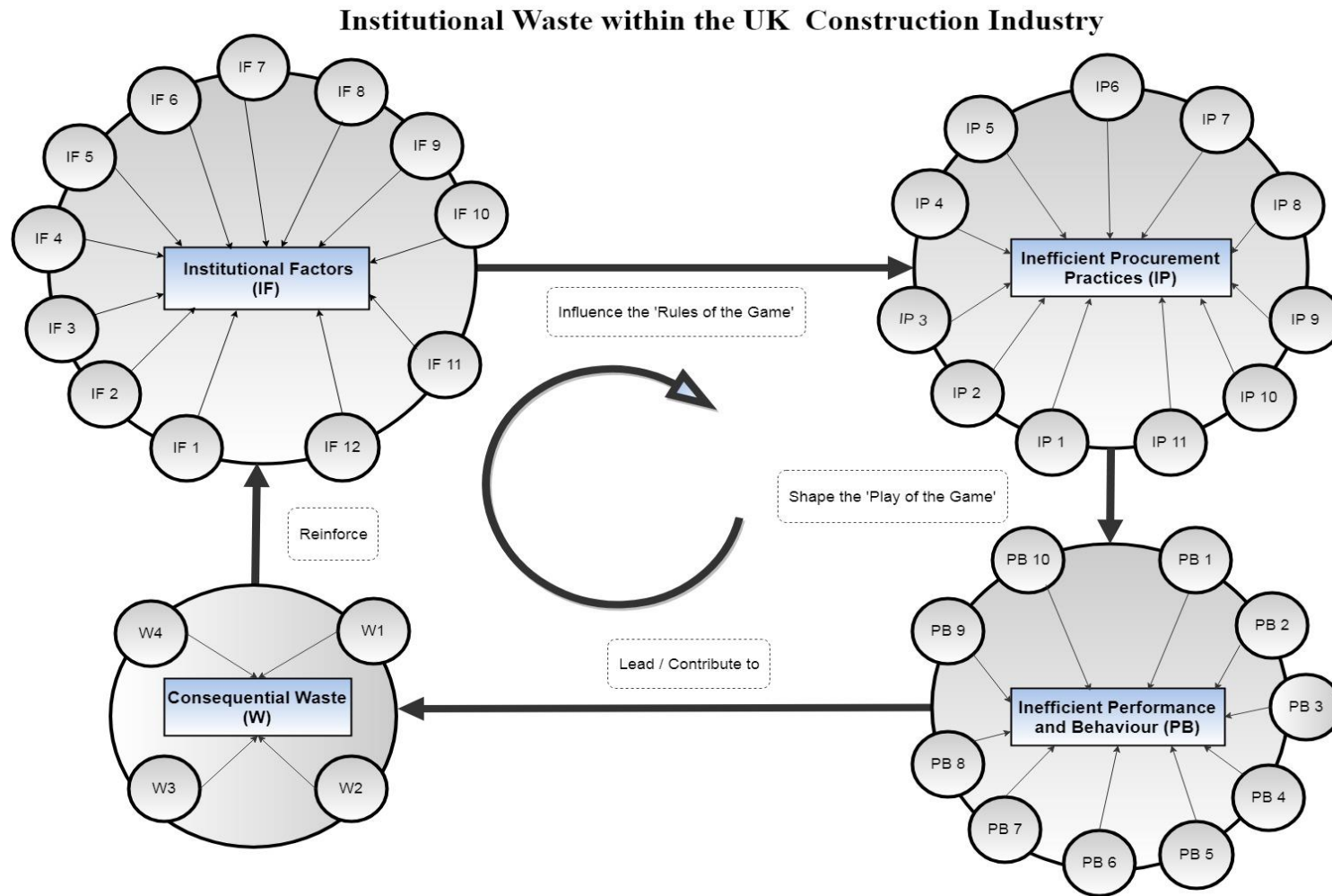


Figure 4.1: Developed Conceptual Model (See sub-sections below, and Appendix 4 for an explanation of abbreviated codes within the model)

4.1.2 An overview of the developed conceptual model of the study

The developed conceptual model of ‘institutional waste within in the UK construction industry’ reveals the role played by current prevailing ‘institutions’ in generating and entrenching ‘waste’ in construction projects. In specific, the model shows that current prevailing institutional factors influence construction procurement practices and arrangements (i.e. the rules of the game), which can lead to inefficient performances and behaviours (i.e. the play of the game), which will lead to consequential wastes. Furthermore, the conceptual model suggests that consequential wastes can reinforce institutional factors; thus forming a loop that leads to self-perpetuating cycles of waste.

The conceptual model is mainly ‘explanatory’ in nature. It offers novel explanations as to why the prevailing construction model is so embedded and so entrenched, despite the substantial attempts to address its recognised inadequacies. The model also provides novel insights into the reasons for the prevalence and persistence of wasteful procurement practices and behaviours in construction projects. At the same time, the conceptual model also includes a ‘predictive’ dimension, as the findings of the study that led to the development of the model indicate that the current (wasteful) construction model will persist, and even deteriorate, unless the institutional factors and the fundamental paradigms that underlie the prevailing model are addressed. Having provided an overview of the developed conceptual model of the study that is grounded in the data collected from the field (Figure 4.1), the rest of this chapter provides an in-depth and detailed description of the data coding and analysis processes that led to the development of the category of ‘Inefficient Procurement Practices’.

4.2 Inefficient Procurement Practices (IP)

The analysis of the primary data of this study led to the identification of various inefficient procurement (IP) practices and arrangements that prevail in the construction industry. It was also found in the study that these prevailing procurement practices lead to wasteful behaviours and actions. This chapter focuses on describing the coding structure that led to the development of the category titled ‘inefficient procurement practices’ and provides explanations to each of its eleven constituent sub-categories (see Figure 4.2).

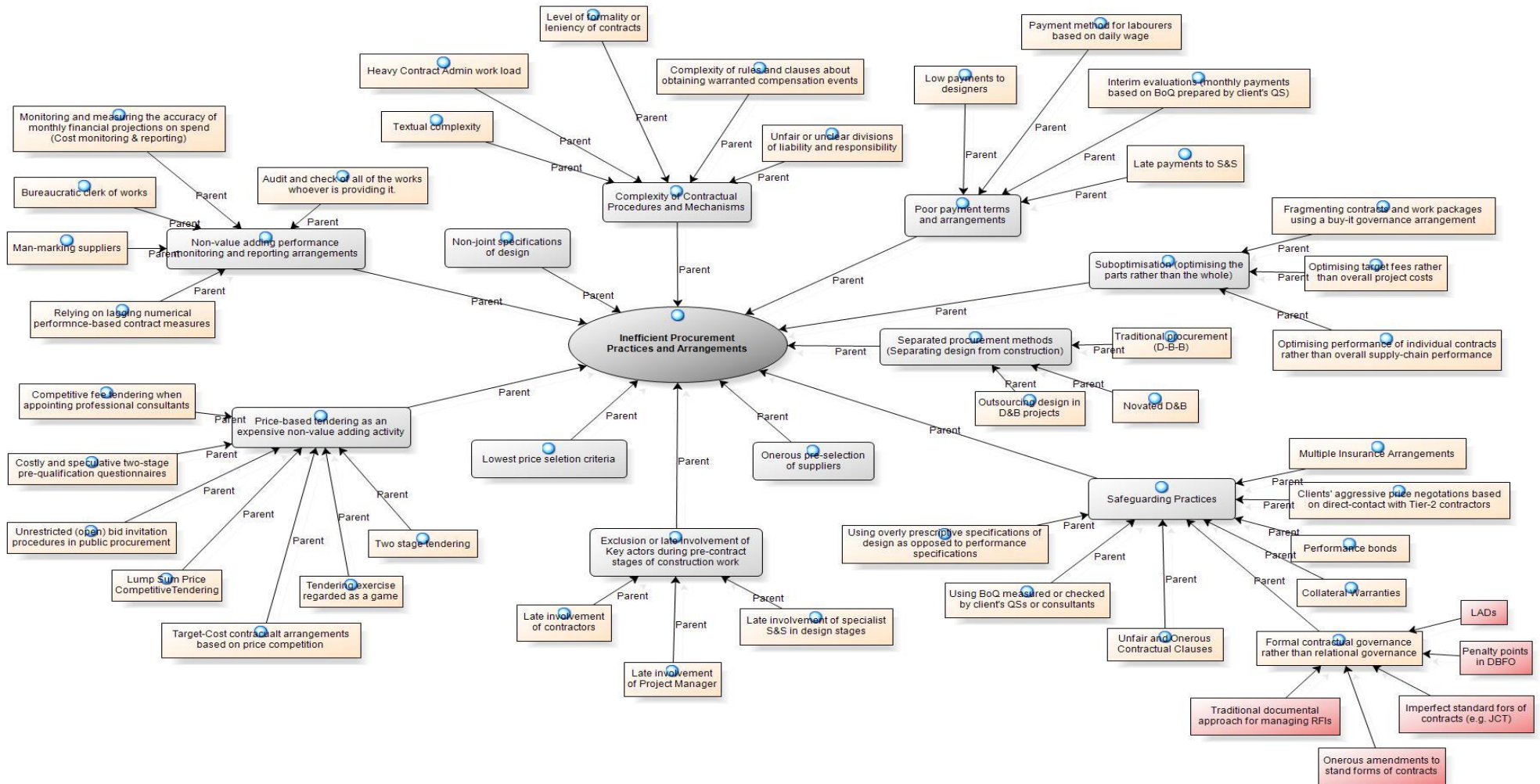


Figure 4.2: Coding structure of ‘Inefficient Procurement practices and arrangements’

4.2.1 Complexity of contractual procedures and Mechanisms (IP1)

One of the major and common problems associated with construction procurement, as described by the participants of this study, is the complexity of contractual mechanisms and procedures used in construction projects. Four themes emerged out of the primary data that led to the formation of this sub-category; these themes are as follows:

- Textual complexity,
- Level of formality or leniency of contracts
- Complexity of rules and clauses related to obtaining warranted compensation events
- Unfair or unclear divisions of liability or responsibility.

The complexity of contractual procedures and mechanisms can lead to various non-value adding activities (e.g. unnecessary heavy admin work load) which could lead to waste of human potential. It could also lead to adversarial relationships due to lack of common understanding, which in turn could lead to conflicts, which could lead to claims and disputes that are very costly and time consuming. In addition, textual complexity and the high levels of formality of contracts may encourage project participants to engage in opportunistic practices, as will be discussed in section 4.3.

When a senior QS working for a leading contractor was asked about the typical commercial challenges they face with their suppliers, he blamed and criticised subcontractors as follows:

“The biggest problem at the moment is that a lot of subcontractors do not understand what they sign to. So, in an NEC subcontract, it requires a quite depth administration and there are processes to follow and they are not particularly good at following those processes” (Senior QS, Nov 2015).

The QS was then asked about the reasons for subcontractors’ poor contract administration and whether it is related to lack of experience or not. The QS emphasised to the author that most of their suppliers are in long-term relationships with them. They also offer them full day courses that are focussed on the main requirements of the contract as requested (e.g. the compensation event processes) to try to give them a head

start before the job. Instead, the problem seems to him to be associated with resistance to change and to some extent linked to self-interest and inefficient habits and ways of working. This is described by the QS as follows:

“I think it is because you’re more used to dealing with other forms of contracts, so you are not used to dealing with the different requirements of the NEC. I guess maybe the use of JCT sort of mindset as opposed to being opened and collaborative, which then tries to drag you off towards that. I think it is a bit of that. And I then think that people fully need to understand what they sign for before the sign up to something that becomes a surprise to them when it perhaps should not” (Senior QS, Nov 2015).

In order to gain a deeper understanding of this issue, the author interviewed one of the subcontractors involved in the same project. The interviewee was asked about his opinion up on whether subcontractors find it difficult or not to administer NEC contracts, especially when it comes to early notifications and compensation events. The response was as follows:

Right, from our own opinion we are from an Irish-based company so we don't deal with NEC contracts until we came to the UK. And with learning terms to do with the NEC contracts, hmm the mechanisms within the NEC contracts are a bit complicated” (Director and Project Manager at a specialist subcontractor, 2016).

Interestingly, the subcontractor then blamed their client for using the contract in a bureaucratic way. He accused them of using the contractual rules related to assessing compensation events as a means to finding reasons to reject their claims, rather than using the early notification procedure as a way to solve problems as a team as early as possible. This has been mentioned by him as follows:

“We raise an early warning, we raise them with our main-contractor client, and then the problem we have then is them coming back actually looking. Hmm, we've raised them from our end but it's waiting for them to come back then from their end type of come to an agreement within us...Hmm from our end, end of

that we've raised the early warnings...But the fifty percent of them that have been dealt with to date, it is the one that I have not had response back from the client that is the problem, which will then typically get pushed down towards the end of the job and then they will come part of the final account...That's not good to do” (Director and Project Manager at a specialist subcontractor, 2016).

This contradiction in the responses of the QS and the subcontractor demonstrates how complexity of contractual procedures could lead to the creation of an adversarial environment that is focussed on blame rather than learning. This led the study to refer to the senior design-coordinator working for the main contractor, in order to gain a more rounded understanding about this phenomenon. According to him:

“The contract does not distinguish between whether there is a small event or a large event. So, in theory, everything requires the same amount of diligence or you know going through it, processing it...these things are quiet complex and therefore it takes a lot of work to put that case forward....And then clearly when you're putting that case doing, you're obviously you've still got your work to do, if that makes sense you know”... we work with a variety of subcontractors and suppliers. And there are obviously on a different scale and a different size, and I think we tend to be more lenient with the smaller suppliers because they are just smaller suppliers if that makes sense. They do not necessarily have the full kind of office backup to follow the contract as they should. Hmm, I think it can be frustrating to some of the QSs at times though” (Senior Design Coordinator, 2016).

The response above clearly indicates that complex contractual procedures, in the absence of relational norms (McNeil, 1985), can contribute to the generation of wasteful behaviours and process. To confirm this argument, the author interviewed a senior site agent working for the main contractor, to check how contractual complexity could impact on compliance with the programme. Interestingly, the interviewee emphasised the significance of managing projects from a relational perspective to support production rather than through relying on contract formality. This challenge was described by the site agent as follows:

“The way normally it will work, contractually he could probably say: ‘No, no, according to the programme I’m, I’m, I will be due to come here’. Hmm, but it’s about communication. Making sure you keep in contact with your subcontractors. You know communicating with them on a regular basis. With all the major subcontractors, we try to have a weekly meeting, hmm either formally or informally. I mean we will discuss programme. You know programme is one of the key issues we discuss... [it’s all about] having a good communication and having a good relationship and being quite open with them” (Site Agent, 2016; emphasis in bracket inserted by author).

4.2.2 Exclusion or late involvement of key actors during pre-construction stages (IP2)

This study found that the exclusion or late involvement of key actors during pre-contract stages may lead to value-loss in design and waste of human potential. It could also lead to gaps in design and contracts, and thus encourage wasteful activities (e.g. opportunism). Three key themes have led to the emergence of this sub-category:

- Late involvement of project managers
- Late involvement of contractors
- Lack of involvement of specialist subcontractors and suppliers (S&S) in design stages

Late involvement of project managers

One of the common, but unnoticeable, inefficiencies in construction procurement, as identified in this study, is related to the late involvement of the ‘project manager’ in large construction and civil engineering projects. The main responsibilities of a project manager in such projects could be described as follows:

“Under the contract, the project manager is there to administer the contract itself. And in the context of the NEC contract that role is quite an important one, due to the timeliness of decisions that have to be made and instructions that have to be given to keep the works rolling along” (ECC Project Manager, DEC 2015).

From the quote above, it appears that the main role of the project manager is to administer the contract effectively, in order to support the flow of production activities. Thus, it would be wise to involve the project manager while drafting the contract to use his experience and knowledge in identifying any contractual gaps that may lead to conflicts or delays during project delivery. Project managers could also help clients to put into consideration the knock-on effects of special contractual clauses that clients may wish to introduce.

During data collection stage, the author asked a senior project manager, working on a major infrastructure project in the UK, about the stage at which he was involved in the ongoing project. Interestingly, the project manager was introduced to the project “*pretty much after, just after, contract award...It will probably be better in ideal world to be involved in a pre-contract for a period of time*” (ECC Project Manager, Dec 2015). Consequently, the author interviewed the deputy project manager and asked her about her opinion upon when they, as project manager, should ideally be involved in a project. She was also asked to justify her answer. Interestingly, the interviewed deputy project manager has always been appointed to projects following contract award. Her response was as follows:

“Hmm, I have not thought of that. Anyway I guess, yup, before signing the contract probably...and maybe being involved in writing the contract... because she is in a better position to identify if there are any gaps or anything that will make it easier for him or her to administer the contract later (CEng MICE ECC Deputy Project Manager, 2016).

This prevailing approach to procurement (i.e. late involvement of project manager), however, typically leads to lots of inefficiencies, such as unnecessary change orders, conflicts and disputes; thereby contributing to time and cost-overruns of projects. These consequences will be described in more detail in section 4.3

Late involvement of contractors

Most of the interviewees criticised construction procurement arrangements that do not allow contractors to be involved during design. According to them, late involvement of contractors, simply, leads to waste and/or value-loss. The advantages of early contractor involvement could be described as follows:

“Every time we have a delay it adds to time related costs. If we are able to work with our customer and design out the risks that will cause those time prolongations before we get on site. And then when we get on site we build what we've designed to build, not what we've been forced to build because we've encountered unforeseen problems. That is gonna significantly reduce the time it takes us to build and significantly reduce the cost” (Business Development Manager, Dec 2015).

Lack of involvement of specialist subcontractors and suppliers (S&S) in design

Most, if not, all of the interviewees who worked for subcontractors or specialist suppliers stressed that their lack of involvement in design leads to value-loss. For example, a specialist subcontractor explained, to the author, the importance of their involvement in design as follows:

“There is a great interest for us and from the client and the designers to keep us part of the design process cause then I could then say look we can do this, this, this and this on that line; hmm there is the budget to do it approximate. Is that going to be alright with the client? Instead of us coming in at a later stage and saying well you can do it this way and it can be cheaper but we can't do this because of the problem there. Hmm, so for us it's very important to be involved in the design stage and there are huge benefits of being involved in the design stage for both us and the client” (Director and Project Manager, Dec 2015).

According to the participants representing S&S, architects tend to focus their attention on the aesthetics of the building, while giving much less consideration to other

important issues, such as logistics of the site, ways of gaining access into the building (e.g. setting-up scaffoldings) to attach the facades, as well as safety matters. This was also emphasised by a senior designer, as follows:

“Getting information of whose doing what and the equipment they'll be using during the detailed design stage is imperative to us, to enable us to do our design properly and reducing risks and reducing assumptions” (Principal Engineer, 2016).

4.2.3 Lowest price selection criteria (IP3)

This is one of the most prevailing construction procurement practices. In construction, the client does not buy a ready-made product. Instead, project partners need to cooperate to produce the final product (e.g. building or road). The focus on picking lowest price when selecting project parties in construction projects often leads to waste and value-loss. In other words, *“if you ask for a high ratio of cost then you'll just get the cheapest and you won't necessarily get high quality...you'll get what you've asked for... That's the way of thinking about it (Senior Consultant, Nov 2015).*

Procuring services based on lowest cost could also drives certain inefficient behaviours (e.g. opportunism), but clients and procurement professionals do not necessarily understand the behaviours that they will create by the rules that they put in place. This has been referred to by the Head of Supply Chain of one of the largest contractors in the UK, as follows:

“Basically the heart of the problem is that traditionally people have been inclined to treat a lot of procurement with a transactional approach...You get clients who are placing their orders purely on cost. They are not necessarily interested into the value that you both agreed. So, that affects our strategy (Head of Supply Chain, Nov 2015).

The factors influencing the wide-spread use of lowest price selection criteria have been discussed with the participants, in order to investigate the root-causes of the problem. The causes mentioned by respondents included, for example, treating

construction projects as a commodity. It was also linked to norms of practice and mind-set of quantity surveyors, as described by a specialist subcontractor: “we're very specialist and it's the cost mind-set of the quantity surveyors...they don't understand what we do” (Director and Project Manager, Dec 2015). These influencing factors will be analysed and explained in more detail in section 4.5.

4.2.4 Non-joint specifications of design (IP4)

This procurement arrangement is linked to problems associated with late or lack of involvement of contractor and subcontractors in design. However the difference here is that this sub-category is focussed on how the use of onerous or overly-prescribed specifications of design could drive certain behaviours (e.g. lack of commitment, self-interest, or exploitation of gaps in contracts) and eventually lead to waste. For clarification, this was described by some of the participants, as follows:

“The designer is the one who drafted the contract...Obviously, all the specifications are coming from the designer” (Deputy ECC project manager, Dec 2015)

“With more traditional construction, the client would be advised by the designer, by the architect. So, it's really down to the architect to explain or to ask to get the information out of the client as to what specifications they are requiring” (Senior Consultant (PhD), Nov 2015).

“The designer can't specify one type of system or product, so the specification has to be wide enough to incorporate any variations if that makes sense, which could be quiet problematic sometimes” (Senior Design Coordinator, Dec 2015).

4.2.5 Non-value adding performance monitoring and reporting arrangements (IP5)

This sub-category was developed based on the emergence of a number of interrelated themes:

- Audit and check of all of the works whoever is providing it
- Bureaucratic clerk of works

- Man-marking suppliers
- Monitoring and measuring the accuracy of monthly financial projections on spend (Cost monitoring & reporting)
- Relying on lagging numerical performance-based contract measures

These non-value adding performance monitoring and reporting arrangements contribute to the generation of waste in construction projects. Obviously, they lead to an unnecessary increase in client's transactional costs. They also lead to an adversarial environment and thus they may lead to feelings of mistrust; thereby hindering collaboration and encouraging opportunistic behaviours. Interestingly, these inefficient cost control practices also lead to hidden costs that the client may not be aware of. A senior consultant who specialises in performance-based contracts (and holds a doctoral degree in construction procurement) describes this, as follows:

“It’s something I tried to explain to a client. You can measure anything you like, and we can design performance measures that can measure whatever you want me to measure, but once you've got that information what are you going to do with it? Because if it's just gonna sit in a cupboard, it's of no value and it's gonna cost you because every time you ask someone to deliver some data to a performance measure, that will be costed and it will be charged through the tender. Even though you won't see it in the tender as an item, it will come under administrative. It has to be paid for. The client will pay for it!” (Senior Consultant (PhD), Nov 2015)

In another interview, a very senior consultant, fellow member of the institution of civil engineers (FICE), was asked about why these inefficient contractual governance practices prevail. His response helped to reveal some of the main causes of these wasteful practices:

“I think most of this comes in as a contract exercise that tries to compensate for not having spent enough time creating certainty before procuring a contract. About two years ago I went on a site visit to a road project – a new road into Nottingham in fact! I had not been to a live road construction site for about

twenty years and the first thing that struck me was the sheer volume of cars in the site office car park, matched by the sheer volume of people in the site offices. I couldn't believe how many people were engaged on site building this road and I suspect that a lot of the staff were there for precisely this reason" (Senior Consultant (FICE), Oct 2015).

4.2.6 Onerous pre-selection of suppliers (IP6)

Clients' onerous selection of subcontractors (e.g. named suppliers) could drive the main contractors to behave opportunistically. These opportunistic practices include re-tendering of subcontract packages and selecting subcontractors based on cheapest price, which eventually lead to wastes and value-losses. An associate director of a consultancy company offering financial governance services to a public client explained this to the author, as follows:

"So the client organisation has already pre-agreed rates and other costs and commercial elements with hmm you know a handful of the country's major suppliers. So, hmm, so, so, on the contract there is a sort of obligation to use those arrangements...but there are get-outs. The main contractor is not forced to use them. He can use them or he can make a case not to use them. It's often, it seems to me personally that they're usually a cheaper option...If the main contractor chooses to go outside the framework, he may well get better rates which are in the benefit of the client as well, as the quality is maintained because they get a lower cost" (Associate Director, financial governance services, 2016)

The response above clearly indicates the (imperfect) cost-based mind-set dictating this procurement arrangement. In order to gain a deeper understanding about this phenomenon, the author therefore referred to the main contractor to understand how this procurement arrangement influences their practice. Interestingly, the author was told that this inefficient procurement practice aligns with their company's commercial policy. A senior design coordinator working for a large Tier 1 contractor explained this as follows:

It will be the company's policy to go to hmm different tenderers, so different subcontractors to get a price. Because, obviously we need to show that, hmm, you know proper evaluation... It is not always done on cost alone, so there are quality aspects to it as well. Hmm, sometimes it will be a commercial decision. Hmm, we have a situation on here where there has been a commercial decision that may not benefit this scheme, but may benefit the company on the long term if that makes sense" (Senior Design Coordinator, Dec 2015).

He then explained to the author that the commercial decision taken by his company was to use new suppliers in this scheme to gain competitive advantage. Also, to show the client that through competition they were able to get better prices. He criticised however this commercial strategy because it meant they had to start a new learning curve with the new suppliers; thus influencing production efficiency in a negative way. This (wasteful) commercial decision has not also allowed them to work with their preferred supply-chain members who assisted them during pre-contract award stages. This (opportunistic practice) was described as follows:

So, a subcontractor may well assist us during target price. When we get to contract award, those subcontracts are then tendered. So, even though he has assisted us, he may not win that work. And sometimes, hmm, it might be because he knows too much information if that makes sense" (Senior Design Coordinator, Dec 2015).

Therefore, it appears from the discussion above that onerous selection of subcontractors may encourage opportunistic behaviours and lead to waste of human potential and financial losses. Sections 4.3 and 4.4 will provide more details about these wasteful behaviours and their consequences on project time, cost and quality.

4.2.7 Poor payment terms and arrangements (IP7)

Poor payment systems could lead to inefficient behaviours and influence productivity rates. This sub-category was formulated based on four themes that emerged out of the data:

- Low and late payments to S&S
- Low payments to designers
- Payment methods for site labourers based on daily wage
- Interim evaluations (monthly payments based on traditional BoQ prepared by client's QS)

In an interview with a ‘Head of Innovation’ at a contracting company (with an architectural background), he blamed buyers for using unfair payment terms and for imposing low profit margins on to their suppliers. He considered these poor payment practices to be major sources of inefficiencies in construction. According to him:

“The problem is that clients behave very badly. Now, they'll do something to collaborate to a certain extent because there is a lack of resource in the industry. And, you know, you see that with main contractors, then, refusing to do single stage tenders and only wanting to do two-stage tenders. And equally the supply chain members if they were treated badly in terms of payment terms or in terms of number of subcontractors on the tender lists. They will behave exactly the same. Treat others the same way you would like to be treated yourself” (Head of Innovation and Director of National Frameworks, Nov 2015).

Low payment to designers, through fee competition, has also been identified by various participants as very problematic, because it leads to design errors, missing information or poor quality and coordination of design works; thus, leading to all sorts of waste. The author was told during interview, for example that:

“Design errors or missing information is a major source of conflict in traditionally procured contracts. And I suspect that is due to, you know, designers facing an ever increased fee competition. Competition is a good thing; but I have been in situations where quite frankly the design has been wrong and where the information has been missing. So, you know how can you expect somebody to price something in that particular situation if he needs competition for it?” (Senior Consultant (FICE), Oct 2015)

“You know designer fees have been reducing. You know when I first started my career, there used to be a prescribed fee scale, for architects and designers, which was in a great deal higher than it is now. And that allowed perhaps more resource to be put into the design, which would actually help the designers actually coordinate the design better” (Head of Innovation and Senior Architecture, Nov 2015).

4.2.8 (Price-based) tendering as an expensive non-value adding activity (IP8)

Tendering arrangements can lead to wasteful behaviours, unnecessary delays and financial losses in construction projects. This sub-category was developed based on the emergence of several themes:

- Competitive fee tendering when appointing professional consultants,
- Costly and speculative two-stage pre-qualification questionnaires,
- Lump Sum Price Competitive Tendering,
- Target-Cost contractual arrangements based on price competition,
- Tendering exercise regarded as a game,
- Two stage tendering,
- Unrestricted (open) bid invitation pro in public procurement

One of the major problems of price-based competitive tendering approaches is that they can create zero-sum game situations, where the construction client (buyer) and the supplier(s) compete against each other. This in turn obviously leads to wasteful behaviours and poor project performance. An interesting example was provided by a senior consultant, as follows:

“I certainly recall a Target Cost scenario held up initially as a model form of collaborative contract, which rapidly became very adversarial. This was when a contractor had been asked to price the cost of building a railway station extension and modification but had not been provided with full details of the existing structure. The existing structure was then found to require extensive redesign of the intended new roof and a large claim developed. The accusation levelled at the contractor was that they had calculated the initial Target Cost to

win the job and then maximised their claims in relation to the re-work required as a result of finding out the true nature of the existing station structure” (Senior Consultant (FICE), follow up email, 2016).

Another major inefficiency of tendering arrangements is the amount of time and costs spent on selecting and procuring project partners. It was regarded by some of the interviewees as an expensive and time consuming non-value adding activity. Tendering expenses are actually hidden transactional costs that many clients may not be aware of. This was explained by a business development manager working for a main contractor, as follows:

“I would say that the cost of procurement is increasing the cost of the industry...Hmm, and procurement is a non-value added cost...We don't dig any hole; we don't pour any concrete; we don't erect any steel for the cost of bidding. And, also customers must understand that although contractors don't actually send them an invoice for the tender they do actually pay for it...Because contractors in the scene of making the profit have all of their costs paid by their clients. So every penny they spend on tenders, even the unsuccessful ones, are reimbursed by their clients; and more frequently the wrong clients” (Business Development Manager, Dec 2015).

In an interview with the ‘Head of Supply-chain’ of a major Tier 1 contractor, the author discussed with the interviewee how client’s major procurement arrangements influences their own practice with their supply-chain. It appeared from the responses received that many clients do not realise how that their desire for seeing competition as a means to reducing project costs, may often lead to opposite results. So, competitive tendering can restrict major contractors from being able to collaborate with their preferred tier 1 suppliers during early stages of projects; thereby hindering value-creation. It is also seen as a non-value adding activity which consumes unnecessary time and costs. This could be summarised, as follows:

“I think if you want to get value out of the supply chain or the procurement exercise, in my opinion, you need to shorten that process as much as you can, so you are giving the people at the operational level and the suppliers themselves

enough time to come up with the value-added solutions. In some instances, you could argue that you should not conduct a procurement exercise traditionally at all...I mean we should be in a position where we would appoint people from the very outset and develop the solution with them...Projects need to be done quicker and with less costs, so if you do it quicker, then in theory the cost drops anyway because you have got less preliminaries, etc. And the cost does not necessarily be the erosion of somebody's margins” (Head of Supply Chain, Nov, 2015).

4.2.9 Safeguarding practices in construction procurement (IP9)

‘Safeguarding practices’ refers to client’s construction procurement safeguards (governance arrangements) against their perceptions of supplier opportunism and exploitation or against their lack of competence (know-how). The ‘Safeguarding’ subcategory was developed based on the emergence of the following themes and sub-themes:

- Overly formalised contractual governance rather than relational governance
 - Imperfect standard forms of contracts (e.g. JCT)
 - Making amendments to standard forms of contracts without considering impacts on other clauses
 - Amending contracts merely due to what happened in the past or to make it look like contracts they have been using in the past
 - Penalty points in DBFO contracts
 - Traditional documental approach for managing ‘Requests For Information’ (RFI)
 - Using liquidated and ascertained damages (LADs) clauses as penalties
- Performance bonds
- Collateral warranties
- Aggressive negotiations of rates with Tier 2 contractors
- Multiple Insurance Arrangements
- Unfair and Onerous Contractual Clauses and Arrangements
 - Disclaimer, Exculpatory and privileged clauses of contracts
 - ‘Unlimited Liability’

- 'Fitness for purpose' clauses
- 'On demand' bonds
 - Historical clauses
 - Onerous Z- clauses
- Using BoQ measured or checked by client's QSs or consultants
- Overly prescribed specifications as opposed to performance specifications
 - Over-engineering of design
 - Designers using an 'approved similar type' clause in their specifications when employed by contractors to cover themselves

As can be seen in the list above, this study identified various examples of conventional (risk-averse) safeguarding approaches to construction procurement. The study, however, identified a remarkably onerous Z-clause used in an infrastructure project in the UK. The author was initially informed about this unfair contractual clause during an interview with a design coordinator working for a main contractor. The author was also able to ask for and receive a full copy of the project contract, so he can review the aforementioned clause by himself and also to check the contractual conditions in detail. Furthermore, the author was able to conduct following interviews with different project parties involved in the project. Some of these represented the contractor (i.e. site agent, sub site-agent, planner, and QS), while others represented the client (i.e.. the ECC Project manager, deputy project manager, and the financial governance consultant) and the designer (i.e. principal engineer). The Z-clause is written in the contract as follows:

'If the Scheme Outturn Cost is greater than the Scheme Target Price, the *Contractor* pays his share of the excess. If the Scheme Outturn Cost is less than the Scheme Target Price, two-thirds of the *Contractor's* share of the saving is retained and contributed to the Programme Level Incentive Fund and the remaining one third (the "remaining *Contractor's* share") is paid to the *Contractor*, provided that the remaining *Contractor's* share is paid to the *Employer* if there is a fatality on the site of the Scheme as a result of a reportable incident, is paid to the *Employer* in the event of termination for any of reasons R1-R15 or R18 and is reduced for late Completion in accordance with the table below'

The project was delivered using an NEC, Engineering and Construction Contract, Option D (target cost contract with a bill of quantities). And the clause above simply implies that if a fatality occurred on the site of the scheme, the contractor loses his share in any savings gained due to delivering the project below the target cost. The project also included a number of commercial misalignments which complicated the situation. For instance, the client kept the design in-house and thus the contractor was not involved in the design. As described by the leader of the commercial team supporting the project:

“The principle with the scheme was that the designs are relatively generic, so the client kept the design in-house. Unfortunately, it then uses a form of contract which pre-supposes you know the NEC, that it’s a contractor’s design. So it’s an uneasy alliance there which leads to a lot of variations” (Associate Director, financial governance services, 2016).

Additionally, the designer had his own target cost, so his main incentive was to reduce his own target fees instead of reducing total project costs. Thus, it has been argued by the contractor that the designer had no incentive to provide timely responses to RFI, resulting in major project delays. This, accordingly, forced the client to pay compensation events for the designer and the financial governance consultant, in order to increase their resources and speed up the process. Compellingly, the author was informed that this Z-clause was used because the public-sector client has a requirement not to have any fatalities on any of their schemes. This Z-clause however proved to be ineffective; because unfortunately, it was not an appropriate measure taken to prevent a fatality from occurring because of an accident on site, as acknowledged by the interviewees. It also led to many conflicts (see section 4.3.5 below) and project losses, as the contractor not only suffered the sorrow and pain resulting from the fatality; but also lost any commercial incentive to collaborate with others in order to beat the scheme’s target price.

On the other side, some of the prevailing safeguarding practices identified above (e.g. performance bonds and multiple insurance arrangements) could directly lead to

unnecessary expenses. For example, a senior QS working for one of the largest main contractors in the UK criticised the cost-effectiveness of performance bonds, as follows:

“We have had performance bonds before and when we relied on it, it has not turned out to be what we wanted it to be. Never recovered what we should have done and we never recovered anything. And we paid for it and repaid for it on other subcontractors as well. The cost of that has been absolute waste” (Senior QS, 2016).

Interestingly, further interviewing revealed that clients end up paying for the expenses of performance bonds, as suppliers (e.g. main contractors) include them as contingencies in their tender price. These claims came across as follows:

“It is a contingency. And so, you talk about embedded waste...well in the public procurement process there is a 1% embedded waste right there! as a client why would I want to pay 1% of contract cost just for insurance, if when I can pick the right team, I can save that 1% and do something better with it” (President of a lean consultancy company, Nov 2015)

Moreover:

It's not just a contingency, its cost. Because, you know, if you want a performance bond you have to go and buy it in the market ways. Because all the performance bond really is: insurance. So, you know, the performance bond is if you don't perform. So it's an insurance policy if you don't perform. So you explore the market place and you buy that insurance, so it's a cost. So, if they want that performance bond, the contractor will go and buy it“(Head of Innovation and Director of National Frameworks, Nov 2015)

Clients typically ask for performance bonds as a safeguard in the form an insurance policy against poor performance, based on risk-averse and transactional drivers. This claim was asserted, for example, by a business development manager working for a main civil engineering contractor, as follows:

“I can understand why clients want to bond...Hmm, because of the risk that a lot of contractors are failing at the moment. And there is a cost to replacing that contractor. So, the client is covering that cost by a bond. Although I do accept that if this is done through a robust procurement process and established a contractor that they believe is the best, then they probably do not need the bond” (Business Development manager, Dec 2015).

The quotes and arguments above demonstrate how that various safeguarding practices (e.g. performance bonds and multiple insurance arrangements) can lead to hidden transactional costs, which are ultimately met by the owner/client. Furthermore, the use of safeguarding practices can lead to defensive attitudes between project participants; thereby hindering collaboration between project-team members. This eventually leads to production losses, which could ultimately lead to project failure. More explanations of the general impacts of prevailing safeguarding practices on project-team performance are provided in the following chapter (Chapter 5: Impact of inefficient procurement on project performance and outcomes). Additionally, a more specific critical evaluation of the safeguarding problem in construction procurement will be presented in the discussion chapter (Chapter 8).

4.2.10 Separated procurement methods (Separating design from construction) (IP10)

Separated construction procurement methods have been criticised for being a main cause of many of the industry’s problems. Based on the data collected for this study, it appears that prevailing construction procurement arrangements, which separate design from construction, can lead to waste. In an interview with a senior director at a contracting company, he criticised traditional construction procurement methods as follows:

“When I first started my career as an architect, what's now called traditional bills of quantities was the prevalent way of building. The idea of that was that the architect and the other designers would completely design the building in detail, the surveyor would create a bills of quantities, and then the contractor would price it and all what they would do is to build what was wrong. So in an

ideal world in that model, the design would be complete and there would be full coordination of all of the designs. But the reality was that it did not work that way; because the designers did not have the build-ability skills to be able to coordinate the design properly. And that's partly why Design & Build as a contracting form was created; because it was recognised that the contractors have got a part to play, and they could help to integrate the designs and make sure that issues do not arise”(Head of Innovation and Director of National Frameworks, Nov 2015).

It is important however to stress that separated procurement methods are not limited to traditional procurement approaches only; instead it includes any project delivery approaches, which separate design from construction. Three examples of separated procurement methods were coded and identified by this study:

- Design-Bid-Build (D-B-B)
- Outsourcing design in ‘Design and Build’ (D&B) projects
- Novated D&B

For example, in D&B projects where the contractor outsources the design packages, the architects become directly contracted to the contractor rather than the client. Thus, the architects may become forced to deliver what the contractor wants, instead of what the main client wants. This was described by a senior architect as follows:

“In design and build jobs, basically the contractor employs the designer, and then yeah we take it from there. Then we know what the contractor wants. In as much as we might want to deliver a lot of quality and good stuff for the client. But because we are reporting directly to the contractor, who pays us, we have to do what the contractor says”(Senior architect and BIM manager, 2016).

Clients may try to overcome the problem described above through the use of ‘novated D&B’ procurement arrangements. However it seemed from the data collected that this still does not overcome the problem; as this approach can create situations where there might be conflicts of interests between the different project parties. Therefore, it

becomes clear that using construction procurement as a means for transferring risks can complicate the problem rather than solve it.

It is well known that architects play a major role in D-B-B projects. Accordingly, they might have a preference to advise clients to employ D-B-B procurement approaches rather than D&B ones that are often dictated by contractors. However, the findings of this study suggest that this is not necessarily always the case, as there are other important factors which need to be taken into consideration. These include the state of the economy, profit margins and risk considerations. So, sometimes, quick wins of limited profit could be preferred to higher profits which require longer periods of work and higher levels of risk and uncertainty. When a senior architect and BIM manager was asked about his company's preferred procurement approach, he said:

"I donnu, that's a difficult one because there are advantages and disadvantages depending on the different types, isn't it? Because in traditional you do a lot of work. Okay? Possibly at the end you might not make enough profit. You might not make enough profit, because there will be so much demand on information from the contractor. The client and contractor will be requiring lots of information from the designer. Where in Design and Build, you can even just do a design sketch and the contractor will build it. Okay, because he just wants to have an idea. You don't have to go into details but just a sketch is enough for him to know what to do. Yeah, so I think that's the only advantage of the Design and Build route - the risk is less with the design and time of design". (Senior Architect and BIM manager, 2016)

4.2.11 Sub-optimisation (optimising the parts rather than the whole) (IP12)

This sub-category was developed based on the emergence of the following three main themes.

- Fragmenting contracts and work packages using a buy-it governance arrangement
- Optimising performance of individual contracts rather than overall supply-chain performance
- Optimising target fees rather than overall project costs

In general, traditional procurement methods could be regarded as an example of

sub-optimisation in construction procurement. In a traditional procurement, the client breaks down the project into separate pieces (i.e. design and construction). Then, the client hopes through the use of competitive price tendering to secure lowest price for each of the design and construction services. However, in reality, things don't work like that; because lowest tender price does not necessary mean best value for money. It does not also guarantee that the project will be delivered to tender price. Instead it can create silos and encourage wasteful activities. As stated by a president of a lean consultancy company:

“Traditional Design-Bid-Build or quantity contracts are pretty tough - transactional and separate project parties when protecting their financial interests. Rather than trying to optimise the supply chain it optimises the pieces, and that creates all the kinds of conflict and embeds waste in the project...The whole concept behind integrated project delivery (IPD) is that we are trying to align everybody in the project's best interest as opposed to the silo independent/individual interest” (President of a lean consultancy company, Nov 2015).

During the ongoing process of data collection and analysis, it appeared that sub-optimisation practices in construction procurement remain to be used even when collaborative contractual arrangements are deployed. Clients and their advisers tend to be relatively unaware of how their sub-optimisation practices hinders collaboration and embeds wastes in their projects. For instance, an NEC3 Engineering and Construction Contract Option D, Target Contract, was chosen by a public client for a major UK infrastructure project. This type of contract contains a “pain/gain” mechanism and is generally designed to achieve a collaborative approach to contracting, rather than the traditional JCT style, to reduce the risks in the construction process. However, the client used procurement mechanisms which focussed on optimising the target fees of each main project party (e.g. main contractor and Designer), while giving much less attention to how this may influence overall project performance. As a result of this commercial misalignment, the main contractor and designer found no incentive to collaborate together to reduce overall project costs; instead each party focussed on finding ways to reduce their own costs, even if this came out of the pocket of others. Interestingly, the deputy project manager was not aware herself of how this commercial misalignment

might impact on project performance. For instance, she said:

“I see, yes, but everyone is not affecting the other. Like they both have, hmm, the target cost. Hmm, there is one target cost for the whole project, then within this overall target cost, we have separate items for the contractor’s cost, and separate items for the designers and the QSs and others – these are part of the auxiliary costs. So although the total target cost will be increased by each party, but they both have to manage their own. So, really at the end, each one is not affecting the other” (Deputy ECC project manager, Dec 2015).

Through further investigation, it was found that the client kept the design in-house. So, instead of using the principle of ‘early contractor involvement’, the contractor in this case was not involved in design and just entered into negotiations to agree on target fees prior to contract award. Furthermore, the “pain and gain” mechanism of the overall project target-cost was only conducted between the client and the main contractor. The share of the designer was only limited to their own performance, in terms of how their own costs compares with their individual targets. So, the designer had no incentive or capacity to provide timely responses to client’s change orders or contractor’s requests for information (ROI), which caused lots of delays and compensation events. The client’s flawed approaches to procurement that led to these problems, as described by the leader of the commercial team providing financial governance services to the scheme, included the following:

”The principle with the scheme was that the designs are relatively generic, so the client keeps that design in-house. Unfortunately, the client then uses a form of contract which pre-supposes, you know the NEC, that it’s a contractor’s design. So, it’s an uneasy alliance there which leads to a lot of variations...because any shortcomings or lateness or delay or change in the design automatically becomes a change event” (Associate Director, financial governance services, 2016).

The author conducted further interviews to investigate the possible causes of the problem of sub-optimisation in construction procurement. Interestingly, it appeared that clients’ advisers such as procurement/quantity surveying consultancy firms (PQSs)

might have a vested interest for breaking down projects into various small packages, because it maximises their roles in projects. This argument was stated, for example, by a business development manager of a main contractor, as follows:

“Yeah we certainly do see certain PQS companies taking a very building development approach to civil projects, and break the project into small packages which from a civil contractor's point of view, we would prefer to manage the whole project than for us to manage those inter-phases; because obviously PQSs managing those inter-phases they get paid for that...so they do that so that they can maximise their fees. You also see occasionally where PQSs, who have a main building portfolio and were very familiar with the likes of JCT, get told they must work in NEC...and a lot of their Z-clauses are trying to make NEC work in the same way as JCT. But their customers have chosen NEC because they do not want to work in a JCT fashion. And JCT is not very good for civils works anyway; because civils works tend to have quite a lot of change in the ground conditions and so on, and JCT just cannot deal with that” (Business Development Manager, Dec 2015).

4.3 Summary

This chapter illustrated various prevailing inefficient procurement practices that evolved out of the empirical data collected for the study. The next section reveals their negative impacts on project performance and outcomes.

CHAPTER FIVE: IMPACT OF INEFFICIENT PROCUREMENT PRACTICES ON PROJECT PERFORMANCE AND OUTCOMES

5.1 Introduction

This study conceptualises construction procurement as ‘institutional arrangements’ that influence the way that project-parties behave and perform throughout the project. The previous chapter (Chapter 4) identified various inefficient procurement practices that are commonly used in construction. Subsequently, this chapter reveals the impacts of these procurement arrangements on project-team behaviour and performance. The chapter also illustrates the consequential wastes.

5.2 Inefficient performances and behaviours (PB)

This chapter focuses on describing the coding structure that led to the development of the category titled ‘inefficient performance and behaviour’, and provides brief explanations to each of its ten constituent sub-categories (see Figure 5.1). The study found that these behaviours and performances occur as a result of the use of prevailing construction procurement arrangements. The study also found that they lead to consequential wastes. Thus, the coding structure that led to the development of the category titled ‘consequential wastes’ will also be analysed (see section 5.4 below)

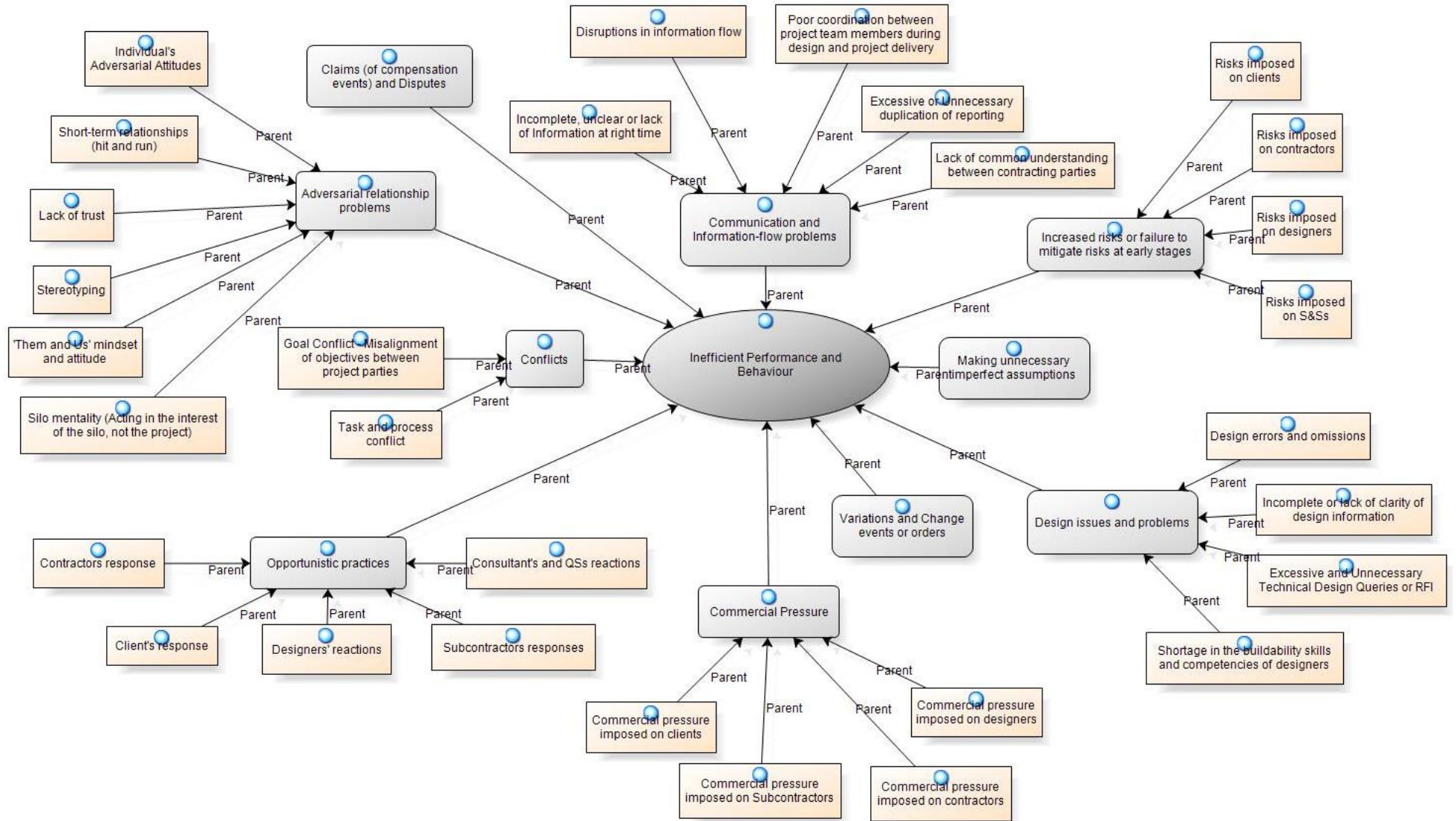


Figure 5.1: Coding structure of 'Inefficient Performances and Behaviours'

5.2.1 Adversarial relationship problems (PB1)

There is no doubt that adversarial relationships could simply occur in construction projects, due to individual confrontational attitudes of people. However, this study found that inefficient construction procurement arrangements could also contribute to the development of adversarial relationships in projects. Thus, instead of blaming individuals, this finding provides a systemic perspective that could help to improve construction practice by shedding empirical light on one of the main causes of adversarial relationships in construction (i.e. wasteful procurement and commercial practices). The sub-category 'Adversarial Relationship Problems' was developed based on the following five main themes that emerged out of the data.

- Silo mentality (Acting in the interest of the silo, not the project)
- Lack of trust
- Short-term relationships (hit and run)
- Stereotyping
- 'Them and Us' mind-set and attitude

So, for instance, inefficient procurement arrangements (e.g. safeguarding and sub-optimisation practices) could drive project parties to act in the interest of the silo, not the project. Examples of incidents coded in the collected data include:

- Contractor disincentivised from collaborating to minimise overall project costs
- Contractor not incentivised to inform the client about mistakes in design during tendering stage
- Designer disincentivised from collaborating with contractor to maintain workflow
- Designers not incentivised to conduct site visits
- Each trade focuses on maximising its own productivity and profit, without giving consideration to the impact of what they do on other trades' work
- Labourers not incentivised to maintain or increase their production rate
- Subcontractors' lack of commitment to the programme

Thus, clients and decision makers need to be aware that by using inappropriate or inefficient procurement options (e.g. unfair contracts), they could be, at the same time, also “*creating a confrontational working environment that may encourage contractors*

and suppliers to exploit opportunities that may occur due to unforeseen conditions” (Managing director and principal consultant in the rail industry, Nov 2015), and that *”the procurement process can help to create a mechanism for working together, or put everybody in silos they don't cross”* (Senior Consultant (FICE), Oct 2015)

5.2.2 Claims (of compensation events) and Disputes (PB2)

This study found that inefficient procurement practices can lead to many problems, including unnecessary claims and disputes. So, for example, it was stressed by a very experienced participant that *“more often than not, to pick the cheapest price ends up more expensive and also involves disputes”* (Turn-around project manager, Oct 2015). The main reason for that, obviously, is that suppliers that have been selected based on cheapest price, often rely on recovering their compensated price and making their profit through planning and applying for claims and disputes. Thus, it is vital for clients and decision makers to put into consideration the impact of their choices on performance and production costs and not just rely on minimising costs of individual contracts. The time and costs spent on the process of agreeing the values of compensation events or disputes could be very detrimental to the project and all project-parties concerned.

In an interview conducted with a principal engineer, he explained a situation at which inappropriate procurement arrangements has led the contractor to behave opportunistically, and thus the designer had to raise claims and ask the client for compensations. This situation was described as follows:

“If there are a lot of RFIs being raised and we don't believe they were all warranted, and believe that the contractor should be able to adapt to the design and does not need the level of details which they are requiring. Well, then we make a case to the client and ask for additional resources. And then you'll be looking at any compensation events, so we can increase what could have been our original target cost or give us another additional sum of money to recover the additional work which would be expected to be undertaken in responding to the RFIs” (Principal Engineer, 2016).

Similarly, in a discussion with a senior consultant about the main impacts of late or poor payments arrangements on construction projects, he emphasised that these inefficient procurement practices often lead to increased project risks, opportunism and costly disputes. He stated that:

“You know as a contractor, the monthly payments are usually useful from a cash flow point of view. And, indeed, if you're not guaranteed that cash flow, then you'll put money somewhere else because it's a risk. You know the risk in agreeing that you've met your milestone! So, you could end up chasing a milestone...and then you end up in dispute” (Senior Consultant (FICE), Oct 2015)

The discussion above reveals the importance of the use of relational forms of contracting, especially in complex projects, as they could help clients to discuss with their project partners the commercial terms and arrangements that would help to optimise supply-chain performance, and thus reduce overall project costs.

“I think a critical part of the procurement is the dialogue between the suppliers and the client to agree precisely on these kinds of things. It could be a situation you've got to address, you know, would you prefer to be paid on a milestone basis or would you prefer on a monthly basis? You know and you take a view and the project will be evaluated to reach the best commercial whole project-objective outcome” (Senior Consultant (FICE), Oct 2015).

5.2.3 Commercial Pressure (PB3)

Inefficient procurement arrangements (e.g. lump sum procurement methods and the use of onerous and overly formalised contracts) can impose increased commercial pressure on project team members, which in turn could stifle innovation, hinder collaboration and embed process-waste within the supply-chain, and eventually lead to project failure. A summary of the coding structure that led to the emergence of this subcategory is provided in figure 5.2.

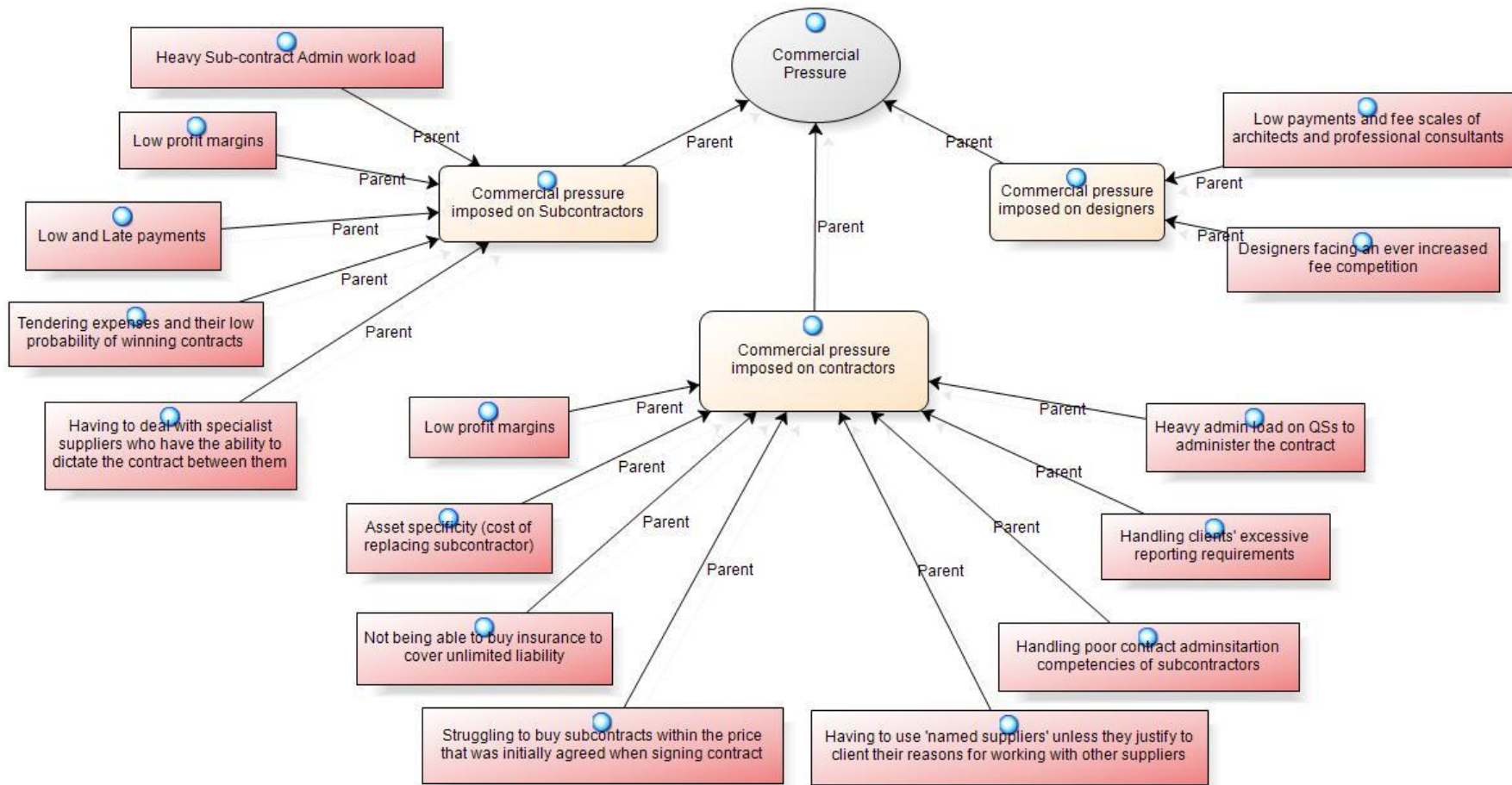


Figure 5.2: Coding structure of 'Commercial Pressure'

5.2.4 Communication and information-flow problems (PB4)

Inefficient procurement arrangements (e.g. separated procurement methods) can lead to many communication and information-flow problems, which in turn lead to consequential wastes. This sub-category was developed based on the emergence of five main themes (See Figure 5.3).

- Disruptions in information flow
- Excessive or Unnecessary duplication of reporting
- Incomplete, unclear or lack of Information at right time
- Lack of common understanding between contracting parties
- Poor coordination between project-team-members during design and project delivery

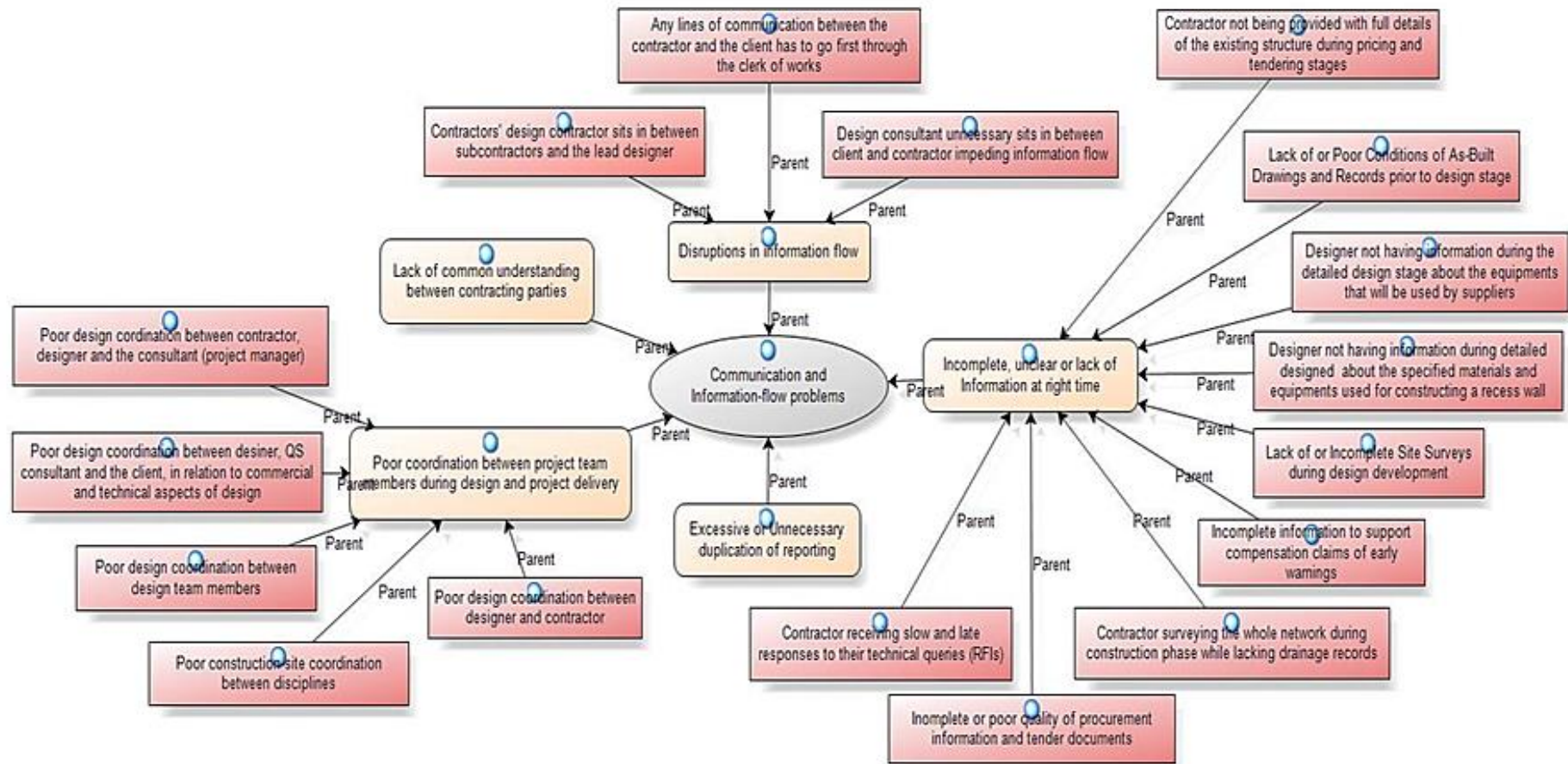


Figure 5.3: Coding structure of 'communication and information-flow problems'

5.2.5 Conflicts (PB5)

One of the major impacts of the use of inefficient procurement arrangements is the occurrence of conflicts between the project parties. These conflicts could lead to lack of trust, wasteful behaviours and eventually disputes. In this study two main classifications of conflicts were grounded in the data:

- (1) Goal conflict; and
- (2) Task and process conflict.

‘Goal conflict’ first refers to misalignment of objectives between project parties. So, they could be regarded as conflicts that occur at a strategic level. One of the examples of this sort of conflict, as captured by this study, occurred when a major public-sector client added an onerous Z-clause to an NEC3 contract. This clause caused a goal conflict during later stages of the project, leading to poor project-team performance. The main cause of this goal conflict was described, as follows:

“There are various Z-clauses in the contract, and then there is one clause that I believe says that 'if there is a fatality then we're not entitled to any gain as part of that project'... I don't know whether you know but we had a fatality on our scheme, so that means that we're automatically barred from getting any gain on this project... We can still go into pain of course, so if we were to go over the target then obviously there are penalties on us as well” (Senior Design Co-ordinator, Dec 2015) .

On the other side, ‘task and process conflicts’ are regarded as operational conflicts. Examples of clustered codes relating to this phenomenon include:

- Conflict between designer and contractor when dealing with prescribed specifications
- Conflict in agreeing on claims and compensations
- Conflict in agreeing on penalty points in DBFO projects
- Conflict in agreeing on performance evaluation scores
- Conflict related to changes in the original Works of Information

- Conflicts related to RFIs between contractor and designer
- Conflicts in measurements and valuations of completed works

5.2.6 Design issues and problems (PB6)

This is one of the most common problems associated with the use of inefficient procurement arrangements (e.g. separating design from construction). This sub-category was developed based on the emergence of the following themes:

- Incomplete or lack of clarity of design information
- Poor design coordination
- Design errors and omissions
- Excessive and Unnecessary Technical Design Queries or RFI

A project manager working for a subcontractor explained to the author how that much of the project challenges they face are due to design errors. According to him, architects focus their attention on the aesthetics of the building, while giving much less consideration to other important issues such as: logistics of the site and ways of gaining access into the building (e.g. setting-up scaffoldings) to attach the facades as well as safety matters. Thus, he believes that an early involvement of facade subcontractors using BIM models could help to mitigate this example of value-loss.

There is no doubt that design errors could be attributed to factors such as shortage in the buildability skills and competencies of designers. However, this study sheds empirical light on the relationship between inefficient procurement arrangements and value-loss in design. There are other institutional, procurement-related and commercial factors which influence the way designers do things. As stated by a senior consultant “*design errors or missing information is a major source of conflict in traditionally procured contracts...and that is due to, you know, designers facing an ever increased fee competition*” (Senior consultant (FICE), Oct 2015). These arguments were emphasised by the ‘Head of Innovation’ of a major contractor (who has an architectural background in education and practice), as he blamed clients for using inefficient procurement

practices which typically lead to design errors and problems. According to him, the main causes for common ‘design issues and problems’ in construction projects include:

- The historical way of procuring projects where clients tend to start project by appointing architects and QSs.
- Client’s reluctance to invest in design (e.g. proper site investigations)
- Low payments to designers due to the use of competitive fee tendering based on lowest price when appointing professional consultants - thus as a response designer's may not be able to invest much time and resources into making site visits, deeper investigations, and peer reviews while producing their designs.
- Poor design coordination - not receiving full information on time due to late involvement of main contractor and sub-trades

This study also identified another important example of design-related problems resulting from the use of inefficient procurement practices, which is the issue of ‘excessive unwarranted requests for information (RFI)’. Compellingly, when a site-agent working for one of the largest main-contractors in the UK was asked during an interview about the number of RFI raised in their ongoing project and the reasons of the queries, he informed the author through a written follow-up email the following:

“883 RFI have been raised to date [within just over a year]. Majority of these have been raised for design clarification where either insufficient information has been provided or the current design is not very clear” (Site Agent (CEng, MICE), Email, 2016)

From the comment above, it appears that the number of RFIs raised is huge, and thus is very costly. According to a study by Hughes *et al.* (2013) that examined the impact and control of RFIs on construction projects, it was found each RFI would require about 9.7 median days for response, and that the average total cost (review and response) per RFI is \$1080 (equivalent to £822). Through further interviewing with different project parties involved in the project, it was found that these huge numbers of RFIs led to change orders, compensations events to all main project parties involved (main

contractor, designer, and the consultancy company responsible for financial governance of the scheme), delays, conflicts and adversarial relationships. Interestingly, the deputy project manager working on the project declared that the client is responsible for this and eventually ends up paying for the consequences of their procurement decisions and arrangements.

“They [the contractors], are having a lot of change in the scope of works...Why! Hmm, well it’s due to the client really” (ECC Deputy Project Manager, 2016)

5.2.7 Increased risks or failure to mitigate risks at early stages (PB7)

Inefficient or inappropriate procurement arrangements could impose increased project-risks on all project parties including client themselves, or lead to the failure to mitigate risks at early stages. Examples of these are illustrated in Figure 5.4, which demonstrates the coding structure that led to the development of this subcategory.

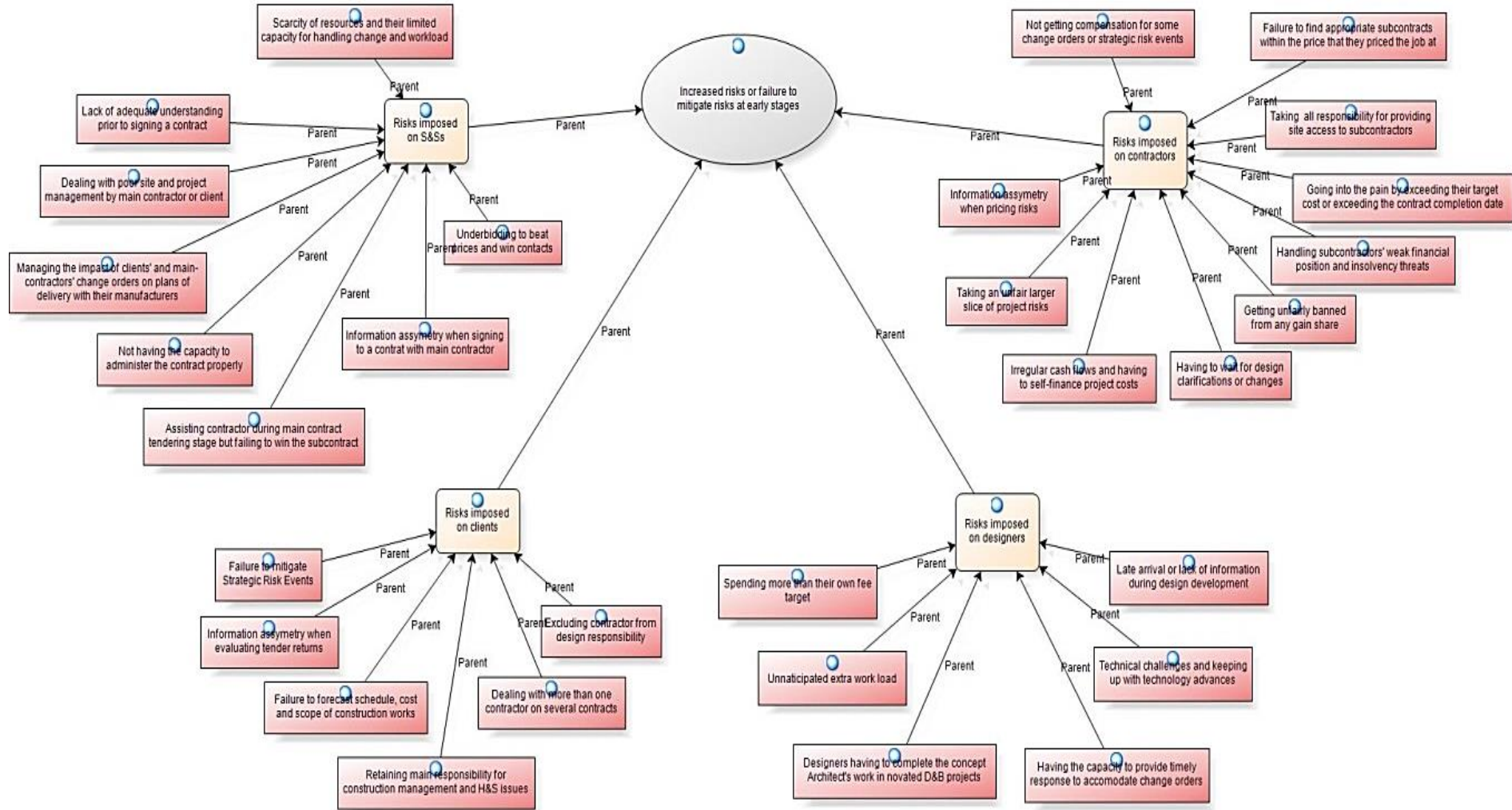


Figure 5.4: Coding structure of 'Increased risks or failure to mitigate risks at early stages'

5.2.8 Making unnecessary assumptions (PB8)

Inefficient construction procurement arrangements can put buyers and suppliers into positions where they have to make unnecessary assumptions, which may lead to consequential wastes. As summed up by a senior consultant:

I think the biggest source of inefficiency from my view is the lack of common understanding developed during the procurement process such that each party enters the contract with a whole set of assumptions that might be wrong - on the contractor side pricing unclear or unknown information and on the client side not knowing exactly what they are buying” (Senior consultant (FICE), Oct 2015).

When asked about his recommendations for overcoming this prevalent source of waste in construction projects, he stated:

“Eradication during the tender procurement process to eliminate or fully understand the assumptions up on which the contract is being priced or procured, so the objectives of the contract could be priced and delivered accordingly” (Senior consultant (FICE), Oct 2015).

When a senior architect who is also a head of innovation at a contracting company was asked about the main causes of common design errors in construction and whether these are procurement-related or not, he said:

“Yes, I think one of the root-causes, it is back to the client though, if the client is not actually prepared to make the investment in terms of a proper site investigation. Quiet often that can lead to issues of cost as well because they have not fully assessed what's actually there, and so the designers are making assumption about what's there and what is not, and then that just leads to delays or additional costs at a later stage when the reality of the situation is exposed” (Head of Innovation and Director of National Frameworks, Nov 2015).

This response helped to expose to the author how that ‘making unnecessary assumptions’ could be a major cause of waste in construction projects. If the right information is not provided to the designer at the right time, then designers would have to make unnecessary assumptions, which in turn could lead to consequential waste (e.g. re-work, delays, additional costs). The same applies to all project parties concerned and that’s what partnering, building information modelling (BIM) and other collaborative ways of working try to minimise.

5.2.9 Opportunistic practices (PB9)

Inefficient procurement arrangements can support and/or encourage opportunism. Figure 5.5 captures various examples of opportunistic behaviours captured by this study. It also illustrates the coding structure that led to the development of this subcategory. In short, the data analysis indicates that if a buyer uses unfair contractual conditions, transfers risks or imposes commercial pressure on their supplier without an adjustment in opportunity, then it is very likely that that their suppliers may react badly. It is, therefore, important for clients to gain a better understanding about the effect of their construction procurement choices on behaviour and performance.

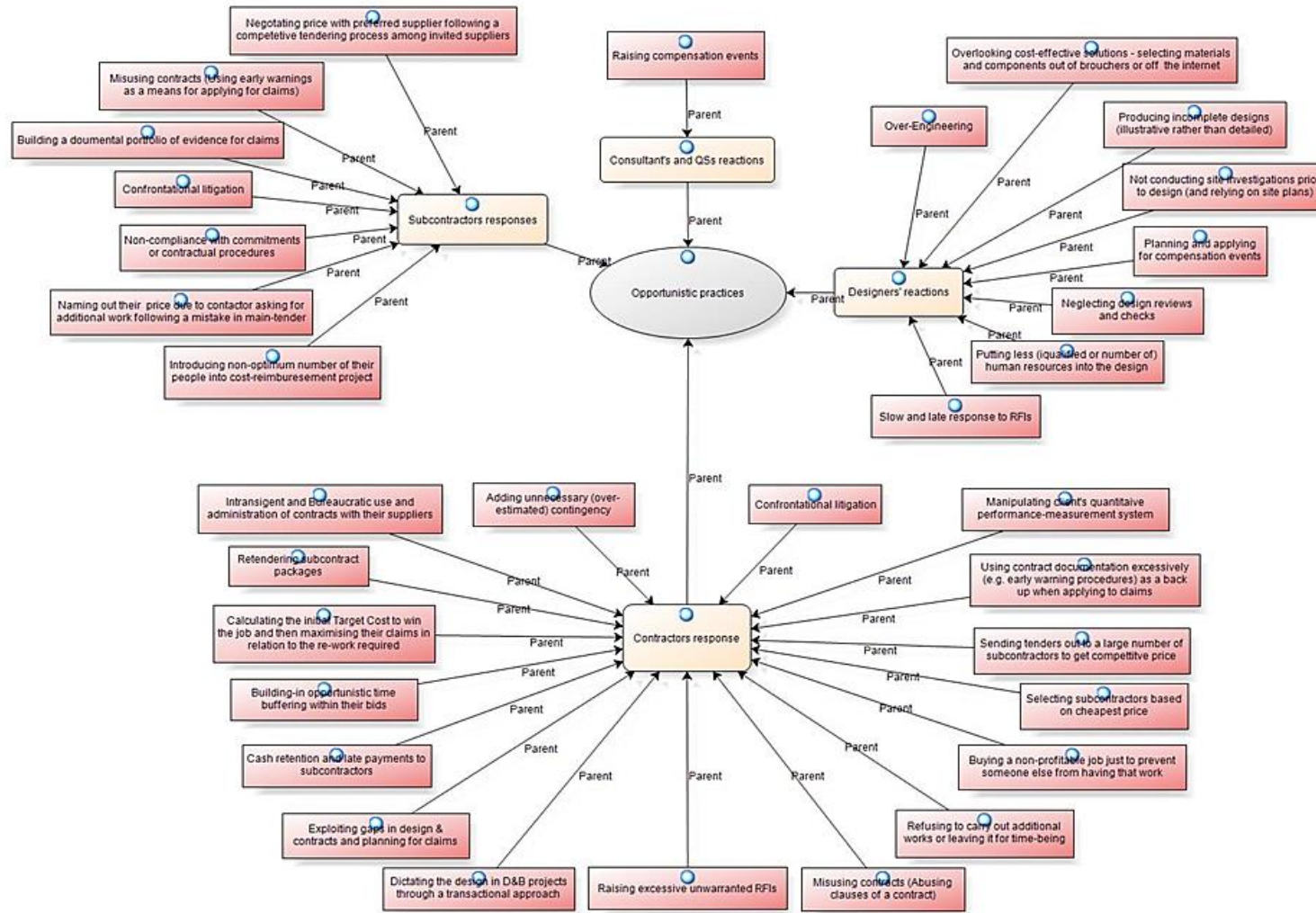


Figure 5.5: Coding structure of 'Opportunistic practices'

5.2.10 Variations and change events/orders (PB10)

There is no doubt that inefficient or inappropriate construction procurement arrangements could lead to variations and unnecessary change orders, which in turn lead to consequential wastes. Many examples which illustrated the possible causes and effects of variations and change orders were identified during the data collection and analysis of this study. For example, it appeared from the data that variations and change orders often occur when clients don't spend enough time and money during pre-construction stages, in order to assess risks and develop solutions to problems during early stages. For example, an associate director of a consultancy company offering financial governance services to a major public client asserted the following to the author:

“One of the problems on this particular job was that the client was eager to let it before the old framework expired. And consequently, it was you might say less well defined at the time it was let than it ought to be, and that resulted in an awful lot of change in the early days” (Associate Director, financial governance services, 2016).

In an interview with the 'Head of Innovation' of a main contractor, he emphasised how that clients should not be hesitant to invest enough money to improve the quality of their procurement and tender documentation, which includes design drawings. That is because the use of poor procurement information, while using a price-competitive tendering approach for example, could encourage tenderers to exploit gaps and errors in the contract. He stated that:

“Depending on the quality of the procurement information, hmm you would immediately sort of standard how much waste could be included. You know, because if the procurement process is not accurate then it leads to a large variation in terms of the approach that people can take and the opportunity for people to be able to exploit the weakness in the procurement” (Head of Innovation and Director of National Frameworks, Nov 2015).

Also, lots of variations and consequential wastes could occur, if clients don't spend sufficient time and money in making proper site investigations and updating and maintaining the quality of their As-built records. As stated by a deputy project manager working on a major infrastructure project in the UK:

“There are not good As-built records kept. That's another issue also that leads to lots of technical queries and a lot of changes” (ECC Deputy Project Manager, 2016).

Furthermore, it appeared through during data collection and analysis that late or lack of involvement of contractors in the design could lead to design errors, change orders, and thus unnecessary consequential wastes. Interestingly, a senior design coordinator working for a major tier-1 contractor informed the author that change orders and instructions cause them lots of troubles and lead to waste of human potential as they enforce Qs to spend most of their time evaluating impacts of changes on their profitability rather than offering value-maximising solutions. He stated:

“I think that so far we are probably just over a year into the contract now, so we've had over a three-hundred instructions, so project management instructions. And we've had two hundred and fifty odd supervisors' instructions. So, that's five-hundred instructions that we've had on this scheme since we've started, on a design that is already supposed to be completed. So those instructions all have to be evaluated and obviously tie the Qs up” (Senior Design Coordinator, 2016).

In follow up interviews to understand the reasons for the huge amounts of change orders and instructions provided in the comment above, the site-agent working for the main contractor provided the author with the following explanation:

“There have been a lot of, we call them, Project Management Instructions (PMIs) on the project. And it has been for a couple of reasons, because the design was not complete or they've missed out quite a lot of details in the design. To start off, the project has been live for nearly a year now. And it has been a

very slow process of getting responses back for 'requests for information' (RFI). And this has been highlighted to the client in our meetings with the client, and with the designer. You know your response time to our RFI is very slow. And they will say that we don't have the resources. And one said, they were accusing us of raising too many RFI. And we conquered that argument saying 'well the reason we are raising so many RFIs is because the design is not clear'. So, which has a sort of indirect impact on the number of PMIs getting raised" (Site Agent (CEng, MICE), 2016)

The comment above clearly shows how that inefficient procurement practices can support or encourage wasteful behaviours. Clients and decision makers, therefore, need to be aware of the impact of their procurement decisions (i.e. change orders) on supply-chain performance and project outcomes. As declared by the 'Head of Innovation' of a major contractor who also has an architectural background:

"On some projects, it's more rewarding for a contractor to have lots of changes in a job. And that's not just that the contractor, that's the supply chain as well because all those delays escalates and the percentages of mark-up escalate on top of those costs" (Head of Innovation and Director of National Frameworks, Nov 2015).

Other implications of change orders include its impact on the downstream supply-chain. This might be less or unknown to clients, as tier-2 contractors are usually contracted to the tier-1 management contractor. In a discussion with a site manager who works for a specialist façade subcontractor, he explained to the author the commercial risks and challenges they face due to change orders. These risks could be severe to an extent that they could lead to insolvency, which if happened could lead the client to large project delays and financial losses. According to the site manager:

"Contractors' and clients' change orders cause us lots of risk and pressure due to our commitments and plans of delivery with our manufacturers - we need at least 3 months of notice prior to delivery. Additionally, facades are expensive

and thus cannot be ordered excessively and just stored on site” (Site manager of a specialist subcontractor, 2016).

5.3 Consequential Waste (W)

It has been shown in the study that prevailing construction procurement practices can lead to or support inefficient performances and behaviours, which in turn lead to consequential waste. In this study, the category of ‘Consequential Waste’, as shown in Figure 5.6, was developed based on the emergence of four main classifications of waste:

- Financial losses and cost overruns (Cost waste),
- Time waste,
- Quality loss (Value loss in design), and
- Waste of human potential.

During data collection and analysis, all incidents of waste were initially coded in a general theme named waste. Then, the four classifications of waste, mentioned above, were formulated through clustering of codes, constant comparison and memoing processes. Consequently, the ‘consequential waste’ category was developed based on an overall understanding of and reflections on emerging themes and concepts. Examples of emergent sub-categories and themes that led to the development of the ‘consequential waste’ category are itemised below.

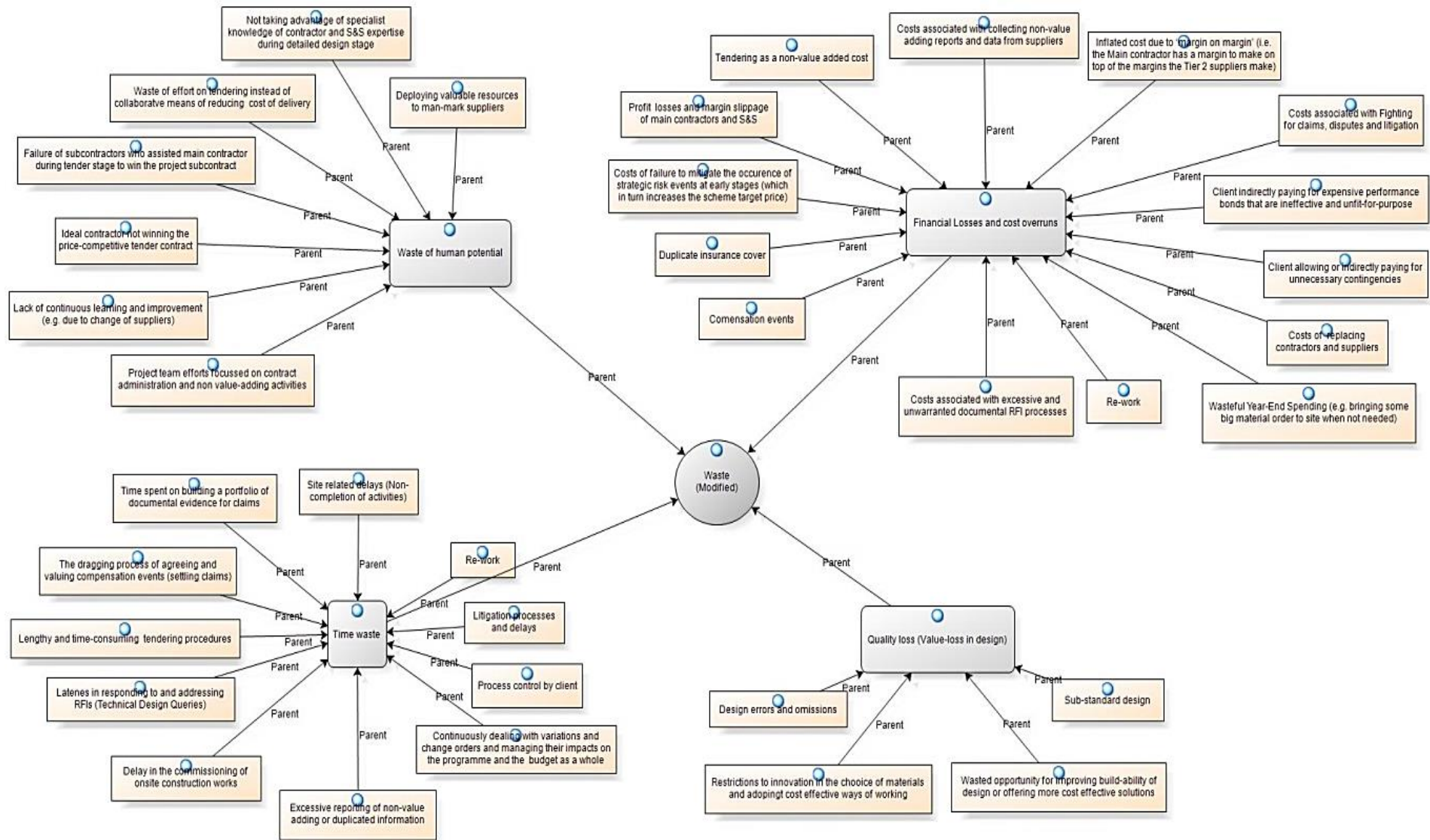


Figure 5.6: Coding structure of 'Consequential Waste'

5.3.1 Financial losses and cost overruns (W1):

The sub-category ‘Financial Losses and Cost Overruns’ was developed, based on the emergence of the following themes:

- Client allowing or indirectly paying for unnecessary contingencies
- Client indirectly paying for expensive performance bonds that are ineffective and unfit-for-purpose
- Unnecessary Compensation events
- Costs associated with collecting non-value adding reports and data from suppliers
- Costs associated with excessive and unwarranted documental RFI processes
- Costs associated with Fighting for claims, disputes and litigation
- Costs of replacing contractors and suppliers
- Costs of failure to mitigate the occurrence of strategic risk events at early stages (which in turn increases the scheme target price)
- Duplicate insurance cover
- Inflated cost due to ‘margin on margin’ (i.e. the Main contractor has a margin to make on top of the margins the Tier 2 suppliers make)
- Profit losses and margin slippage of main contractors and S&S
- Costs of re-work
 - On-site rework
 - Reproducing design
 - Duplication in reporting
- Tendering as a non-value added cost
 - Clients indirectly reimbursing contractors for tendering expenses
 - Costs of man-hour that have been put into answering and submitting PQQs
- Wasteful Year-End Spending (e.g. bringing some big material order to site when not needed)

5.3.2 Quality loss (Value-loss in design) (W2):

The following themes evolved from the analysis of the data, and led to the development of the sub-category titled as Quality loss or Value-loss in design:

- Design errors and omissions

- Restrictions to innovation in the choice of materials and adopting cost effective ways of working
- Sub-standard design
 - Cost-cutting
 - Poor specifications
- Wasted opportunity for improving build-ability of design or offering more cost effective solutions

5.3.3 Time waste (W3):

This sub-category (Time Waste) was developed based on the emergence of the following themes:

- Continuously dealing with variations and change orders and managing their impacts on the programme and the budget as a whole
- Delay in the commissioning of onsite construction works
- Excessive and time-consuming reporting of non-value adding or duplicated information
- Lateness in responding to and addressing RFIs (Technical Design Queries)
- Lengthy and time-consuming tendering procedures
- Litigation processes and delays
- Slow performance due to bureaucratic process control by client
 - Client double checking BoQ prepared by main contractor
 - Over-emphasis on process control procedures and inefficient deployment of human resources in public sector projects
 - Slow performance due to bureaucratic documentation via clerks of work.
- Delays due to re-work
 - On-site rework
 - Reproducing design
 - Duplication in reporting
- Site related delays (Non-completion of activities)
 - Due to a late start
 - Due to a priority change
 - Due to conflicting demands

- Due to Incomplete Enabling Actions (mainly because of insufficient collaboration and coordination between disciplines)
 - Poor performance of the subcontractor who might be on the critical path
 - Waiting for design information
 - Waiting for payments that a client needs to make
 - Waiting for safety paper-work that needs signing of
 - Waiting for site clearance
- Due to Insufficient Time Planned
- Due to lack of decision on an activity
- Due to lack of resources
 - Break down of Equipment
 - Unavailability of required manpower on the day of the job to start the activity
 - Waiting for specific materials to arrive
- Due to project changes
- Due to 'other' related issues
- The dragging process of agreeing and valuing compensation events (settling claims)
- Time spent on building a portfolio of documental evidence for claims

5.3.4 Waste of human potential (W4):

This sub-category (Waste of Human Potential) was developed based on the emergence of the following themes:

- Deploying valuable resources to man-mark suppliers
- Failure of subcontractors who assisted main contractor during tender stage to win the project subcontract
- Ideal contractor not winning the price-competitive tender contract
- Lack of continuous learning and improvement (e.g. due to change of suppliers)
- Not taking advantage of specialist knowledge of contractor and S&S expertise during detailed design stage
- Project-team efforts focussed on contract administration and non-value-adding activities
 - Contractor getting on with drainage works 'blindly and having to deal with high change in the scope of construction works

- Contractor's commercial manager efforts mainly focussed on dealing with the reporting of financial performance rather than offering solutions to manage risks and reduce costs
- NEC Project manager's effort mainly focussed on administrating the contract rather than managing production flow
- Project team members putting too much effort on providing evidence for claims and compensation event rather than managing production
- QS efforts tied up to heavy contract admin work rather than providing more valuable risk management and cost reduction activities
- Waste of effort on tendering instead of collaborative means of reducing delivery costs

5.4 Summary

This chapter illustrated the main themes , concepts and relationships that emerged out of the data and led to the development of two main categories of the study's conceptual model; these are: 'Inefficient Performance and Behaviour' and 'Consequential Wastes'. The next chapter reveals the institutional factors that influence approaches to construction procurement. These institutions influence the 'rules of the game' and, arguably, lead to the generation and persistence of waste in construction.

CHAPTER SIX: INSTITUTIONAL FACTORS INFLUENCING PROCUREMENT

6.1 Introduction

The previous chapter demonstrated how transactional-based procurement arrangements can influence project-team behaviours and performances, and thus lead to consequential wastes. This chapter introduces various institutional factors that have been found to influence construction procurement choices and practices. It is argued that these institutional factors provide novel explanations as to why inefficient procurement practices prevail and persist in the construction industry.

6.2 Institutional Factors (IF)

This chapter focuses on describing the coding structure that led to the emergence of the category titled ‘institutional factors’, and provides brief explanations to each of its twelve constituent sub-categories (see Figure 6.1). The study found that these institutional factors lead to inefficient procurement arrangements, which lead to inefficient behaviours and practices, which in turn lead to consequential wastes. The overall findings of this study also revealed that the institutional factors, identified within this chapter, combine to create the apparent coherence for the current prevalent construction model. The examples provided in the sections below demonstrate how these prevailing institutions contribute to the generation and persistence of wasteful behaviours and practices in construction.

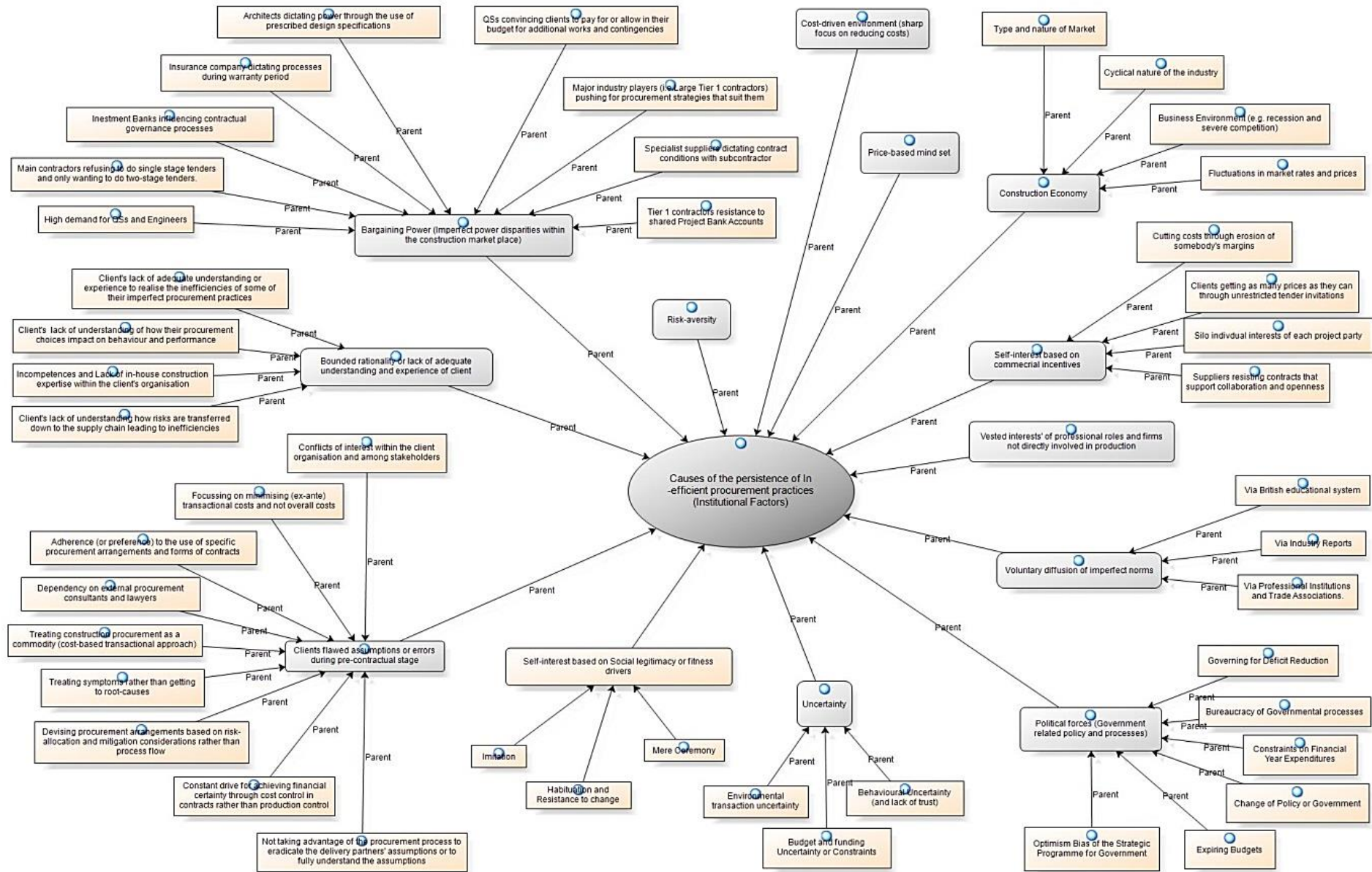


Figure 6.1: Coding structure of 'institutional factors'

6.2.1 Bargaining Power (Power disparities within the construction market place) (IF1)

This study found that bargaining power is one of the major institutional factors that influence construction procurement choices and arrangements. There are various examples provided by the participants of the study, which have led to the development of this sub-category. These included:

- Major industry players (i.e. Large Tier 1 contractors) pushing for procurement strategies that suit them
 - Tier 1 contractors resistance to shared Project Bank Accounts
 - Main contractors refusing to do single stage tenders and only wanting to do two-stage tenders.
- Architects dictating power through the use of overly prescribed design specifications
- High demand in the market for Qs and Engineers
- Investment Banks influencing contractual governance processes
- Insurance company dictating processes during warranty period
- Qs convincing clients to pay for or allow in their budget for additional works and contingencies
- Specialist suppliers dictating contract conditions with subcontractor

6.2.2 Bounded rationality or lack of adequate understanding and experience of clients (IF2)

The term ‘bounded rationality’ simply means that decision makers act rationally but have constraints on their cognitive, analytical and data-processing capabilities, especially in uncertain and complex environments. In this study, four main themes emerged out of the data, which have led to the development of this subcategory:

1. Client’s lack of understanding of how their procurement choices impact on behaviour and performance.
2. Client's lack of adequate understanding or experience to realise the inefficiencies of some of their procurement practices

3. Client's lack of understanding how risks are transferred down to the supply chain leading to inefficiencies
4. Incompetence and lack of in-house construction expertise within the client's organisation

During data collection, various participants provided the author with interesting incidents that indicate that client's may not be aware of how their procurement rules and arrangements could drive wasteful behaviours. So for example, a senior consultant who specialises in the use of performance-based contracts explained to the author why clients remain to have a preference to rely on inefficient contract-performance measures, as follows:

“We have tried to help them and offer them a procurement route with performance measures that aid and help them to understand the contract...But they were not convinced partly because some people don't understand the impact of performance measures on behaviour. And sometimes because they have a certain mind-set, so they interpret how they use performance-based contracts incorrectly” (Senior Consultant (PhD, Nov 2015).

6.2.3 Buyers' flawed assumptions or errors during pre-contractual stage (IF3)

This study identified a number of critical flawed assumptions or errors that buyers make during pre-contractual stage; these cultural-cognitive institutions contribute to the persistence of inefficient procurement practices in construction. Examples of these include: treating construction procurement as a commodity, taking an approach to procurement based on risk-considerations rather than process-flow, and treating symptoms rather than getting to root-causes. Figure 6.2 below provides a holistic view of the emergent themes that led to the development of this sub-category. In addition, Chapter 8 (Discussion and Integrated Extant Literature) will provide more detailed explanations of this sub-category.

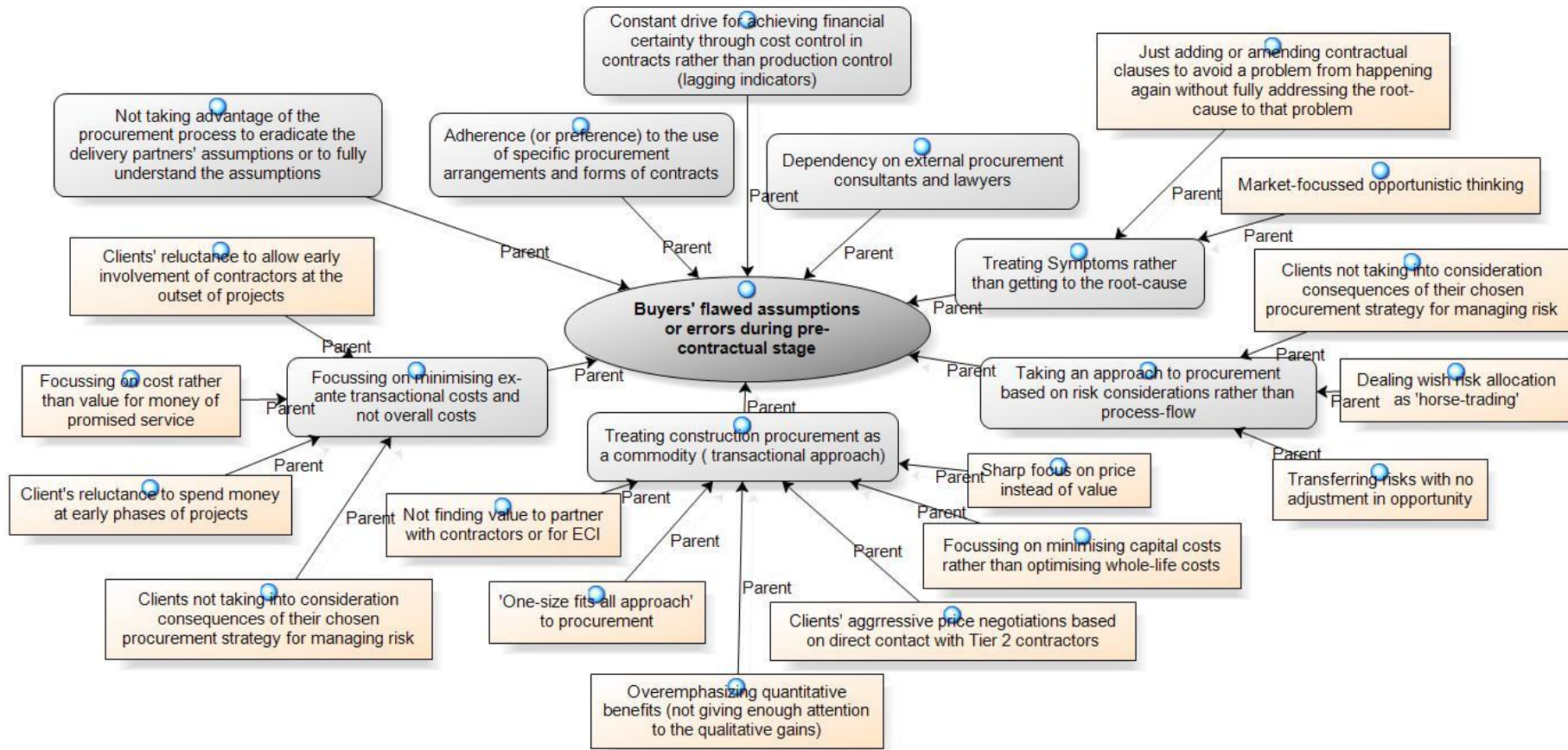


Figure 6.2: Coding structure of 'Buyers' flawed assumptions or errors during pre-contractual stage'

6.2.4 Construction Economy (IF4)

This study found that the construction economy can influence construction procurement practices. There were a number of themes that emerged out of the data and led to the formation of this subcategory:

- Business Environment (e.g. recession and severe competition)
- Cyclical nature of the industry
- Fluctuations in market rates and prices
- Type and nature of the construction market

In a discussion with the ‘Head of innovation’ of a major UK contractor about how the construction economy can influence procurement practices, he informed the author about how clients took advantage of the UK recession in 2009 and transferred unfair risks to desperate contractors. He stated:

“Yeah, it is unfortunately part of the cyclical nature of the industry. It is no real surprise but during the recession, when we are coming out of the recession, you have all the main contractors reporting large losses on projects; because they have taken risks or accepted contracts or terms of conditions that they would not normally because they are desperate to get the work. And equally when you get out of the recession, it's kind of making 'Hey' because the resources and the teams are not there, so it allows contractors to make more money than they would normally...because that cyclical nature of the industry drives that behaviour as well in terms of the procurement practice. So clients behave badly when it is a recession” (Head of Innovation and Director of National Frameworks, Nov 2015).

Consequently, he also described to the author how clients’ poor procurement practices (e.g. sending tenders to large numbers of competitors and using aggressive price negotiations based on direct contact with tier 2 contractors) pushed main contractors to behave opportunistically. According to him, this is part of the cyclical nature of the industry. The narrative below clearly shows how the construction economy (as a regulative institution) can influence procurement practices. It also demonstrates that

‘self-interest’ (see section 6.2.9 below), as an institutional norm, contributes to the generation and persistence of wasteful behaviours and practices in construction.

“So, I remember when we went into the recession and a lot of contractors were saying we will only bid design and bid projects if we were on a three, and we will only do traditional tenders if we were on a four. And we were seeing tenders coming out where they would normally go out to eight on a traditional project, they will may be even go to eight on a design and build. Because they knew they can do that, because people were actually desperate to win work. But, then when recession ended, it was very hard to find any contractor with any free people and tendering capability, so suddenly clients were saying oh yeah we were sending out this tender with six on the list and all the contractors were saying ‘no we don't want to tender it’. And equally, I remember one bid when the council was looking to tender a group of schools. It was five schools I think, and they have gone out to the supply chain to find modular suppliers and get the prices of them first. And then give those to the contractors and say right give us your price then for building this. You know where they have already kind of massaged the Tiers 2, if you want, in terms of where the price was” (Head of Innovation and Director of National Frameworks, Nov 2015).

A following interview was then conducted with a business development manager to gain more insights about how the construction economy influences clients’ construction procurement decisions and arrangements. Interestingly, the interviewee criticised procurement consultants for using trends of what happened in the past, so as to convince clients to utilise safeguarding practices (see section 4.2.9); that is because these procurement arrangements can allow consultants to maximise their positions and roles in construction projects (see section 6.2.11 about ‘vested interests’ below). He stated:

“I think this arises from the fact that these procurement experts are looking at trends based on what happened in the industry over the last five years. And if you look at the last five years, contractors have taken a considerably larger slice of risk on their customers. However that was consequence of a significant recession, when work was very difficult to come by; and contractors took decisions that they certainly would not have taken in a stronger business

environment. And also are unlikely to take again, because many contractors have had their fingers burnt...Hmm, so I think one of the important issues is to understand the direction in which the construction economy is going as opposed to what happened in this recent past...So, look ahead rather than look behind you” (Business Development Manager, Dec 2015).

6.2.5 Cost-driven environment (sharp focus on reducing costs) (IF5)

Buyers’ and suppliers’ sharp focus on reducing costs was identified as one of the major institutional factors, which lead to the persistence of wasteful construction procurement practices. In an interview with a senior consultant, he provided the author with an example at which a public sector client initiated the use of new types of contracts (i.e. Asset Support Contract), with the aim of achieving efficiencies of 25% over the following five years. The problem is that the client and the suppliers focused on cutting costs rather than maximizing value for money, leading to increased inefficiencies. This was described as follows:

“We had an example with a public-sector client where they altered their style of maintenance contracts so that it was looking more at the cost of the item, and concentrated more at the costs going through the project. It was a positive move because, hmm, there were concerns that projects were costing more than they should. There was a big study which showed that roads cost more to be built in Britain as opposed to Denmark and Germany, Finland and New Zealand and various other places. So there was lots of pressure to say well we need to look at the costs we spend on the projects. So, there was a change in the style, in the attitude of contracts that was being put out. So, it focussed more on the cost running through the project. Unfortunately, what happened was exactly as we predicted. We suggested that they did not do it. But what happened was that the contractors that were being put on to those projects; then had an army of quantity surveyors so they could look at the costs in as much detail as possible. But they looked at it from their own perspective and not from the client's perspective. So, of course things did not get or help to achieve any better value” (Senior Consultant (PhD), Nov 2015).

The example above emphasises that main efforts and attention should be focussed on finding more efficient ways of working to reduce costs (the focus is on production improvements), rather than contractual and cost-cutting practices which may have an impact on quality (sharp cost-driven focus). This interpretation was confirmed by the interviewee as follows:

“Yes. And I think it's the interpretation between the two. If someone says: we need to look at the cost of this. What we should be looking at is we should be looking at the value that is being delivered for that price. But what people invariably misinterpret as is looking at cutting the cost. And that's where the mistakes are made. You just look at a percentage being taken-off rather than being intelligent about it and saying 'what value is this delivering? Is this part not delivering value?' It's almost like doing a process management where you look at each individual step through the process and you decide whether it's delivering value or not, and then you take out the non-value adding items. The problem with the approach they followed is that it only looked at delivering a service from the financial point of view” (Senior Consultant (PhD), Nov 2015).

A senior project manager was asked about the reasons that his clients have a preference for breaking down work-packages into smaller pieces and several individual contracts, although such practice often leads to increased risks and fragmentation, his answer showed that ‘cost control’ is the main driver for such inefficient procurement practices.

“I think, bottom line, it's all about money. And apparently, losing influence on how their money is allocated to contractors, and how that bunch of money might be used to ‘forces of will’. So it's a bit dramatic explanation; but I think this is the core of this idea of clients trying to engage in individual contracts” (Certified Senior Project Manager (PMP, MRICS), Nov 2015)

In subsequent interviews, many of the participants complained about the cost-driven environment at which they have to operate. For example, the ‘Head of Innovation’ of a leading contractor explained to the author how that construction buyers’ sharp focus on reducing costs leads to a zero-sum game, and thus can encourage suppliers to behave

opportunistically. He stated:

“I remember one bid when the council was looking to tender a group of schools. It was five schools I think, and they have gone out to the supply chain to find modular suppliers and get the prices of them first. And then give those to the contractors and say right give us your price then for building this. You know where they have already kind of massaged the Tiers 2, if you want, in terms of where the price was...The problem is that most clients only work on the advice of their procurement advisers, which is all these larger companies....and the problem is that in any business it has got to be accredit-able for everybody. It has got to work for everybody. If you screw the main contractors down so hard, then they will try to find other ways in making their money. It's exactly the same with the supply chain. You know, everybody has got to make a profit” (Head of Innovation and Director of National Frameworks, Nov 2015).

6.2.6 Political forces (Government-related policy and processes) (IF6)

This study found that political forces can have a negative influence on construction procurement arrangements and outcomes. These political issues could be in the form of bureaucracy of processes (e.g. excessive reporting requirements), which lead to unnecessary delays and expenses. They also relate to other factors such as bias of strategic programmes, pushing projects to start without spending adequate time in planning for and assessing potential risks, or unnecessary bulk-buying of materials due to expiring budgets. In general, this subcategory was developed based on the emergent of the following themes and subthemes:

- Bureaucracy of Governmental processes
- Change of Policy or Government
- Constraints on Financial Year Expenditures
- Expiring Budgets
- Governing for Deficit Reduction
 - Deferring actions and events to the next financial year
 - Financial Engineering
- Optimism Bias of the Strategic Programme for Government

When asking participants about the causes of commercial misalignments and inefficient procurement arrangements that they reported during interviews, they often referred to political forces and pressures, as one of the major sources leading to inefficiencies in construction and civil engineering projects. In many instances, the responses indicated that clients and decision-makers have not been able to invest enough time and resources during planning and pre-contractual stages, due to political pressures imposed on them. For example, when investigating the main reasons for the vast amount of change orders that occurred with an infrastructure project as reported by various project-parties, the following response was received:

“We can and we have on this particular scheme successfully obtained compensation events for increased resources as a result of the sheer volume of change. One of the problems on this particular job was that the public-sector client was eager to let it before the old framework expired. And consequently, it was, you might say, less well defined at the time it was let than it ought to have been, and that resulted in an awful lot of change in the early days” (Associate Director and Leader of commercial team providing financial governance services, 2016).

This claim was supported by the deputy project manager, as follows:

“Obviously politics do affect the project... Well, well, from what I have seen in this project, it has put a pressure on everybody to deliver the project faster. And that has been difficult because it has been promised politically that something will be completed by a certain date; but that has not considered all the changes that we had to deal with after. You can understand how much pressure it has put on everybody. They still have to finish at a certain date to satisfy the client or the Government. But they have to do then quite a lot of more work, which was not originally planned. So that really put a lot of pressure on everyone” (ECC Deputy Project Manager, 2016).

Similarly, a client adviser referred to political pressure when explaining the reasons for the existence of commercial misalignments in a trial project that he was involved in. In that project, according to him, the tier 2 suppliers exploited the cost-reimbursable contracts deployed by the client, which also forced the client to man-mark their suppliers. As a result, these practices led to a confrontational environment and consequential wastes. His response emphasised that political pressure has not allowed them to spend sufficient time in considering and designing the most appropriate construction procurement arrangements for their project. Accordingly, they had to enforce governance approaches during the project delivery to control exploitation and opportunism, which eventually complicated the problem rather than solved it. According to him, these problems occurred and persist *“because always there is a pressure to get to site and start progress basically. So, there have been a pressure to probably go to site maybe a bit earlier than what we were set-up to”* (Senior Consultant and Project Manager, 2016).

Changes of Government or policy could also influence the way projects are procured, managed and operated. Funding and budget uncertainty, due to unstable political conditions, could limit the decision makers’ ability to adopt innovative procurement and project delivery approaches. It could also make them reluctant to spend lots of money at the front end of projects. So, for example, under budget uncertainty clients may tend to prefer a separated procurement approach, as opposed to integrated approaches which require early contractor involvement and thus increased initial costs. In an interview with a senior design coordinator working for a major contractor, he explained to the author how political forces have influenced the progress of their project, as follows:

“You’ll probably be aware that the Government obviously has a rouge programme. Hmm, so that rouge programme effectively fixes the budget for all of these schemes. Now you might (Hehehe) happily be going along and then suddenly either there is a change of Government or, hmm, there is a change of policy. So, this scheme, I think suffered a change of Government early in the stage. So, effectively they have to do a funding review or whatever. So, the scheme is then put on hold while they establish whether the money can be spent on that scheme or not... Obviously, there is some politics involved in some of

that as well, in terms of getting schemes through” (Senior Design Coordinator, Dec 2015).

There are also political forces related to expiring budgets and governing for deficit reduction, which might lead to the execution of ill-defined projects. In some instances, these political forces may also support inefficient procurement practices (e.g. bulk-buying of materials) and thus lead to consequential wastes. As stated by a senior project manager working on a major infrastructure project:

“The other issue which comes about is when the public-sector client looks at their total programme expenditure, for example, of the current financial year. And, so they may say ‘collectively we’re not spending enough money’. So, they may then look for projects to come up with hmm, if you like, ways of spending more money in the financial year, which may be possible through hmm pre-payment on material orders - getting materials to site quicker. Hmm, and perhaps paying for some of the long-term site overhead costs in advance. But then on the converse of that, sometimes they may come around the other way and say we’ve got too much money forecast for this year, we need to cut back a bit” (ECC Project Manager, Dec 2015).

When asked about how the client cuts back in expenses and whether this is achieved through making design changes during projects, he said:

“It’s Aha [laughing] I suppose it’s predominately almost through financial engineering to be perfectly fair with you; but sometimes it may mean that you have to, you may have to, put off hmm bringing some, some big material order to site, or you may have to defer that a month or two, so it goes into the next financial year; that sort of thing” (ECC Project Manager, Dec 2015).

The arguments above have been supported by author participants. For example, when a senior procurement consultant was directly asked about his opinion of why wasteful procurement practices persist, he criticised the ‘taken for granted’ approaches to funding and procuring public sector projects, as follows:

“Partly it's also to do with the way, certainly in public sector, the way that they are funded. So we do have and we have had with a number of our public sector clients, hmm position around March, February/March, where they've got budget to use them. Because if they don't spend the money they have been allocated, it gets reduced for the following year. And the following year might be reduced but then you don't have as much to spend. You can't do what you wanted to do with it. So, they end up spending money just to keep the budget for the following year. And it happens through our public sector and in every country...Absolutely ludicrous but it's accepted that ‘that's the way it is and we can't do anything differently or anything better!’” (Senior Consultant (PhD), Nov 2015).

6.2.7 Price-based mind set of procurers (IF7)

This study identified ‘price based mind-set’ as an intuitional norm that influences construction procurement choices and practices. For example, in an interview with a senior consultant (who specialises in performance-based contracts), he was asked about why many clients remain to have a preference for utilising price-competitive tendering, despite the strong criticisms by many professionals and academics. He argued that this procurement practice persists because of clients’ price based mind-set and poor understanding of the implications of the price-quality ratio that they choose. He stated the following:

“We have had different clients. What we have is called a cost-quality ratio or price-quality ratio. And different clients have had different ideas of the ratio. I would say the less experienced clients would have a higher cost-quality ratio. They may do it 70:30 on cost. Whereas the most experienced clients I would say would do it the other way around. They would have a 70% on quality and 30% on cost. The reason being is that if you ask for a high ratio of cost then you'll get what you've asked for. You'll just get the cheapest and you won't necessarily get high quality. The other way around, you'll guarantee getting a higher quality and then the cost comes into it less so. But you will get what you pay for. You get what you asked for; that's the way of thinking about it” (Senior Consultant (PhD), Nov 2015).

Consequently, the author interviewed a senior cost consultant, in order to gain a better understanding of why many clients and their consultants tend to have a price based mind-set and approach to construction procurement. Interestingly, he asserted that this is because:

“They don't know and understand how risks are transferred down to the supply chain leading to inefficiencies. It is easier and more tangible for them to compare between prices; that is what they can see and understand” (Senior Cost Consultant (MRICS), Dec 2015).

Furthermore, when a project manager who works for a subcontractor was asked about the typical problems that they face with contracts and commercial arrangements, he complained about the prevalence of price competitive tendering approaches. In particular, he criticised clients' consultants (i.e. Quantity Surveyors) for their price-oriented mind-sets, as follows:

“Trying to tender for contracts; but you'll never get them because the quantity surveyors or the commercial teams don't understand what they are looking for. It's a price based mind-set! We're very specialist and the cost mind-set of the quantity surveyors doesn't allow them to understand what we do” (Director and Project Manager of a Specialist Subcontractor, 2016)

Given that most of the clients that procure construction projects lack experience and may only ever build once or twice; they invariably seek cost and procurement advice from quantity surveyors (Qs). These professional consultants are not directly involved in the production of construction works, and thus tend to rely mainly on financial and legal criteria when making their decisions. As argued above, this 'price-based mind-set' can lead to flawed construction procurement choices, which in turn can prevent ideal suppliers from winning contracts (i.e. waste of human potential), or encourage those who secured the job to engage in opportunistic practices in order to compensate their compromised contract price. Interestingly, it has been argued by a business development manager working for a main civil engineering contractor that QS's price-based mind-set could also lead to inaccurate project cost-estimates, which in turn may

have a negative impact on clients' procurement decisions. This has been described as follows:

"I've got some sympathy with cost consultants in that they are quantity surveyors; they are counters. They understand the cost of concrete, steel, excavation, and so on. What they don't understand is the method-related cost, programme, build-ability and so on. And if you look at the cost on a kilometre of a highway on five different projects, you'll find very different answers. And the correct answer is not the average. It's driven by the method-related cost whether it's ground conditions, or location, or choice of plant, or time constraints" (Business Development Manager, Dec 2015)

6.2.8 Risk-aversity (IF8)

This study found that 'risk-aversity' contributes to the persistence of inefficient procurement practices in construction. This institutional norm occurs in two different forms. Firstly, it appears, according to the participants' views, that many clients are reluctant to take the risks of trying newer or different construction procurement approaches. So, this institutional factor leads to the establishment of a close-minded approach to procurement, which is based on familiarity rather than appropriateness – A 'habituation' approach. Secondly, many "*clients believe that they are not doing business to take on risks; instead, others should take this risk on behalf of them*" (Managing Director and Principal Consultant in the Rail Industry, Nov 2015). This claim was also asserted by the 'Head of Supply Chain' of one of the largest tier-1 contractors in the UK. He stressed to the author that: "*what you have got to recognise is that we as a business are very risk-averse to be honest as a business generally*" (Head of Supply Chain, Nov 2015). Most of the participants criticised clients for pushing risks to their suppliers and explained the possible consequences of transferring risks. Interestingly, these implications are not just limited to the pricing of risks that the client eventually pays for; but more importantly about creating a confrontational working environment, which may encourage suppliers to exploit opportunities that may occur due to unforeseen conditions.

An interview with a business development manager has also allowed the study to gain more insights of how risk-aversity leads to inefficient construction procurement practices, and thus contributes to the generation and persistence of wasteful behaviours and outcomes. For example, the interviewee provided the author with the following narrative:

“We often get customers who come to us and say: we’ve got the scheme, it has been designed and our advisers tell us that we should go Design and Build, because we transfer the risk that if our design is wrong you cannot come back to us and claim’. Hmm, the problem contactors have then is there is virtually no way of managing that risk. It’s not our design, there are no means of checking the design in the tender period; we just have to say what are the chances of it being wrong and put a number against it. Hmm, similarly, we get customers who come to us and say: well, you know, other risks are transferred to you e.g. ground conditions or, and the problem is that if we don’t have a means for managing that risk during the tender period, then the selling price, the value would be reflected in the selling price which in the current market will not be good value for the customer.” (Business Development Manager, Dec 2015).

6.2.9 Self-interest drivers (IF9)

This study identified ‘self-interest’ as one of the major institutional factors which contribute to the generation and persistence of wasteful procurement practices in construction. Self-interest here was found to be based on two different types of drivers or rewards: (1) Commercial incentives; or (2) Social legitimacy considerations or mere ceremony. Self-interest influences construction procurement approaches and drives opportunism. In other words, self-interest leads to a zero-sum game, as one organisation seeks to protect its interests from the opportunism of others whilst continuing to exploit all opportunities themselves. Figure 6.3 illustrates the themes that emerged out of the data and led to the development of this sub-category.

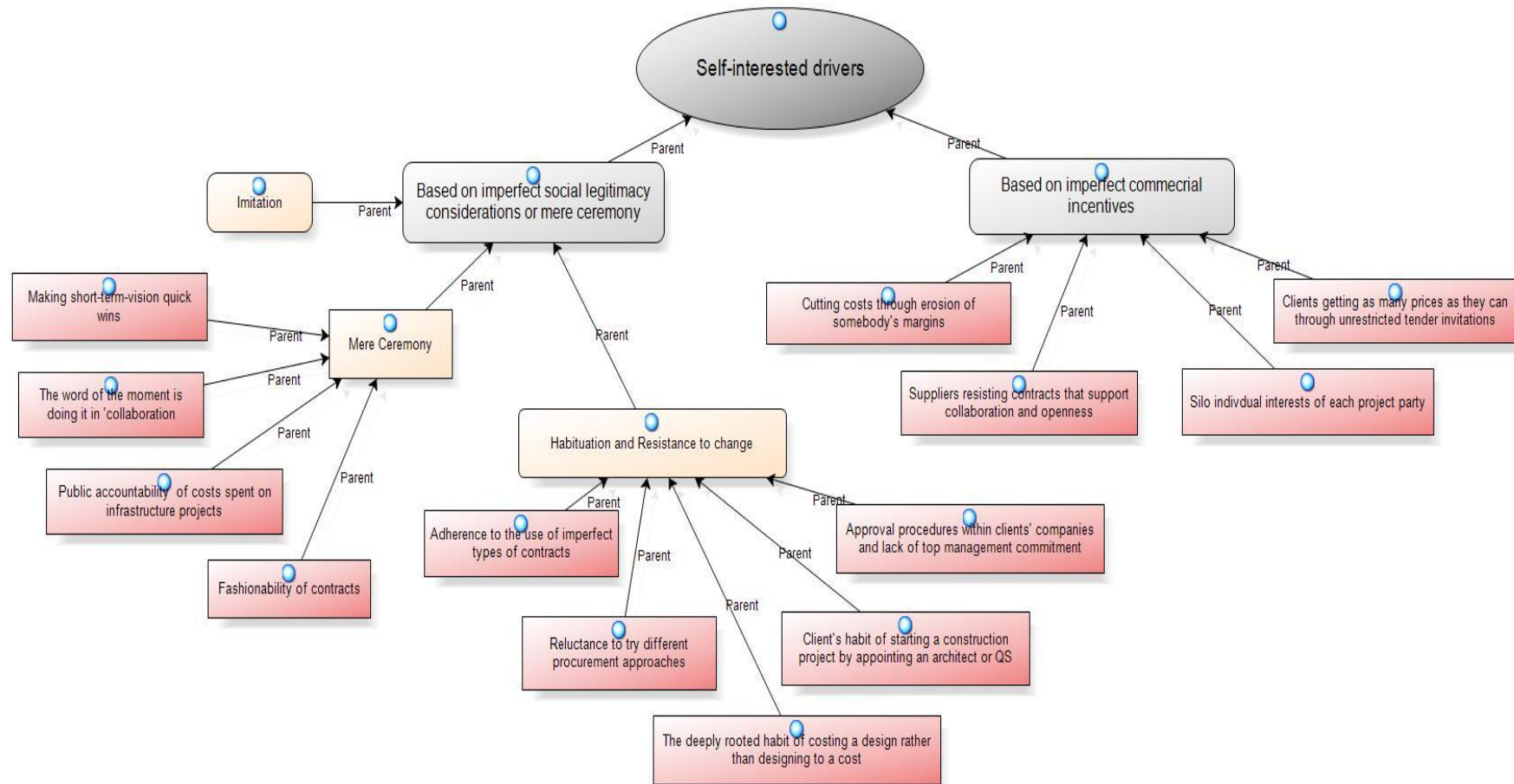


Figure 6.3: Coding structure of ‘Self-interested drivers’

6.2.10 Uncertainty (IF10)

This study found that ‘uncertainty’ can contribute to the deployment and persistence of inefficient procurement arrangements in construction. Uncertainty can be defined in its simplest form as what is known in comparison to what needs to be known. In this study, the term ‘uncertainty’ was divided into three distinct classifications:

- Behavioural Uncertainty (and lack of trust)
- Environmental transaction uncertainty
- Budget and funding Uncertainty or Constraints

‘Behavioural Uncertainty’ refers to the amount of trust between the buyers and their suppliers, and it influences the buyers’ safeguarding approach to construction procurement. As mentioned previously in section 4.2.9, conventional safeguarding practices can support opportunistic behaviours and contribute to consequential wastes. When the ‘Head of supply-chain’ of a leading tier-1 contractor in the UK was asked about why wasteful procurement practices persist, he simply asserted that “*the problem of trust comes into it. But you should work closely with the supply-chain that you can trust in order to come to the right solution, where you both win*”. Similarly, when the “ of a major contractor in the UK was asked the same question, he said:

“I would say that there is a trust issue there as well to be fair. You know and that goes all the way up and down the supply chain. If there were more trust, then may be people will be more honest about the real cost of things, and people would not select based on lowest cost; because the problem is that when procurement people put their processes in place for selection, they then drive behaviours. But, they do not necessarily understand the behaviours that they will create by the rules that they put in place” (Head of Innovation and Director of National Frameworks, Nov 2015).

‘Environmental transaction uncertainty’ refers to unforeseen circumstances and the associated complexity surrounding the project context. This study argues that this type of uncertainty forces buyers to imitate or to stick to procurement practices that they have already tested in the past, even though they may not be ideal for specific project

characteristics and circumstances. It could also drive buyers to deploy inefficient safeguarding approaches to construction procurement. Examples of ‘environmental transaction uncertainty’ that faced one of the client representatives that this study interviewed include:

“Well, in this particular project, it's really a technology overlay to an existing motorway. So, that technology is sort of being developed all the time. So, at the time of signing the contract, the client knew that he probably wanted to incorporate a system called 'Side Fire Radar' which monitors the volume of traffic flow by radar on the side of the road, instead of having loops in the road; so it removes maintenance risk in the future. But he wasn't able to confirm the design and the extent of scope of that system, so that was a strategic risk event which was subsequently confirmed and instructed in. And then another example is where on this project, because we are overlaying on an existing motorway...we get quite a lot of unknowns that we have to deal with...once we get onsite and we expose things or discover new things or things that are not in the place that we thought that they were going to be” (ECC Project Manager, Dec 2015).

Budget and funding Uncertainty or Constraints could also influence buyers’ approaches to construction procurement. In this study, various participants argued that budget and funding uncertainty is one of the possible reasons of the traditional sequential process of construction projects (Design-Bid-Build). Also, a senior cost consultant claimed that *“many clients are reluctant to allow early involvement of contractors at the outset of projects, due to their uncertainty about proceeding with the project and front-end cash flow considerations”* (Senior Cost Consultant (MRICS), Dec 2015). These claims have also been supported and described by a senior project manager as follows:

“When you're a client funding some money to the project, and you're not being sure really that you can realise that kind of project...at the beginning you just have an idea about the total cost of the project. Then, you allocate let's say a project management company and a design team. And they are running through the stages. And each and every project phase ends with a cost estimate. It becomes much more detailed when it comes to the construction phase; but at the

beginning most of the clients are not even sure that they will execute that project. And that makes them reluctant to think of introducing contracting companies already in the design stage; because they think 'why should I do that and spend money on them, because they [the contractors] don't do it for free' (Certified Senior Project Manager (PMP, MRICS), Nov 2015).

From the comments above, it appears that buyers need to gain a better understanding of the implications of their construction procurement decisions on project performance and outcomes. So, if they don't invest enough time, money and effort during upfront of projects (e.g. invest in design and proper site investigations), in order to assess risks and reduce assumptions and uncertainties, then it is very likely that they will end up losing much more money than what they saved during early project stages and vice versa. This argument was emphasised by a business development manager who provide the following advice to construction buyers in general:

"If you don't spend enough upfront you're not going to get cost certainty, and the chances are that your objection cost is going to be higher than if you would spend the money upfront" (Business Development Manager, Nov 2015).

6.2.11 'Vested interests' of professional roles and firms not directly involved in production (IF11)

This study found that a number of professional roles and firms could have a vested interest in the wide-spread use of some inefficient construction procurement arrangements and options. These professional roles and firms as identified by the study, include:

- Accountants and Financial Directors
- Architects and Engineering Firms
- Claims Managers
- Clerk of works
- Concept Architects
- Cost consultants (Qs)
- Insurance companies

- Investment Banks
- Lawyers
- Procurement advisers and consultants
- Quantity Surveyors
- Tier 1 Contractors
- Turn-around project managers

For example, various participants of this study argued that architects and quantity surveyors (Qs) have a vested interest in the use of traditional procurement arrangements (e.g. D-B-B with bills of quantities) as opposed to integrated procurement approaches; that is because the traditional approach allows them to maximise their positions within the project and thus maximise their fees as well. In particular, many participants of this study criticised quantity surveyors' (Qs) mind-sets, attitudes and influence on approaches to construction procurement. In an interview with a senior consultant and a fellow member of the institution of civil engineers (FICE) in the UK, he stated:

“I have been in situations where I have been operating alongside quantity surveying teams and also lawyers. And I would say that where I have been working with someone with a heavy quantity surveying background, they would advise a route which needed a lot of quantity surveying project management attention, because they would want to provide it...I think it's the professional services firms, the engineering and the quantity surveying side, that possibly need the closest attention to see that they are simply not maximising their own position” (Senior Consultant (FICE), Oct 2015)

This argument was supported by a business development manager, working for a main civil engineering contractor, as follows:

“Yeah we certainly do see certain project management-quantity surveying (PQS) companies take a very building development approach to civil projects, and break the project into small packages...because obviously PQSs managing

those inter-phases they get paid for that...so that can maximise their fees” .
(Business Development Manager, Dec 2015).

Similarly, the ‘Head of innovation’ of a major contractor condemned the role that quantity surveying project management firms play in advising clients to adopt risk-transferring approaches to construction procurement. According to him:

“Yeah, absolutely, I think that is part of the problem, because quite often the large professional practices; you know the QS/project management practices they advise large number of clients on the procurement choices that are available to them. And, you know, it was an interesting transition over the last couple of years, where during recession the clients were beginning to behave more poorly because they knew they could drive the supply chain harder”.

Other participants argued that quantity surveyors have a vested interest in the use of overly stringent contract conditions, and criticised them for using and administering contracts in such a bureaucratic way. Interestingly, when an experienced turnaround project manager was asked about his suggestions for overcoming problems resulting from wasteful procurement practices, he stated in a frustrated manner:

“It isn’t knowledge of the law which is the important thing; it is actually being a lawyer with the ability to out-argue QS’s who are being too greedy!”
(Experienced turn-around project manager, Oct 2015)

In addition, many clients *“rely on external lawyers to vet or even develop their contracts”* (Associate Director, financial governance services, 2016). And, obviously, some lawyers might *“have a vested interest in developing contracts with complex language and clauses, so they can maximise their roles”* (Managing Director and Principal Consultant in the Rail Industry, Nov 2015). However, it is fair to argue that these professional consultants (i.e. lawyers and QSs) are subject to commercial pressure and forced to comply with buyers’ (flawed) assumptions and risk-averse appetite.

In a discussion with a senior consultant about the most common wasteful procurement practices that he experienced in his career, he referred to the huge amounts of unnecessary and non-value reports often required by clients with the intension of measuring contract performance of their suppliers (See section 4.2.5 for more details about the consequences of these procurement practices). He then explained how accountants and financial managers have a vested interest in the use of these procurement practices, as follows:

“I remember having an argument with a Finance Director [The participant laughs] and this was years ago. And he was collecting all this financial information of this project. And I told him well that's loads of rubbish. They won't tell you anything. And he would argue with me for ages and say: ‘well it tells me what I need to know’. But it just tells you what happened three or six months ago. It does not tell you how to manage your project any better. It's not of any use in explaining how you can make more money or become more efficient or deliver a better project. He just would not have it, but that's because he is a finance person. And finance people like to talk about money. The same like a procurement person would like to talk about procurement” (Senior Consultant (PhD), Nov 2015).

Overall, an important observation is that none of the professionals or firms listed above as having a vested interest in the wide-spread use of prevailing wasteful procurement practices is directly involved in production. This suggests that there might be a crucial need for a deeper examination of the roles and responsibilities of the professions and wider participants involved within the construction procurement context.

6.2.12 Voluntary diffusion of (imperfect) norms

This study found that inefficient procurement practices can exist and persist in the construction industry, due to voluntary diffusion of imperfect norms. This diffusion could occur via:

- British Educational System
- Industry Reports
- Professional Institutions and Trade Associations

In an interview with a very experienced turn-around project manager, he explained to the author how that the British construction culture and educational system leads to conflicts with professionals' pre-assumptions. According to him, there seems to be a crucial need for an increased focus on incorporating interdisciplinary, integrated and inclusive courses and principles into the built environment programmes of study. Similarly, it has been argued that industry reports play a major role in influencing construction procurement strategies and practices. In some instances, there could be an element of politics involved. In other instances, there could be misleading interpretations of how to achieve the required efficiency improvements. It could also be attributed to simply offering inappropriate solutions to problems or overly optimistic expectations. However, in all cases, it appears that “*procurement practices often mirror institutional factors*”. An example of how industry reports (as an intuitional force) can shape construction models and procurement practices was identified during the data collection process of this study, in the following narrative:

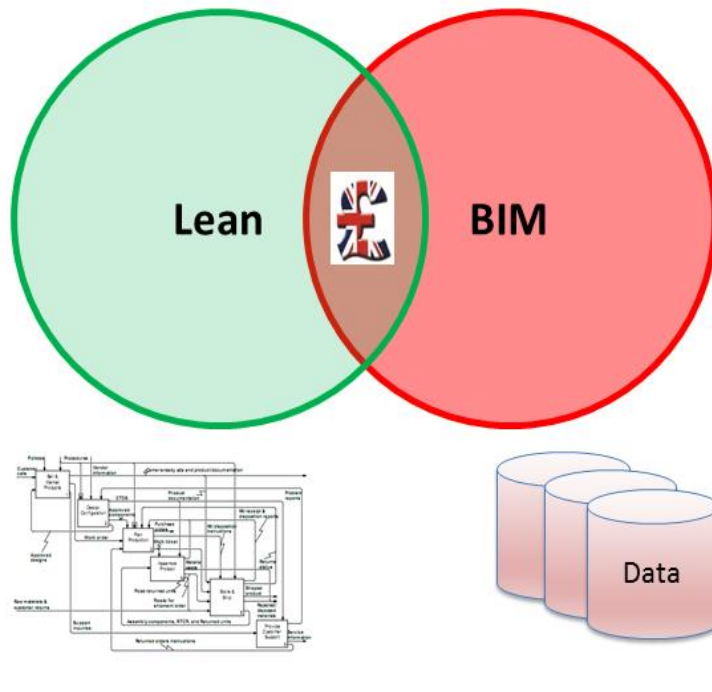
“...The (UK) Government began to be concerned about efficiency and a report called the ‘Gershon Review’ was published. This pushed for central and local government authorities to become more efficient and set efficiency targets – improving efficiency by 2% per annum was a common one...The (UK) Highways Agency was held up as an exemplar of...improved efficiency in roads management and maintenance. So Local Authorities were then encouraged by Central Government to look at this model. The now limited numbers of contractors were pleased to extol the virtues of the Highways Agency’s model to a local government market which they could also see turning into a market with a limited number of players able to deliver large, integrated service contracts. Local authorities often asked the market (contractors) what scale of efficiencies could be delivered if they were to let a single large integrated manage and maintain contract. The contractors usually came back with the same reply, “20%”. There was never any real evidence for this. Twenty per cent seemed to be a figure all the authorities would like to achieve and the major contractors were happy to tell them they could achieve it. So the whole industry created a belief that an integrated service contracts delivered by one (Tier 1) contractor with a chain of (Tier 2) suppliers was the most efficient form of delivery...”
(Senior Consultant (FICE), January 17, 2016, E-mail message).

Another example was identified during the Lean Construction Institute in the UK (LCI-UK) Summit in 2015 (Bew, 2015). During this summit, Mark Bew, the Head of the UK Government Task Group for BIM delivered a keynote on the synergies between Lean and BIM. Interestingly, the delivery and introduction slides of the presentation (see Figure 6.4 below) revealed the Government's main driver for using BIM and Lean. Their ultimate focus and view of the benefits of lean and BIM (as shown in Figure 6.4) is money – ‘a transactional mind-set’, with little or no reference at all given to other important goals and attainable benefits such as: production effectiveness, quality, whole-life-cycle costs, sustainability, collaboration, optimisation of supply-chain efficiency, improved transparency, health and safety and social and ethical values for all parties concerned.

Furthermore, this study also found that professional institutions and trade organisations can influence the mind-sets and practices of many of the professionals involved within the construction procurement context. These members are requested to conform to the norms, job duties and responsibilities diffused by their relevant professional bodies. Also, some of the views of these professional institutions could be influenced by other institutional factors such as bargaining power, politics and vested interests. When a senior consultant was asked about whether he believes that construction industry bodies, professional institutions and trade associations have an influence on the use of some procurement routes and contracts; he asserted the following:

“I think they do. I think they listen to their Governments. I have seen things sorted down - They need to procure a practice or a general procurement strategy...Hmm, sometimes to good effect and sometimes to a bad affect as well; because again the industry can be interested in maximising its position. Hmm, you'll find many of the major (industry) players on many of the boards. And you can find the major players' view is taken on board, because that's the view that suits them - it maintains a competitive position. So, I have been in a position before as a consultant where actually I thought the model needs breaking; because all it's doing in some cases is 'preserving the position of the major contractors' and not necessarily giving the best value to the client” (Senior Consultant (FICE), Oct 2015).

Introduction



Benefits

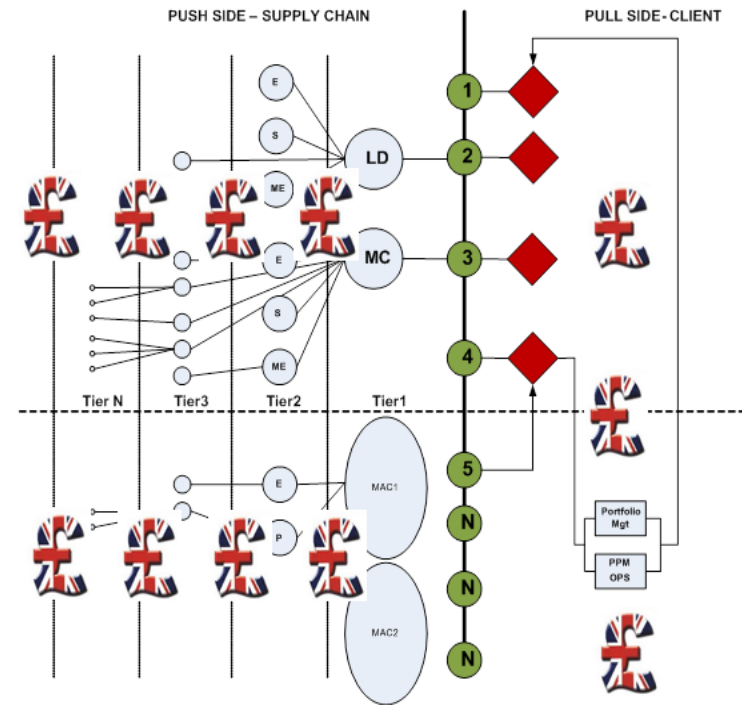


Figure 6.4: Snapshot of keynote 1 (Lean & BIM) presentation at the LCI-UK summit 2015 (Bew, 2015)

6.3 Summary

This chapter identified and analysed various institutional factors that emerged out of the empirical data collected in this study. The findings revealed that these prevailing institutions lead to inefficient construction procurement arrangements, which lead to inefficient behaviours and performances, which in turn lead to consequential wastes (i.e. financial losses or cost overruns, time wastes, quality/value losses, and/or waste of human potentials). Having illustrated the analytical processes (presented in Chapters 4, 5 and 6) that led to the development of the study's conceptual model of 'institutional waste within the UK construction industry', the next chapter, consequently, presents the details and results of an evaluation exercise that was conducted with various UK industry experts, in order to critically assess the quality and rigour of the developed conceptual model and main findings of the study.

CHAPTER SEVEN: CONCEPTUAL MODEL EVALUATION

7.1 Introduction

The previous data-analysis chapters (Chapters 4, 5 and 6) illustrated the analytical processes that led to the development of a conceptual model of ‘institutional waste in construction’, which is grounded in empirical data collected from the field. This chapter presents the details and discusses the results of an evaluation exercise that was conducted with a number of academic and industry experts to assess and receive feedback on the rigour and quality (i.e. credibility, originality, resonance, and usefulness) of the developed conceptual model (Figure 4.1, page 143). The definition of each of these quality criteria has been previously provided in Chapter 3.

7.2 Method of Evaluation

The evaluation exercise took place on two stages. The first stage comprised of a pilot/preliminary unstructured interview with Professor Glenn Ballard who specialises in lean construction and project-production-systems. The aims of this interview were to receive detailed feedback on the quality of the conceptual model (Figure 4.1), and to make necessary corrections before sending the ‘evaluation’ invitations out to a sample of industry experts. Piloting, in general, is good research practice and is part of the research Plan-Do-Check-Act process (Lancaster *et al.*, 2004). This pilot interview lasted for around two hours and it took place at Nottingham Trent University. During the meeting, the author delivered a presentation to the participant about the aim, objectives, methodology and main findings of the PhD study. The participant was also provided with printouts of main Nvivo outputs and diagrams, to clarify how the author reached the study’s findings and conclusions. This meeting enabled the author to make some minor but valuable corrections to the study. Following this, a 15 minute recorded call was conducted on the following day to confirm the corrections made. An example of suggestions for correction included:

“You mentioned clients’ habits of risk aversion...but it’s any buyer in the industry. I mean general contractors buy the services of sub-contractors. So they’re also in turn buying; hence having multiple-tiers in the supply system. The behaviours you are

talking about are broadly distributed in the industry” (Professor Glenn Ballard, Feb 2017, Phone interview).

In addition, when the participant was asked about whether he agrees or not with the study’s link between the concepts of ‘institutions’ and ‘waste in construction’, he stated the following:

“Yes, emphatically...I think you may want to refer to the work of Thomas Kuhn. He published work in the 60s and 70s. Mostly on history and philosophy of science, but he really made visible this idea of paradigms, so this would be something worth taking advantage of” (Professor Glenn Ballard, Feb 2017, Phone call interview).

The author referred to the work of Thomas Kuhn as recommended above. A reflection on the relationship between Thomas Kuhn’s concept of ‘paradigms’ and the concept of ‘institutional waste’ that has been developed in this study is provided in the next Chapter (section 8.7).

Consequently, the second stage of the evaluation exercise consisted of structured ‘open-ended qualitative’ questionnaires with five experts in the field (four industry professionals and one senior researcher with industry experience). Each of these participants was provided with:

- An invitation sheet that outlined the purpose and included details of the evaluation exercise (See Appendix 4)
- A copy of the PhD presentation used in the pilot interview described above
- A copy of supplementary material and documents, which supported the development of the conceptual model.

The evaluation exercise consisted of five main open-ended qualitative questions, where the respondents were asked to provide the author with their written ‘feedback and evaluation’ within two weeks of time. Written communication was chosen over face-to face communication, to allow the participants to have sufficient time and space to evaluate the findings of the study appropriately, without being influenced or intruded by the interviewer’s

physical presence. As mentioned previously, altogether, five experts participated in the conceptual-model evaluation process. They were all purposively targeted based on their expertise, strategic view, and broad experience in construction and civil engineering management. More information about their positions, years of experience and professional and academic qualifications is provided in Table 7.1 below.

Table 7.1 Characteristics of sample used for conceptual-model evaluation

Position	Years of experience	Qualification
Senior Consultant	30+	BSc (Hons), FICE CEng
Project / Contracts Manager	30+	PhD, MICE CEng, MCIHT
Senior Researcher	20+	PhD, MPhil
Site Manager (subcontractor) & Lean Specialist	20+	BSc (Hons), MPhil
Construction Manager	12 -15	BSc, MSc

7.3 Analysis and Discussion of Conceptual-Model Feedback

Feedback received from the five targeted experts who contributed to the evaluation phase of this study is analysed and discussed here under four main sub-sections: (1) Relevance and usefulness of the model; (2) Credibility; (3) Resonance; (4) and Explanatory sufficiency. Participants were also asked to provide suggestions for improving the developed conceptual model, future research directions, and potential practical implications; however these suggestions will be discussed as recommendations in the final concluding chapter. The analysis and discussion of this chapter will be enriched with cross-reference to direct quotes from the feedback obtained, whenever possible.

7.3.1 Relevance and usefulness of the developed conceptual-model

All participants agreed upon the ‘relevance’ and ‘usefulness’ of the conceptual model. Interestingly, participants viewed the ‘usefulness’ of the developed model from various different angles. For example, the senior consultant argued that looking at the sources of waste at an ‘institutional level’ is more efficient than trying to solve waste-related problems at a ‘task-level’. He stated the following:

“I think it is exceptionally relevant and useful. Exploring the factors that influence waste at an institutional level looks at the industrial and social contexts that lead to waste as opposed to trying to ‘fix waste’ at a task level. The industrial and social contexts in which projects are conceived, promoted, procured and delivered has a far greater bearing on efficiency outcomes than task efficiency itself – which is after all only acted out in whatever context construct has prevailed” (Senior Consultant and Fellow Member of the Institution of Civil Engineers, 26th March 2017).

The site manager (lean specialist) acknowledged the study’s originality and contribution to knowledge by exploring ‘hidden sources and sorts of waste’, as opposed to looking at physical wastes. Furthermore, the participant seemed enthusiastic about the study’s novel explanations as to why many wasteful practices and behaviours persist in construction projects. According to him:

“This is a really relevant and interesting study / findings to help the AEC sector understand the impact of (process) waste on project delivery. In my experience when people say “eliminating waste” they are primarily talking about physical wastes and not the waste that is hidden in processes and historical cost models that new projects are baselined against. I have personally (on site and managing projects) experienced many of the factors identified through this research. Projects go round and round in circles just like the model, because of past experiences of AEC stakeholders and their instance to safeguard against what has happened before” (Site Manager and Lean Specialist, 10th April 2017).

The project/contract manager, who holds a doctoral degree, considered the topic of this study to be very useful. He also argued that *“little research [has been] undertaken in this sphere to date”*. Similarly, the senior researcher emphasised the usefulness and relevance of this study by arguing that:

“The elimination of waste should be the primary aim of construction management research. Currently, the development of efficient management techniques is far in advance of their implementation. Therefore, the study of institutional barriers to implementation is vital and timely” (Senior Researcher, 9th March 2017)

The comment above clearly indicates the relevance of the findings of this study to the construction industry. It also reveals the usefulness of the developed conceptual model, as it can be applied to a wide variety of fields and topics, in order to investigate the ‘*institutional barriers*’ to the implementation of any innovative management techniques that require trustful collaboration between different project parties (e.g. Building information management and integrated project delivery approaches).

In addition, the construction manager provided an interesting distinction between what he classified as ‘production’ waste’ and ‘institutional waste’. In other words, he differentiated between what he classified as our ‘relatively normal’ understanding of waste resulting from inefficient production processes, as opposed to the ‘wider and improved’ understanding of waste in construction resulting from imperfect institutional and procurement processes (as sources of waste) and their impacts on production. He described this as follows:

“I consider the topic to be very relevant and useful. Clearly the industry has not made any significant advances since the Egan/Latham reports; this is despite more research and knowledge in this area. The normal focus on waste is largely attributed to material or production waste as opposed to governance and institutional waste. I believe this is a key consideration. (Construction Manager, 13th June 2017).

7.3.2 Credibility of the developed conceptual model

All participants of this evaluation exercise agreed up on the credibility of the main findings of this study; however each of them different justifications. For example, the site manager / lean specialist focussed on how some professionals have a vested interest in the wide-spread use of some imperfect procurement practices. This was mentioned as follows:

“In short, I agree 100%. As I read through the parent nodes and the child nodes, I was nodding my head in agreement. Based on my 21 years AEC sector experience and more recently (7 years) with lean project delivery, the findings of the study make a lot of sense to me and would be most valuable to clients and owners who are already on their lean journey. I suspect there may be a lot of resistance to the findings from those not familiar with lean philosophy and those who make their living out of

the waste inherent in the AEC sector” (Site Manager and Lean Specialist, 10th April 2017).

The comment above supports the study’s arguments that many imperfect mind-sets, behaviours and practices that exist in construction have become ‘institutionalised’, to an extent that existing beliefs, values and professional roles have become unopen for questioning. Similarly, the project/contracts manager criticised the increasing role and influence of QSs, lawyers and procurement consultants in construction projects, and argued that this has led to the prevalence and entrenchment of imperfect cost-driven mind-sets and business models in construction. His comment on the credibility of the main findings and conclusions of the study was as follows:

“I can’t fault any of the research findings, particularly the existence of cost focus almost to the exclusion of any other factors. This is driven by the increasingly commercial mind set in procurement, influenced by QSs, i.e. get the cheapest price and pay the consequences as a project unfolds. The issue of clients’ input is important, particularly where we see collaborative type contracts like the NEC 3 continually ‘Z-claused’ to become less collaborative and more adversarial. The point on the increasing influence of external consultants and lawyers is also pertinent. The point of understanding value is relevant, a lot of issues result from a lack of understanding of the value proposition by clients and contractors. You mention procurement experts, yet I’d question how much expertise many of these have, as far as I’m aware there is little formalised training or accreditation in [construction] procurement” (Project / Contracts Manager, 20th March 2017)

In the comment above, the project/contracts manager questioned, according to his knowledge, whether there are formalised professional training or qualifications to procurement consultants in construction. To the best of the author’s knowledge, the Chartered Institution of Procurement and Supply (CIPS) offers training and accreditation to its qualified members. However, the findings of this study demonstrate that construction procurement should not be treated as a commodity. There is no doubt that procurement of materials or ready-made products is very different to procuring a construction project where the buyer and suppliers

have to cooperate to deliver the final product. Therefore, the trainings and courses provided by CIPS may not be relevant to construction professionals. In construction it is more about 'doing the work' rather than 'doing the deal'. Furthermore, it has been argued by Pasquire *et al.* (2015) that much of the accepted procurement theory and practice taught in construction courses at Universities and recommended by relevant professional institutions (e.g. Royal Institution of Chartered Surveyors) is underpinned by imperfect prescriptions offered by TCE, which are not ideal for construction (Koskela and Ballard, 2006 and 2012; Koskela and Tommelein, 2009)

The senior consultant strongly agreed upon all the relationships that exist within the four main categories of the developed framework. Interestingly, he did also provide some fascinating explanations as to how consequential wastes can reinforce imperfect institutions. According to him:

"I believe that imperfect institutional factors will lead to inefficient procurement practices, which will lead to inefficient performance and behaviours, which will lead to consequential waste. The impact of consequential waste on imperfect institutional factors may need some explaining. In one sense we might hope that consequential waste will feedback to the institution in a way that the institution may learn – this depends on the capacity of the institution to learn though. An imperfect institution may be one that doesn't learn very well, having a low absorptive capacity. In another sense, consequential waste may impact on the institution in a way that is detrimental to its financial performance, which in itself could generate imperfect institutional behaviours. Perhaps another view to add to this is to pity the poor institution. Can it ever be perfect? And is what is perfect for one point in time is less perfect in another, particularly when we consider societal and macro-economic contexts of industrial relations referenced in particular by Godard (2011) and Ackers (2014)"(Senior Consultant and Fellow Member of the Institution of Civil Engineers, 26th March 2017).

The comment above supports this study's findings and provides three possible explanations as to how consequential wastes may influence institutions. Firstly, that learning from

complex projects, especially construction projects, is usually difficult (See Williams *et al.*, 2005). This situation is worse in construction, as many construction clients either lack experience or in-house expertise; and thus they often rely on external consultants to help them with the decision-making process. These consultants might have a vested interest in the use of specific imperfect procurement and contractual arrangements, because they are more familiar with them or because those arrangements maximise their roles and positions in projects. In addition, most of these consultants, if not all, usually lack production expertise, and thus they drive projects through an imperfect transactional mind-set and arms-length approach to project delivery. Secondly, poor project outcomes and past performances of suppliers may re-inforce imperfect institutional factors (e.g. self-interest and risk-aversity) and thus encourage clients to adopt inefficient safeguarding practices, which in-turn lead to vicious cycles of wasteful behaviours and practices. Thirdly, it could be argued that ‘institutions’ are imperfect either due to increasing and changing societal demands and values over time (Godard; 2011; and Ackers, 2014) or due to the fact that formal rules within are often created to serve the interests of those with the bargaining power to create those rules (See North. 1994; and Sarhan *et al.*, 2016) and thus they might not be created to the benefit of the ‘all’.

7.3.3 Resonance of the developed conceptual-model

The evaluation exercise questioned the ‘resonance’ of the findings in two different ways. Firstly, this was achieved by asking the respondents to provide an ‘overall assessment’ of the logic and relevance of the four main categories of the developed conceptual framework (Table 7.2). Then, participants were asked to provide ‘specific and detailed’ feedback on each of the four evolved categories and its associated relationships (see Tables 7.3, 7.4, 7.5, and 7.6 below).

Table 7.2: Participant’s evaluation up on the resonance of the overall findings

Are the relationships between the four main categories of the developed conceptual model logical, relevant to the construction industry, and reflective of the situation in real practice?	
Senior Consultant	<i>Yes.</i>
Project/Contracts Manager	<i>Yes.</i>
Senior Researcher	<i>Yes.</i>

Site Manager/Lean consultant	<i>Yes, very much so. At first when I looked at it I thought where does this start? Then I realised that it is a vicious circle we are in and it will keep going around and around unless the institutional factors are addressed. It is a good title for the study.</i>
Construction Manager	<i>The relationships of the 4 main categories are broadly ok. I do however believe that there are many factors which could be rolled up, for example, quite a few of the (IF) factors come down to commercial views, cost saving, price based mind set etc etc. It should be noted that the reason businesses exist is to make a profit, there will always be an element of this in any organisation. Relaxing this may lead to a high increases in initial costs which might or might not offset against any efficiencies</i>

As can be seen in Table 7.2 above, all participants agreed with the overall logic and relevance of the four main categories of the developed conceptual model. It can also be noted that the construction manager claimed that the reason businesses exist is to make profit. So, he raised concerns that if organisations followed the study's criticisms to the imperfect transactional approach to construction procurement, then this may lead to high increases in initial costs of projects, without a guarantee that these expenses will be offset by the savings that may be made due to efficiency improvements.

There are a few responses to the construction manager's concern mentioned above. Firstly, there is no doubt that the underlying assumption of most economic theories, if not all, is that firms exist to make money (see for example Coase, 1937), which implies that construction companies must make profit to survive. However, it also makes sense to argue that in order to sustain this profit, we must also add value. In other words, it could be stressed that "*making money is a consequence of adding value to external clients and our shared society*" (Kaufman and Guerra-López, 2013, p. 20). Whilst many organisations disdain it, assume it, or ignore it, any organisation that hopes to thrive must add value to all of its stakeholders, including the wider shared society (Moore et al., 2011). There is more to business than just making money; having a reason and purpose for operating, enables thriving organisations to sustain their journey when market conditions, cash flow and customers appear low. This,

therefore, brings us to debates on whether we need to stop our obsession with maximising profit and start maximising value. The real concern is not whether companies should exist to make money or not; but it's how to make profit in an ethical, value-adding, and socially-responsible way. For these reasons, there have been substantial industry calls that try to guide construction companies and clients towards recognising the importance of corporate social responsibility (CRS) issues (see for example, Jones *et al.*, 2006; Murray and Dainty, 2009; Huang and Lien, 2012; CIOB, 2013).

Furthermore, it is important to understand that (construction) projects need to be profitable for all. Construction procurement arrangements need to be created in ways which create win-win scenarios between buyers and suppliers. Secondly, buyers shouldn't focus only on minimising initial costs (ex-ante transaction costs), as opposed to overall costs (transaction plus production costs). Thirdly and finally, the construction manager himself seemed to have correctly answered himself by stating in other parts of his evaluation feedback that:

“The conclusion suggests that clients are reluctant to invest during the pre-construction phase, I would agree with this and there is evidence to show that costs at this stage are low whilst value is high (through collaboration, ECI and value engineering). I would however question why this is the case...” (Construction Manager, 13th June 2017).

Participants were then asked to provide feedback on specific components of the developed conceptual framework. As appears in Table 7.3, all participants strongly agreed with the study's conceptualisation that institutional factors influence construction procurement decisions and arrangements. Interestingly, the comments provided by two of the participants (the senior consultant and the site manager) align with the study's findings that construction business and procurement models are path dependent (e.g. use of 'historical clauses') and influenced by the institutional context.

Table 7.3: participants' opinion on the influence of institutions on procurement practices

To what extent do you agree that institutional factors influence construction procurement choices and practices?	
Senior Consultant	<i>Broadly agree with the factors illustrated. I think it is also worth bearing in mind that organizations will have a history that becomes part of the stories substantiating the reasons for the way they do things; major accidents on the railway perhaps, damning cost reviews by central government, sector client expectation norms. All of these things create an organizational story for the way things are. They become part of the semantic symbolism of organizational culture (Janicijevic, 2011).</i>
Project / Contracts Manager	<i>To a large extent, construction procurement is driven by organisational values and behaviour</i>
Senior Researcher	<i>Of course.</i>
Site Manager / lean consultant	<i>Greatly. Clauses are inserted in contracts (in my experience and opinion) to "prevent" similar issues happening again in the future even though it is not the same individuals in question. The AEC sector is plagued by a culture of claims and manipulating contracts to maximise claims. Contractors (not all) usually look for every angle to ensure they make a profit and their behaviours reflect this. On the other hand, I think that many owners do not appreciate that contractors need to make a profit to survive.</i>
Construction Manager	<i>I believe that the IFs play a huge role in influencing procurement choices and factors.</i>

Participants were also asked about their opinion on whether imperfect construction procurement and contractual arrangements could support and/or encourage wasteful activities. As shown in Table 7.4 below, there is a common agreement that contracts and procurement systems can drive certain behaviours. However, it is worth noting that this also depends on how people decide to use and exercise contracts. As argued by this study, it is important for construction clients and buyers to move away from deploying construction procurement systems based on risk-allocation and mitigation considerations; and instead consider the impact of their devised construction procurement arrangements on process flow.

Table 7.4: Participants' opinion on the impact of construction procurement arrangements on project-team performance and behaviour

To what extent do you agree that construction procurement and contractual arrangements can impact on the performance and behaviour of project team parties?	
Senior Consultant	<i>In the first instance there is the choice of strategic procurement route, say; 'traditional' (construction separated from design), design and build, or Design, Build, Finance and Operate (PFI/PPP). Each route places different obligations and expectations of performance for different elements of the asset creation process with different actors. Actors will respond accordingly according to; a) their knowledge of where those obligations and expectations lie; b) their assumptions in relation to those obligations and expectations; c) their responses in relation to how those obligations and expectations are either met or unfulfilled.</i>
Project/Contracts Manager	<i>Contractual arrangements such as heavily Z-claused NEC contracts, JCT and ICE conditions of contract play a big part on the performance and behaviour. When the NEC was introduced initially in the 1990's, I witnessed collaborative behaviour which impacted positively on all aspects of procurement, including sub contract procurement and behaviours between these parties. Many clients are now attempting to shift power back in their favour by amending contracts. This shows a lack of understanding of value, with a result that win-win scenario is migrating to lose-lose for all parties</i>
Senior Researcher	<i>100%</i>
Site Manager/Lean consultant	<i>Greatly. Contractual terms dictate behaviours and with silo terms focused on maximising each parties' interests who can blame the delivery partners for using every trick in the book to make sure they make profit and survive. That is only human nature. I do not use the term "subcontractor". This infers that they are below the main contractor and language matters. It sets the tone. Therefore, contractual language matters in a big way.</i>
Construction Manager	<i>There is no question that the procurement and contractual arrangements play a part in the performance of the project team parties. The operations team always have to deal with the mess which often created at contract award stage, this is usually because the supply chain has been driven down so much on cost that they have no incentive to collaborate, they are looking to boost their profit through changes and disputes.</i>

Furthermore, participants were asked to evaluate the study's finding that consequential wastes exert pressure upon and thus re-inforce imperfect institutional factors. In particular, participants were asked about whether they agree or not with the study's argument that project failures and poor project-performances influence institutions, in particular construction buyers' imperfect paradigms and approaches to procurement. As shown in Table 7.5 below, all participants agreed with the study's arguments and findings. However, different explanations or interpretations were provided (all these are already considered by the study). Interestingly, the senior researcher suspected that this phenomenon is historically variable, depending on the balance between the vicious cycles of institutionalised waste and the measures taken to fix and de-institutionalise them. The author doesn't necessarily disagree with this argument; however it makes sense to suggest that conditions will progressively deteriorate, as long as the scope and magnitude of wasteful reinforcing loops remains greater than improvement efforts.

Table 7.5: Participants' opinion upon the impact of project failures or poor experiences on reinforcing imperfect institutions and paradigms

To what extent do you agree that client time and cost overruns of construction projects reinforce imperfect institutional factors (e.g. clients' flawed assumptions and errors during pre-contractual stages)?	
Senior Consultant	<i>The client can be a 'learning organization' and respond positively. Or the client can react defensively and negatively on the basis of personal or organizational self-interest. Or the time and cost overruns can present resource constraints that limit ideal response modes.</i>
Project / Contracts Manager	<i>To a large extent. As you mentioned parties treat the symptoms rather than the root causes, result in bunkered blame game mind sets</i>
Senior Researcher	<i>This certainly occurs. I suspect that it is historically variable – as the consequences of reinforcement loops increase, measures are taken to ameliorate them.</i>

Site Manager / lean consultant	<i>Projects are almost set up expecting cost overruns. One of the projects I am supporting now was originally tendered at 2 million. Re-tendered at 2.5 million after some changes and 20% contingency is likely to be allowed on top of this to deal with unforeseen conditions. The procurement/negotiations of this contract have cost (wasted) a lot of money to “protect” the client against risk when all it really boils down to is not trusting the contractor and declaring a budget from the outset. Playing one contractor off another to secure the lowest price and “best value...”</i>
Construction Manager	<i>Clearly there is a reason why a large number of projects run late and over budget. It is not possible to single out any project or factor but it would be a reasonable suggestion that the institutional factors play a part.</i>

Finally, participants were asked again about their agreement with the study’s novel explanations as to why prevailing imperfect construction business and procurement models remain to be so coherent. As shown in Table 7.6 below, all participants (who understood the question) agreed up on the study’s novel hypothesis and explanation. Only, the construction manager was not able to comment on this question, because he could not fully understand the question; however his response in Table 7.5 clearly resonates with the study’s explanations. The senior researcher suggested that further research is required to test this novel hypothesis.

Overall, most respondents stated, based on their extensive industry experience, that the construction industry is generally renowned for its blame culture (Egan, 1998) and fire-fighting mentality to problem solving (Bølviken and Koskela, 2016). This assertion aligns with many research studies that claimed that the construction industry is often regarded as confrontational, risk averse, and lacking trust and capacity for innovation and improvement (See for example, Zaghoul and Hartman, 2003; Rooke *et al.*, 2004; Eriksson and Laan, 2007; Eriksson *et al.*, 2008; Sarhan and Fox, 2013). As stressed by Kululanga *et al.* (1999), the construction industry is characterised by a lack of a learning curve, where existing values and beliefs are not open for questioning; and this constitutes a general barrier to change, improvement and innovation.

Table 7.6: Participants' opinion upon reasons for the coherence of prevailing imperfect construction models

To what extent do you agree with the loop leading to the coherence of the prevailing imperfect construction business and project delivery model?	
Senior Consultant	<i>I'd largely agree with it on the basis that the response to manifest waste is often institutionalized by the personal agendas of actors within it attempting to preserve or promote their own careers. I believe institutional tolerance of personal failure in the construction industry tends to be low rather than learning. So, the response tends to be to apportion blame, dispense with the opportunity to learn from accumulated experience, introduce a 'hero' with a new approach – repeat.</i>
Project / Contracts Manager	<i>To a large extent. Rather than assessing reasons for failure and implementing improvements, parties are caught in tribal blame</i>
Senior Researcher	<i>This is a difficult question which the study cannot fully answer. Generally speaking, practices continue without change simply because 'that is the way that it's done'; this is a powerful conservative force that should never be underestimated. In addition, while inappropriate institutional arrangements are reinforced by their own consequences (e.g. attempting to control outcome costs through excessive use of competitive price tendering, leading to claims planning) they are also reinforced by contingent events (e.g. the discovery of unexpected ground conditions leading to attempts to transfer risk). To adequately answer this question would require a participant action research approach in which detailed study could be made of chains of consequence in actual real-time cases and solutions devised and tested.</i>
Site Manager / lean consultant	<i>Vicious cycle of safeguarding.</i>
Construction Manager	<i>I am not sure that I understand this question fully.</i>

7.3.4 Explanatory sufficiency of the developed conceptual model

The evaluation exercise included two questions to assess the 'explanatory sufficiency' of the developed conceptual model. In the first question (Table 7.7), the participants were asked whether the category of 'imperfect institutional factors' provides sufficient explanations to explain why inefficient construction procurement practices persist. In another question (Table 7.8), the participants were asked about whether they agree or not with the examples/instances

(sub-categories and sub-sub categories) identified within the emergent theme of ‘clients’ flawed assumptions and/or errors during pre-contractual stage’.

As shown in Table 7.7 below, all participants were satisfied with the conceptual model’s explanatory power and sufficiency. The senior consultant, however, questioned whether three of the study’s identified institutional factors (price-based mindset, cost-driven environment and risk-aversity) should be classified as ‘sources of institutionalised waste in construction’. He simply based his arguments on tax-payers’ values and how that they might be delighted to know that public-sector client-organisations are risk-averse and take a cost-driven approach to procurement. The author, however, argues that this claim, certainly, supports this study’s findings of how institutional norms and cultural-cognitive framework assumptions influence construction procurement decisions and practices.

Table 7.7: Participants’ evaluation of the explanatory sufficiency of how imperfect institutions influence construction procurement

To what extent do the main themes identified within the 'imperfect institutional factors' category sufficiently explain why inefficient procurement and contractual practices persist?	
Senior Consultant	<i>I don't necessarily think, cost-driven environment, price-based mind-set or risk-aversity are a bad thing. The ultimate clients of public infrastructure are the tax-payers and I expect that by and large they would be very pleased to hear that procuring institutions have a cost-driven environment or price-based mindset. Perhaps what is missing is a leadership that can exercise that mind-set in a way that secures an efficient as opposed to an inefficient procurement process...The trick is often to set the right goals – and not just set task goals but set context goals. And the responses of people to goals set are peculiar to the nature of the individuals themselves – what are their personalities and motivators...What is wrong with a client being risk-averse? Why would anyone not want to be risk averse?...The real issue here is the bargaining power of the client in relation to the suppliers. Particularly where the clients are monopolistic”.</i>
Project / Contracts Manager	<i>I think you have identified many of the issues responsible. Procurement practice has improved somewhat, with the use of supply chains, but much more effort needs to be expended on the end to end process</i>
Senior Researcher	<i>To a significant extent</i>

Site Manager / lean consultant	<i>Greatly. People don't know what they don't know; and if for example QS or owner do not know about a lean project delivery model why would they recommend it??? They would have to learn and experience it before they recommend it or take a "chance" using it. Chicken and egg scenario...</i>
Construction Manager	<i>I believe the main themes identify the tip of the iceberg in most categories.</i>

This study identified a number of imperfect 'normative and cultural-cognitive institutions'; and this eventually led to the emergence of a theme named 'buyers' flawed assumptions and/or errors during pre-contractual stage'. Within this theme, a number of imperfect fundamental paradigms were identified that, arguably, influence buyers' approaches to construction procurement. The participants were asked through the evaluation exercise to provide feedback on whether the study succeeded in identifying sufficient examples/instances to express the theme to readers (See Table 7.8).

Table 7.8: Participants' feedback on the explanatory power of the emergent theme of 'buyers' flawed assumptions and/or errors during pre-contract stage'

To what extent do you agree with the examples/instances identified within the theme 'clients' flawed assumptions and/or errors during pre-contractual stage'?	
Senior Consultant	<i>I think the two most relevant...are 'Focussing on minimising transaction costs and not overall costs' and 'Not taking advantage of the procurement process to eradicate delivery partner assumptions'. By focussing on transaction costs and not overall costs clients try to minimise costs associated with full understanding of project parameters; ground conditions, condition and extent of existing assets etc. The clients then try to pass this risk on to the suppliers by making the suppliers submit prices that include for that risk. The procurement process then misses the opportunity to understand how much of the risk the supplier has priced and the assumptions made. The attitude towards managing assumptions and risk seems to have become quite immature and a function of a power imbalance. Clients avoid transactional costs involved in fully identifying constraints prior to construction – they then see if they can further avoid them by asking the contractors to price them – who feel compelled to do so because of the competitive landscape.</i>

Project / Contracts Manager	<i>Your use of the phrase imperfect normative and cultural-cognitive institutions is relevant, as poor practice has been normalised and embedded in the industry with little real criticism and research into how these norms can be challenged. I think figure 2 has captured most of the issues</i>
Senior Researcher	<i>This appears to be a satisfactory summary, which might form the basis of a useful check-list of do's and don'ts for procurers.</i>
Site Manager / lean consultant	<i>Spending money at the front end on lean design (which = more design actually) is seen as waste. There is never time or money to do this but always time for re-work on designs or construction or worse still after construction to fix the problems.</i>
Construction Manager	<i>I agree with most of the identified examples...Clearly an intelligent client would have more skills to make more sound investment decisions</i>

As shown in Table 7.8 above, all participants provided positive feedback and justified their answers. The senior researcher suggested that the findings of this study should be used as a basis for a useful guiding check list for procurers. Additionally, the project/contracts manager praised the study's choice of the phrase 'imperfect norms and cultural-cognitive institutions, as he believes that it represents reality. Overall, all participants agreed that the study provided satisfactory explanations to this developed theme

7.4 Summary

This chapter provided an analysis and discussion on feedback received from a number of industry and academic experts to evaluate the quality of the study's developed conceptual model (Figure 4.1) and main findings. Four quality criteria were assessed within the conducted evaluation exercise; namely: (1) relevance and usefulness, (2) credibility, (3) resonance, and (4) explanatory sufficiency. As discussed within this chapter, the results of the conducted evaluation exercise demonstrate that the developed conceptual model has met these quality criteria. The next chapter presents an overall discussion of the main findings of the study.

CHAPTER EIGHT: DISCUSSION AND INTEGRATION OF EXTANT LITERATURE

8.1 Introduction

In this chapter, the main findings of the study and the developed conceptual framework will be discussed in line with the aim and main objectives of the study. The chapter refers to extant literature and feedback received during the evaluation exercise, whenever appropriate, to augment the main arguments and empirical findings of the study. The chapter starts by providing a summary of the research problem and the main steps taken to reach the findings. Next, a discussion of the main findings and arguments of the study is provided with reference to relevant literature. This is followed by discussions about the study's potential implications for practice and future research.

8.2 The Need for a Wider Conceptualisation of Waste in Construction

The construction industry is often regarded as wasteful, confrontational, risks averse, and lacking trust and capacity for innovation and improvement (for example, see Koskela, 1992; Zaghoul and Hartman, 2003; Rooke *et al.*, 2004; Eriksson and Laan, 2007; Eriksson *et al.*, 2008; Carrillo *et al.*, 2012). Over the past 80 years, the UK Government and many organisations have commissioned several reports, in order to review the performance of the construction industry, highlight areas of concern, and suggest means for improvement. In particular, Egan's report (1998), *Rethinking Construction*, called for 'waste-reduction' as an improvement strategy. A subsequent report, *Never Waste a Good Crisis* (Wolstenholme *et al.*, 2009), was then conducted to assess the progress that the industry has made since Egan's report, and it was concluded that hardly anything had changed. For instance, the UK industry has seen partnering and framework agreements losing its momentum and going back to lowest price tendering, especially during the recession period between 2008 and 2009. In 2012, the UK Government Construction Strategy report introduced three new models of construction procurement with the aim of reducing inefficiencies in construction projects (UK Government, 2012). These alternative procurement models have been examined in trial projects, and demonstrated evidence in achieving cost savings and

other intangible benefits (Cabinet Office, 2012b); however, the subsequent adoption of these alternative approaches is negligible. In 2013, the UK Government challenged construction to achieve 50% faster delivery and a 33% reduction of clients' capital costs by 2025. Obviously, prevailing 'business as usual' approaches will not meet these targets. It is thus questionable why the current construction model is so coherent and so embedded, despite the substantial attempts to address its recognised inadequacies.

Eliminating (process and physical) waste from construction design and delivery, as advocated by lean ideals, is a necessary step towards achieving the aforementioned goals. However, waste-reduction understood simply as the improvement of current processes rather than fundamental system redesign will not be enough. Obtaining a better understanding and conceptualisation of waste in construction is therefore crucial, in order to prepare the industry for the radical demanded of it. One aspect of this conceptualisation is the consideration of the wider institutional, procurement and commercial environments surrounding the design and delivery of construction projects. It is this this aspect which led the study to explore whether there is anything in the aforementioned environments that is blocking radical new production system design and therefore pinning the prevailing wasteful construction model in place.

Many of the problems that lead to the occurrence of waste in construction are strongly related to lean theories adopted in production management. However, it can still be argued that waste is created primarily from project-organisational and contractual problems (Williamson, 1991, pp. 78-79); and as such, a focus on waste reduction in production (design and delivery of design) alone would be insufficient. As stressed by Matthews *et al.* (2003), it is difficult to maximise value and minimise waste at the project level if the prevailing contractual structure hinders coordination, constrains collaboration and innovation, and sub-optimises performance and goals. Similarly, it is suggested in this study that procurement systems, as institutional arrangements, are designed to assign liabilities and authorities to people and organizations (Love *et al.*, 1998) at the project and programme levels; and thus structure the borders that shape '*the play of the game*' (Williamson, 2000). From a production management perspective, organisation and contracts are essential parts of the production system design (Koskela

and Ballard, 2012); and thus it makes sense to argue that poorly aligned project-organisational and institutional arrangements may cause process waste and impact on project outcomes.

In order to start unpicking the apparent coherence, and yet wastefulness, of the prevailing construction model, there is a need to evaluate the wider institutional, procurements and commercial context surrounding the design and delivery of construction, and to assess the fundamental paradigms and cultural-cognitive assumptions that underlie approaches to construction procurement. The institutional and commercial environments that underpin project production are enshrined within the project procurement processes, and cover every aspect of setting up the transaction from identifying the business case and funding through to the appointment of project-suppliers and monitoring and measuring their performance. Such an evaluation, however, needs to draw upon theory from disciplines outside construction. Three particular theories, therefore, were ‘abductively’ selected as fit for this purpose (Figure 8.1).

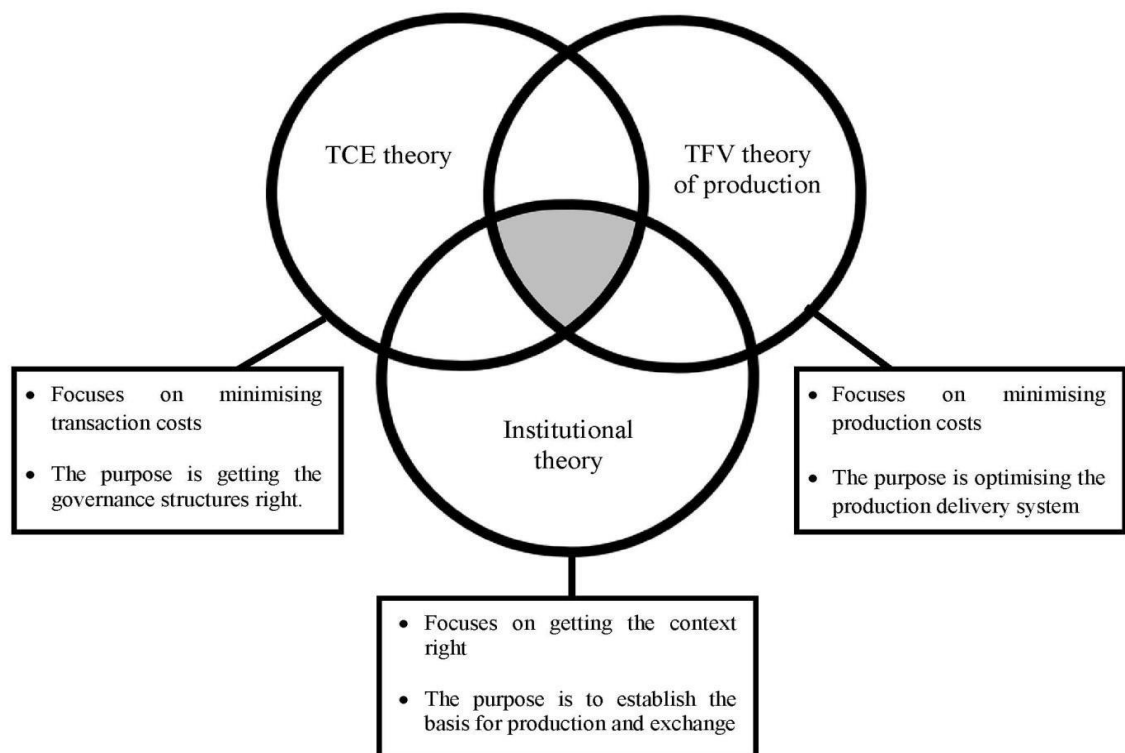


Figure 8.1: Theoretical perspectives underpinning this study

The TFV theory of production was used to help the author gain a better understanding of the concept of waste in construction. TCE offers a useful mechanism to analyse conflicting interests among contracting parties (Li *et al.*, 2013) and to understand the hidden costs associated with pre- and post-contract work (See for example Li *et al.*, 2014; Rajeh *et al.*, 2015; Guo *et al.*, 2016). Thus, the author referred to TCE to gain knowledge about procurement dynamics. Neo-institutional theory focusses on the context and gives careful consideration to the roles played by normative and cultural-cognitive systems, which are regarded by the author as vital forces affecting the success or failure of construction projects.

A review of these three theories (as presented in Chapter 2), in association with a contextual review of construction-procurement literature, enabled the study to formulate six guiding propositions and to develop a preliminary conceptual model (see Figure 2.2 in Chapter 2) prior to data collection. The use of theory, tentatively, at this stage was seen to be important to guide the researcher during data collection, whilst also leaving the scope open for generating unintended findings or even new hypotheses. Subsequently, a reflexive grounded-theory approach was adopted for data collection and analysis (refer to Chapter 3, for fuller details).

Consequently, the use of inductive-abductive reasoning approaches led to the emergence of new concepts, themes and categories, including the relationships between the four main core categories of the developed conceptual model of ‘institutional waste within the UK construction industry’ (see Figure 4.1 in Chapter 4). Thereby, allowing the study to move beyond the relatively limited preliminary conceptual model, and instead develop a more useful and relevant conceptual model that is grounded in empirical data collected from the field. Having summarised the research background and processes that led to the developed of the study’s conceptual model, the next sections will discuss the main findings of the study, with reference to extant literature.

8.3 The Relationship between Construction Procurement and Waste in Construction

The construction industry has, over a long period, been criticised for its short term “hit-and-run” relationships which are focused on win-lose situations and poor performance. The current approach contains many inefficiencies that have been frequently attributed to factors such as fragmentation of the industry (Egan, 1998; Sarhan and Fox, 2013), adversarial hierarchy structure of construction projects (Ghassemi and Becerik-Gerber, 2011), obsolete procurement methods (Eriksson and Laan, 2007), confusing and treacherous contractual arrangements (Hawkins, 2012; Cox, and Thompson, 1997), the highly competitive cost-driven environment (Bresnen and Marshall, 2000) and the sequential organisation of construction processes (Koskela, 2000). Despite the wide recognition of these problems the industry persistently resists the radical demanded of it.

In general, increased trustful collaboration between project parties is argued to be an appropriate remedy for many of the industry’s problems (See for example Eriksson *et al.*, 2008; Xue *et al.*, 2010; Sebastian, 2011; Pasquire *et al.*, 2015; Walker *et al.*, 2017). Since, the extent of cooperation (and trust) is largely influenced by procurement arrangements and procedures (Eriksson and Laan, 2007; Pasquire *et al.*, 2015); this is considered a key area that requires substantial attention and improvement (Egan, 1998) and which is central to overall client satisfaction and project success (Love *et al.*, 1998; Tookey *et al.*, 2001; Osipova and Eriksson, 2011).

As emphasised by Matthews *et al.* (2003, p. 1) “*maximizing value and minimizing waste at the project level is difficult when the contractual structure inhibits coordination, stifles cooperation and innovation, and rewards individual contractors for both reserving good ideas, and optimizing their performance at the expense of others*”. Adding to this, it is suggested in this study that procurement and contractual systems, as institutional arrangements, are designed to assign liabilities and authorities to people and organizations (Love *et al.*, 1998) at the project and programme levels; and thus structure the borders that shape ‘*the play of the game*’ (Williamson, 2000). Thus, inefficient or inappropriate construction procurement arrangements could encourage

wasteful behaviours and poor performances, which in turn lead to consequential waste. This, therefore, implies that buyers and decision makers need to give significant consideration to the impact of their chosen construction procurement arrangements on process-flow.

A small but emerging number of studies have attempted to explicitly investigate the relationship between construction procurement systems and waste in construction (for example see Jaques, 2000; Gamage *et al.*, 2009). However, most of these studies, if not all, have limited their attention to physical (material) waste as opposed to process waste and value creation. Additionally, very few, if any studies, have sought to investigate why prevailing construction procurement practices persist. Furthermore, in the construction management literature, according to the author's knowledge, there are hardly any studies that have sought to explore the impact of institutional factors, which influence construction procurement choices and practices, on the generation and entrenchment of waste in construction projects. Waste here can be in the form of monetary, time, effort or value-loss, and can arise during pre or post construction stages.

This study identified a number of procurement and contractual arrangements, which are taken-for-granted and impede efficiency and improvement efforts in construction (see Figure 8.2). These prevailing procurement arrangements were identified by the participants of this study as major 'causes of waste and inefficiencies' in construction projects. Some of the identified inefficient procurement practices have already been extensively criticised and acknowledged in literature. These are: separated procurement methods; lowest price selection criteria; complexity of contractual procedures; late involvement of contractors; poor payment terms and arrangements; non-joint-specification of design; and onerous preselection of suppliers.

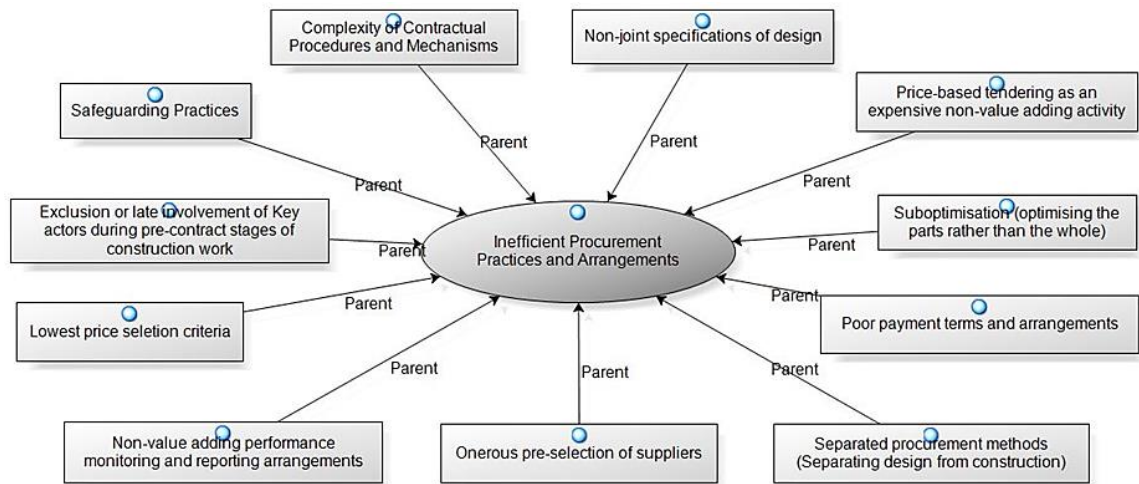


Figure 8.2: Prevailing inefficient construction procurement practices in construction

A few others are less prevalent in literature, but mainly recognised by researchers belonging to the lean construction community (i.e. sub-optimisation through fragmenting contracts using a ‘buy-it’ governance arrangement, exclusion of subcontractors from early project stages, tendering, and non-value-adding performance monitoring procedures). Nevertheless, to the author’s knowledge, very few studies have managed to collate inefficient construction procurement practices in such a way into one study. Thus, the findings of this study could serve as a useful compendium for researchers and industry practitioners to access, in order to gain a better understanding of the impact of prevailing (inefficient) construction procurement practices on project-team dynamics (Figure 8.3).

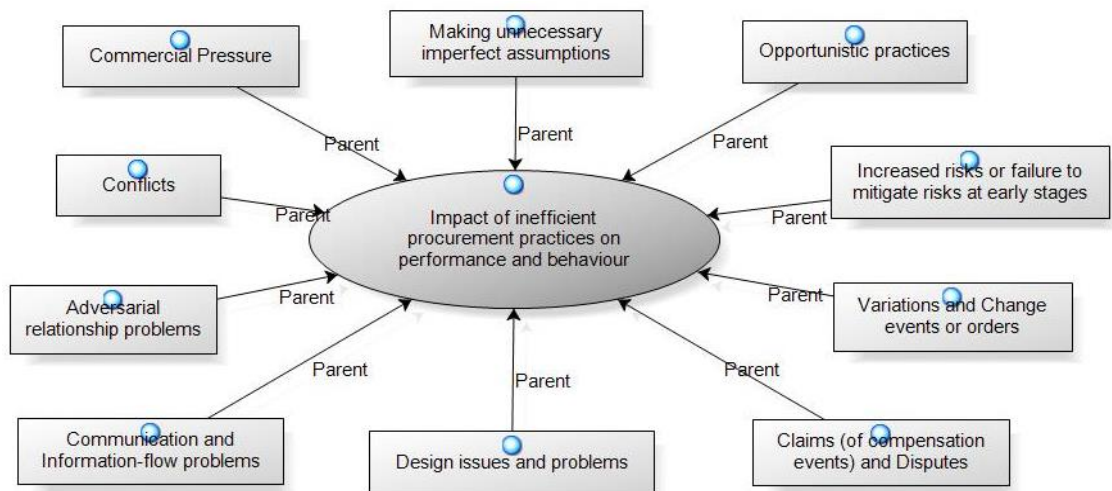


Figure 8.3 General impacts of prevailing inefficient procurement practices on project-team performances and behaviours

Moreover, very few, if any, studies have attempted to critically evaluate prevalent safeguarding practices in construction procurement. This study contributes to existing knowledge by exposing prevailing safeguarding-mind-sets and approaches to construction procurement, as a cause of waste hitherto unacknowledged. The findings of this study revealed that clients and decision makers often tend to safeguard their project-specific assets, against opportunism and exploitation, through the deployment of formal contractual arrangements and governance structures. These arrangements and structures typically dominate the management of the project delivery often to the detriment of the project itself; but because there is a belief that interests are safeguarded, clients and decision makers feel they have taken the best course of action. This finding offers a novel explanation to the reasons for the prevalence of the current construction model. This finding was also supported by the industry experts who were invited to evaluate the findings of the study (See Chapter 7). For instance, a site manager with more than 20 years of industry experience stated:

I have personally (on site and managing projects) experienced many of the factors identified through this research. Projects go round and round in circles just like the model, because of past experiences of AEC stakeholders and their instance to safeguard against what has happened before” (Site Manager and Lean Specialist, 10th April 2017)

Interestingly, while using NVivo matrix-coding query to investigate patterns in the data, it was found that ‘safeguarding practices’ in construction procurement has the strongest correlation with all other categories and sub-categories of the developed model (see Table 8.1). This “*quantitizing*” approach (Sandelowsk et al., 2009), was not used to convert qualitative data into quantitative data, but as a way to look at experiences grounded in the data through a numerical rather than word form. It is important, however, to emphasise that the intention was not to claim that the result is statistically significant, but to find patterns in the data and then refer to the content that shows those patterns to look for explanations.

Table: 8.1: Results of a QSR NVivo 10 matrix-coding query conducted by this study

	Institutional Factors (IF)	Inefficient Performances and Behaviours (PB)	Consequential Wastes (W)
Inefficient Procurement Practices and Arrangements (IP)	128	127	78
Bulk Buying or cumulative ordering	1	0	1
Complexity of contractual procedures and mechanisms	9	12	9
Exclusion or late involvement of Key actors during pre-construction stages	5	12	10
Lowest price selection criteria	17	5	3
Non-joint specifications of design	3	8	3
Non-value adding performance monitoring arrangements	27	13	12
Onerous pre-selection of suppliers	8	8	1
Poor payment terms and arrangements	5	12	3
Safeguarding practices	37	46	26
Separated procurement methods	13	23	10
Sub-optimisation	9	8	1
Tendering as an expensive non-value adding activity	32	18	16

* The numbers in the Table represent a count of the coding intersections between lists of items

The next sections, therefore, explain the ‘safeguarding problem in construction procurement’ in greater detail, by referring to extant literature and feedback received during the evaluation exercise to augment the empirical findings of the study. The focus will particularly be upon how self-interest drives opportunism and influences the governance (safeguarding) approaches and how this becomes a dichotomy as one organisation seeks to protect its interests from the opportunism of others whilst continuing to exploit all opportunities themselves. It is proposed that one way to begin to break this seemingly irreconcilable and self-perpetuating cycle is to expose it as a cause of waste hitherto unacknowledged. Thus, the following sections will start by providing a summary of the ‘safeguarding problem’ as conceptualised in TCE (Refer to Chapter 2, for fuller details). Following this, a critical discussion upon a number of safeguarding approaches that are commonly practiced in construction is presented from a lean perspective. Interestingly, it is shown that when these safeguarding approaches are viewed through a "lean" lens, it can be observed that they are wasteful and/or create waste

8.4 An Introduction to the Safeguarding Problem in Construction Procurement

Due to the difficult nature of many construction projects, clients and decision makers, in practice, tend to allocate risks and seek to safeguard their project-specific investments and assets, from exploitation and opportunism, through the deployment of formal governance mechanisms contained within the contractual arrangements. This applies to all parties across the project chain from high level project funders through to raw material suppliers. Since, most of the clients who procure construction projects lack experience and may only ever build once or twice (Love et al., 2010); they invariably seek advice from lawyers and from those who are familiar with construction contracts and the laws related to them (e.g. quantity surveyors). These lawyers or consultants are accordingly paid, as part of their agreed fees, for providing means for safeguarding their client’s rights and transaction-specific assets. Unsurprisingly, in some cases these means can include the use of privileged conditions of contract, where clients may not mind protecting themselves from any risks, even if, this occurs at the expense of others and ultimately themselves. An example of this can be found in the inappropriate risk allocation in the use of disclaimer (exculpatory) clauses which can attract between 8% - 20% of the total project cost as contingency (Zaghloul and Hartman 2003). This is

potentially an example of a contingency that clearly consumes resource without adding practical value and thus conforms to the archetypal definition of waste. This study reviewed, during the concurrent data collection and analysis stages, a full project-contract of a major infrastructure project in the UK, which included the following onerous clause:

“The *Contractor’s* share is paid to the *Employer* if there is a fatality on the site of the Scheme as a result of a reportable incident” (Z-clause within an anonymous NEC 3, Option D, target cost contract with a bill of quantities)

However, in most cases, the intention for or on behalf of client’s (experienced or not) is to control opportunism and utilise efficient governance of the transaction. Additionally there may be little awareness of how these procurement decisions and arrangements may affect the likelihood of creating a cooperative environment (Eriksson *et al.*, 2008) and thus impact on project performance and outcomes.

8.4.1 A summary of TCE explanations to the safeguarding problem

According to TCE, a ‘*safeguarding problem*’ arises when a firm deploys transaction-specific assets and worries that its exchange-partner may opportunistically try to exploit these unique investments (Rindfleisch and Heide, 1997). Accordingly, it can be concluded that asset specificity and opportunism are the antecedents of the safeguarding problem. Figure 8.4 shows a conceptual representation of these governance problems and possible solutions.

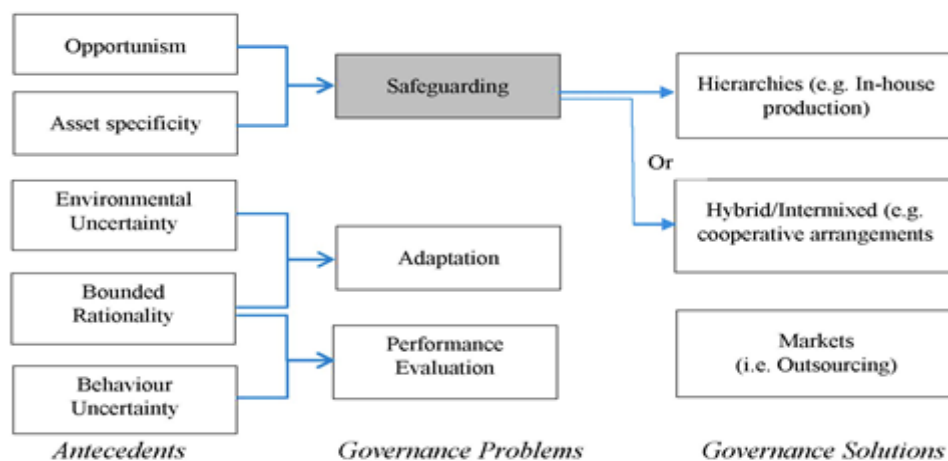


Figure 8.4: A basic model of transactional governance problems and solutions

TCE has the objective of total cost minimisation (Winch, 1989; Rindfleisch and Heide, 1997) because it assumes that transactions will be adequately governed by the institutional (procurement) arrangements that are most efficient (Bradach and Eccles, 1989). According to North and Davis (1971, pp. 6-7; emphasis in original), cited in Williamson (1990): “*An institutional arrangement is an arrangement between economic units that governs the way these units can cooperate and/or compete. It [can] provide a structure within which its members can cooperate...or [it can] provide a mechanism that can effect a change in law or property rights*”. This implies that, according to TCE, the institutional arrangement chosen will be that which reduces the total costs (transactional or organizational costs plus production costs) of undertaking and coordinating those activities (Chau and Walker, 1994).

When applied to construction clients deploying their procurement arrangements in general, and governance techniques and approaches in specific, this suggests they should also consider the impact of their decisions on a project-team’s performance and total costs. Not to do so might mean a cheaper transactional arrangement leading to a disproportionately higher production cost. This idea now contradicts the previous suggestion that economic agents should primarily seek to economise on transaction costs (Williamson, 1985). These contradictions, therefore, indicate that it is insufficient to expect that the most economic transactional arrangements will implicitly lead to the most efficient institutional arrangements.

Having, provided an overview of the ‘safeguarding problem’ as conceptualised in TCE, next the study presents a critical discussion upon a number of safeguarding approaches that are commonly practiced in construction. Figure 8.5 illustrates a range of (inefficient) safeguarding practices, which inductively emerged out of the data collected for this study. However, for reasons of brevity and conciseness, the following discussion will be focussed on contractual governance (safeguarding) arrangements, because they are more dominant and prevalent in both literature and practice.

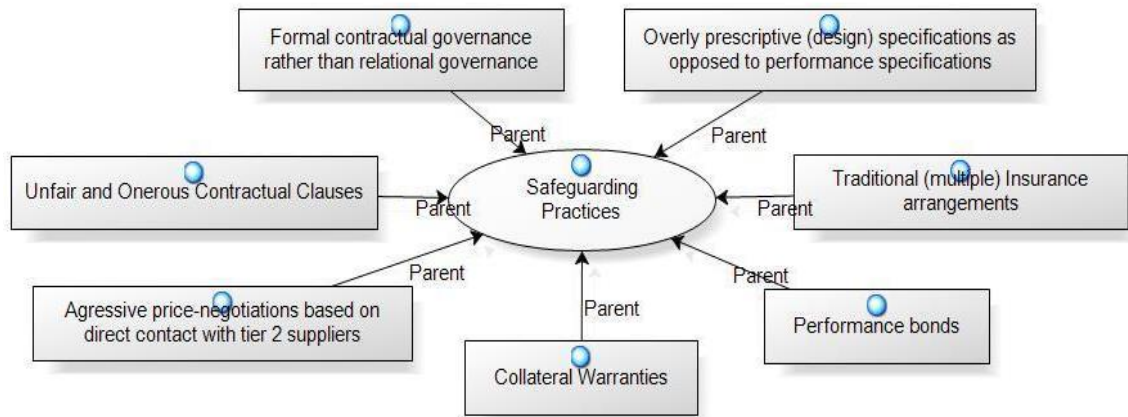


Figure 8.5: Inefficient safeguarding approaches commonly used in construction

8.4.2 Prevailing safeguarding approaches to construction procurement

The prevailing transaction approach taken in construction conforms to the “buy it” type of governance where contractual and governance instruments are often adapted from other transactions, and performance is evaluated through stringent conditions agreed in advance. In this way, it is anticipated that risks and uncertainties are captured and managed and parties are protected from the opportunistic exploitation of these risks and uncertainties by these governance arrangements. This prevails even though the high transaction cost, asset specificity and uncertainty mean that a vertically integrated “make-it” or production-led approach is more appropriate where interests are protected through “in-house” or “hybrid” production (see Figure 8.4). The prevailing approaches for the management of projects and arrangement of transactions are widely documented by professional institutions, for example PMI¹, RICS², CIPS³ among others. So the contradictory position seems to apply to the execution of many types of projects. However, one project domain which conforms more to the “make it” type of governance would seem to be film and theatre production although it is not investigated here.

¹ Project Management Institute www.pmi.org

² Royal Institution of Chartered Surveyors www.rics.org

³ Chartered Institute of Procurement and Supply www.cips.org

In the construction industry the contradictory position is compounded by the prevailing institutional arrangements in which the asset specificity and low transaction frequency creates an opportunistic culture resulting in a myriad of safeguarding approaches. When these safeguarding approaches are viewed through a "lean" lens, it can be observed that they are wasteful and/or create waste. Some of the most commonly used safeguarding approaches to construction procurement are now critically discussed.

STANDARD FORMS OF CONTRACT

Construction parties rely heavily on contract formalisation through the use of standard forms of contracts (Eriksson and Laan, 2007). Theoretically, standard forms of contract optimise the balance of risk and responsibilities between the parties, and eliminate ex-ante transactional costs required for re-drafting and getting familiar with new contracts (Cox and Thompson, 1997). Their main advantage is that they enable a body of experience in their use to be developed among the whole industry (Williamson *et al.*, 2004). This includes the formation of an established body of case law which can assist in the drafting and interpretation of contracts (Laryea and Hughes, 2009). Thus, as a safeguarding technique, they are supposed to reduce the amount of time and risk involved for contract administrators and tenderers as well. However, there are many problems related to the use of standard forms of contract. These forms of contract are drafted by third parties who focused their formulation of the contracts on specific types of projects; thus one of the main problems associated with the use of un-amended standard forms of contract is their inability to adapt to the context in which they operate (Laryea and Hughes, 2009). This argument was acknowledged by various participants of this study, including a 'Business Development Manager', as follows:

You also see occasionally where PQSs, who have a main building portfolio and were very familiar with the likes of JCT, get told they must work in NEC...and a lot of their Z-clauses are trying to make NEC work in the same way as JCT. But their customers have chosen NEC because they do not want to work in a JCT fashion. And JCT is not very good for civils works anyway; because civils works tend to have quite a lot of change in the ground conditions and so on, and JCT just cannot deal with that" (Business Development Manager, Dec 2015, Interview).

Nevertheless, in practice, clients rarely use standard-form contracts without making some amendments to them (Laryea and Hughes, 2009), and the same applies to subcontracts (Greenwood, 2001). This argument was supported by a ‘Contracts Manager’ with more than twenty years of experience who was invited to evaluate the main findings of the study.

“The issue of clients’ input is important, particularly where we see collaborative type contracts like the NEC 3 continually ‘Z-claused’ to become less collaborative and more adversarial. The point on the increasing influence of external consultants and lawyers is also pertinent” (Project/Contracts Manager, March 2017, Evaluation exercise)

A study by Laryea and Hughes (2009) which was based on four observational case studies in two of the top contracting companies in the UK, showed that these amendments made by clients are mostly related to payment issues and legal arrangements. Similarly, an exploratory study of 11 Swedish construction projects, by Opisova and Erksson (2011), reported that in all 11 projects, clients made amendments to the general conditions of contract to transfer more risks to the contractor; many of them were applied to the length of guarantee and additional insurance. Laryea and Hughes (2009) revealed that a general perception exists among contractors that clients, actually, amend conditions of standard contracts and introduce their own special clauses, in order to gain an advantage rather than genuinely to suit the project needs. Additionally, Hawkins (2012) warns us that users making amendments to standard forms of contract at negotiation stages do not always ensure that all the interlinked clauses affected by the amendments are also amended. Thus, in the absence of trust and collaboration, any amendments to contract conditions may lead to ambiguities and encourage opportunistic behaviour. Actually, a study by Love *et al.* (2010) identified onerous and one sided amendments to standard forms, often drafted by lawyers to improve their clients’ position, as one of the underlying dynamic factors influencing disputes.

A number of studies show compounding factors by verifying that some contract conditions (i.e. FIDIC, 1999 and NEC, 1993) are very difficult to read, and require at least college-level reading skills to correctly interpret them (Rameezdeen and Rajapakse, 2007; Rameezdeen and Rodrigo, 2013). At the same time, it is important to emphasise that lawyers and specialist surveyors are not the primary users of a contract; it is the project parties' ability to capture their meaning which is fundamental for contract performance (Rameezdeen and Rodrigo, 2013). In general, textual complexity of standard forms of contract, in terms of readability and comprehensiveness, may lead to misinterpretation and lack of common understanding between project parties; thus supporting arms' length relationships and potential time-consuming and costly disputes (Rameezdeen and Rajapakse, 2007).

Additionally, one of the major critiques concerning the adoption of standard form of contracts is associated with the dominance of adversarial dispute resolution mechanisms within many of these contracts (Mante *et al.*, 2012). Furthermore, the availability of adjudication clauses as contained in standard forms of contract make disputes a less disruptive action for the parties concerned (Love *et al.*, 2010); thereby hindering collaboration efforts. In a study by Mante *et al.* (2012) which aimed to review the influence of procurement methods on dispute resolution mechanism choice in construction, it was found that almost all traditional procurement contracts in the UK (e.g. JCT standard building contracts (2005) and the NEC3 Engineering and Construction contract) offer adjudication, arbitration and litigation as the primary dispute resolution mechanisms. In contrast, standard forms of contract for Project Partnering (i.e. PPC 2000) promote a clear preference for non-adversarial methods of dispute resolution, by providing a problem-solving hierarchy that starts with the client's representative and ends with legislation as the final means of determining the dispute (Mante *et al.*, 2012). The use of the multi-tiered dispute resolution mechanism ensures that relationship-based approaches to resolving disputes are exhausted prior to the use of any adversarial methods. Similarly, Alliancing Contracts in Australia include a "no dispute" clause, in which project participants agree to use an alliance board for resolving all disputes as an alternative approach to arbitration or litigation (Jones, 2000). This allows project participants to resolve any conflicts or issues on site and

within the project team, and consequently facilitates earlier settlement of final account (Rahman and Kumrasawy, 2004).

In summary, it seems from the critical discussion provided above that the problems of standard forms of contract outweigh their advantages. The heavy reliance on the use of standard forms of contract, established by third parties, brings with it lots of formality and rigidity that stifles cooperation and focuses on the individual parties and their responsibilities; thereby driving a distance between project parties and encouraging opportunistic behaviour (Eriksson *et al.* 2008). According to Cox and Thompson (1997, p. 132):

“...Standard forms of contract are nothing more than instruments used by the parties to seek strict liability and attach blame to events as they occur. Nevertheless, the industry's hands are tied to the standard forms and their traditional methods of contracting, even though they do not deliver satisfactory results. These methods, when linked with the prevailing adversarial culture and fragmented structure lead the parties away from 'trust' towards self-seeking interest ('opportunism')”.

Nonetheless, Eriksson and Laan (2007) suggest that the deep-rooted practice of using standard contracts construction is only harmful, if they are used as “*safeguards*” in the absence of strong “*relational norms*”. Without good relationships between the project-parties, once a default occurs, they are most likely to refer back to the clauses of the standard contract which, in turn, may encourage opportunism and lead to adversarial ways of working (i.e. remedies of damages through legal actions). Therefore, it could be argued that the criticism is not about the use of standard forms of contracts; but it is about what is being standardised within these contracts, as well as how people interpret and choose to use contracts. Partnering and alliancing are regarded as practical examples of “relational contracting” (RC) principles (Rahman and Kumrasawy, 2004). RC-based approaches seem to offer a cost-effective means of achieving total project cost minimisation through encouraging mutual trust, collaboration and joint

management of risks (See for example Rahman and Kumrasawy, 2002a&b, 2004; Eriksson and Westerberg, 2011).

DISCLAIMER, EXCULPATORY AND PRIVILEGED CLAUSES OF CONTRACT

Shifting project risks to other contracting parties is a general practice in the construction industry (Zaghloul and Hartman, 2003), which may lead to cost wastage and opportunistic behaviours (Clegg, 1992). It is common practice for clients to exert most project risk, if not all, on contractors and designers (Ahmed *et al.*, 1999; Osipova and Eriksson, 2011), in order to have more control whilst passing responsibility. This is achieved through the use of disclaimer clauses or exculpatory language in contract conditions for risk allocation and as a ‘safeguard’. This argument was affirmed by a ‘Site manager / Lean Specialist’ who participated in the evaluation exercise of this study, as follows:

“One of the projects I am supporting now was originally tendered at 2 million. Re-tendered at 2.5 million after some changes and 20% contingency is likely to be allowed on top of this to deal with unforeseen conditions. The procurement/negotiations of this contract have cost (wasted) a lot of money to “protect” the client against risk when all it really boils down to is not trusting the contractor and declaring a budget from the outset. (Site Manager and Lean Specialist, April 2017, Evaluation exercise)

In 12 case-studies, by Smith and Bohn (1999), which aimed to investigate the factors which influence the assumptions of risk and the use of contingency by small-medium construction firms, it was reported that *“on many occasions designers work with owners who believe it is the design engineer’s obligation to protect them against all project risks using whatever exculpatory language they can find in defence of their position (p. 102)*. An example of this includes imposing ‘unlimited liability’, ‘on-demand bonds’, or ‘fitness for purpose obligations’ on project-parties in the contract. Such proposed forms of warranty, which are used to the employer's advantage, are described by Hawkins (2012) as ‘weasel clauses’ that most insurers will eschew. These onerous contractual

clauses were criticised by a ‘Business Development Manager’ working for a main civil engineering contractor in the UK, who participated in this study, as follows:

“I think with the NEC contract, there are a couple of errors within the contract. One is limited liability and the other is fitness of purpose. There are X-clauses (X-15 and X-18) which correct these errors. And my belief is that when we get a Fourth Edition, I certainly hope that those errors are corrected... We cannot buy insurance to cover ‘unlimited liability’, so we have to ‘put our business on the line’... ‘Fitness for purpose’, well, we’re contractors we do not know what the purpose is. Hmm, you know, our job is to build the scope. And ‘on demand’ bond is effectively a loan because if our clients can take it on demand, it’s classed by our banks as borrowing. So, it means there is less money that we can borrow from our banks to fund our business” (Business Development Manager, Dec 2015, Interview).

An empirical survey that was conducted in the Canadian and the United States construction industries by Zaghoul and Hartman (2003) revealed that inappropriate risk allocation through disclaimer (exculpatory) clauses in contracts is a major reason for increasing the total cost of a project. The study reported that, under all circumstances, whenever disclaimer clauses existed in contracts, contractors always added risk premiums to the total cost of a project in order to safeguard themselves against these clauses. These attached premiums ranged between 8% and 20% of the total cost of the project, depending on various factors including their relationship with the owner, contract type and fairness. According to Zaghoul and Hartman (2003), the most common *exculpatory clauses* used in construction contracts in descending order are: Uncertainty of work conditions; Indemnification; Delaying events; Sufficiency in contract documents; and Liquidated damages. Adding to this list is ‘Site access disclaimer clauses’. Site access is classified by Smith and Bohn (1999) as an internal, predictable and contractual type of risk that falls within the responsibility of the owner. This type of risk can be shared and planned-ahead to secure access; instead of being pushed to contractors in the form of disclaimer clauses, leading to unnecessary additional costs (in the form of insurance or contingencies, adversarial relationships and potential claims and disputes).

In short, it is obvious that ‘disclaimer or exculpatory clauses’ often used by clients as ‘safeguards’ may lead to increased costs of projects in the form of unnecessary contingencies and insurances (cost wastage), restricted bid-competitions (waste of human potential), and potential (timely-consuming) disputes. Compellingly, as found in this study (See Chapter 4), despite all of these, “*disclaimer clauses continue to be used in some of the newer contractual agreements between owners and contractors such as partnering/alliances*” (Zaghloul and Hartman, 2003, pp. 422).

CONVENTIONAL (MULTIPLE) INSURANCE ARRANGEMENTS

Typically, a client would wish to obtain the broadest possible insurance protection from project-parties against any loss arising from a project (Cushman, 2003). If insurance requirements are too lenient, client's loss exposures may not be covered sufficiently. If requirements are set too stringent (e.g. to cover any losses even if even if the fault is caused in whole or in part by the indemnified party), the client may have to pay for additional premiums or unnecessary contract costs (Cushman, 2003). In general, main contractors usually follow the same approach when dealing with their project-supply-chain. However, it has been suggested by expert construction professionals that conventional arrangements for providing insurance cover add unnecessary costs to constructions projects, and can also obstruct collaboration between supply chains (Ndekugri *et al.*, 2013).

This wasted cost, ultimately met by the buyer/client, arises through duplication in insurance cover as stakeholders’ policies overlap in the risks that they cover (Ndekugri *et al.*, 2013; Mossman *et al.*, 2010). Furthermore, the conventional practice of insuring the liabilities of individual project participants rather than the project risks themselves often leads to defensive attitudes between project participants; thereby hindering supply chain collaboration (Ibid.). As summed up by a Business Development Manager’ who participated in this study:

“Before you look into insurance, you really need to look at the reason for the insurance. And the reason for the insurance is risk. And in my experience where

we struggle with insurance, is usually down to an inappropriate risk strategy”
(Business Development Manager, Dec 2015, Interview)

In a survey study (Kent and Becerik Gerber, 2010) completed by 415 practitioners, traditional insurance products were identified, based on the respondents opinions, as a main barrier to integrated project delivery (IPD). Subsequently, Ghassemi, and Becerik-Gerber (2011) conducted a qualitative investigation, through nine IPD construction projects in the United States, and revealed that the biggest worry for leading industry professionals concerning adopting IPD to its full capacity is insurance and liability issues; as it was found that insurance products impose liability issues on each project-party separately and thus make collaboration complicated. According to Mossman *et al.* (2010, p. 11):

"If each party to a relational agreement is required to have its own insurance and there is a claim during design or construction, an insurance company could force parties to sue one another in order to trigger insurance coverage, threatening relationships".

It seems, therefore, that a 'project insurance' option (Ndekugri *et al.*, 2013) could be an efficient and effective alternative model which enables project participants to optimize the project risks as-a-whole. A single project insurance model may incur higher ex-ante costs than conventional ones; but would fill insurance gaps and reduce the need for litigations and dispute procedures often conducted to determine which member of the supply chain to blame once a damage or loss occurs; thereby leading to enhanced collaboration and work-flow and reduced post-ante costs. That being said, it is important to stress that in order to reap the full benefits of project insurance arrangements, there would be a crucial need for making project insurance a mainstream option, so that it can become an industry norm.

COLLATERAL WARRANTIES

Collateral warranties are well established, in the construction industry, as contracts which are collateral to the main agreement between project parties. The main objective for their use is to ‘safeguard’ those parties with a financial interest in the building from any consequent losses arising out of building defects which appear after practical completion (Wordley, 1991). They usually provide a direct contractual linkage between the producing parties and those parties who have long-term interest in the building once it is completed (i.e. the owner, the occupier and the financier) (Hawkins, 2012). Many forms of these collateral contracts provide that the rights and benefits of the warrant (guarantee given) may be passed on, at least twice, to subsequent interested parties (Hawkins, 2012; Wordley, 1991).

The construction industry, in particular the property sector, has been and is still subject to considerable growth in the use of collateral warranties, which are seen as taken for granted ‘safeguards’ in procurement arrangements. However, little attention has been focussed on assessing their true costs (Wordley, 1991) and effectiveness. Putting into consideration the fragmented nature of the construction industry, the predominance of outsourcing, and the way in which most construction projects are procured involving large numbers of project-participants (e.g. architects, consultants, contractors, sub-contractors, specialist suppliers), it is obvious that the number of collateral contracts that interested parties must obtain in order to protect themselves is enormous. Each of these collateral warranties requires careful drafting by lawyers, and each concerned party seeks involving its own lawyer in negotiating the content and extent of the warranty (Ibid.). Thereby, leading to substantial transactional costs and additional management time spent in co-ordinating the responses. It is also worth noting that when design consultants provide collateral warrantee, additional premiums are factored into their professional indemnity insurance to cover their extension of liability (Ibid.); thus increasing the overall cost of the insurance on any one project.

Additionally, there are serious concerns about the ability of the collateral warranty matrix to meet the interested parties’ objectives in seeking them (Wordley, 1991). First,

the assets backing the warranties are not guaranteed. If the contractor or subcontractor providing the warranty becomes insolvent, the value of the remedy gets destroyed. As for the designer consultant, the asset backing the collateral warranty is the consultant's professional indemnity insurance, which is annually renewed based on a claims-made basis. There are many events, at which professional indemnity insurance policies may fail to respond to submitted claims (Ibid.). This includes for example, "*exhaustion of the insured's policy limits during the year in which the claim under the warranty was notified due to the policy limits being applied to another claim, also notified during that period*" (Wordley, 1991, p. 237). This incident for example is outside the influence or control of the collateral warranty recipient, and indicates the difficulties inherent in relying on the consultant's professional indemnity insurance as an asset that backs collateral warrantees.

It therefore appears that the latent defect insurance (LDI) options may be a better alternative to collateral warranties. The LDI option provides compensation to the project-parties as a whole without reference to their contractual liabilities; and thus removes the need for any affected party to dispute the issue at fault and to assign blame with a resultant costly delay (Wordley, 1991).

8.4.3 The need for embedding trust in construction procurement

According to TCE, economic actors should seek to overcome the 'safeguarding problem' that arises during transactions by selecting an efficient governance structure (see Figure 8.4). Williamson (1985) developed a theoretical model for the choice of an optimal governance structure for six different types of transaction, depending on their asset specificity and frequency. In general, TCE researchers have conceptualized three general types of governance structure (i.e. market, hierarchies and hybrid/intermixed) which map into price, authority and trust respectively (Williamson, 1985). A comprehensive review by Rindfleisch and Heide (1997), which provided an integration and synthesis of 45 empirical TCA articles, found that the use of vertical integration as a means of safeguarding specific assets from possible opportunistic behaviour is broadly confirmed amongst researchers. However, it was also demonstrated in the reviewed

studies that firms can also protect their specific assets by deploying a variety of hybrid governance mechanisms, such as partnering, prequalifications, and the development of relational norms. Eriksson (2006) developed a TCE-based procurement model based on Williamson's (1985) optimal governance model (Figure 8.6) and argued that:

"According to Williamson (1985), the construction of plant facilities is a typical occasional transaction involving high asset specificity, i.e. a type five transaction. Overall, most construction projects are of that type. However, some projects are significantly less complex than constructing a plant, for example production of small houses with modular construction. Such projects may be categorized as transactions of type 3 or 4. For construction projects in general, the model prescribes medium emphasis on authority, medium to high trust, and low to medium emphasis on price" (Eriksson, 2006, pp. 10-11).

In Eriksson (2006)'s conceptual study, he suggested that TCE's three main governance mechanisms (i.e. price, authority and trust) are strongly linked to three different types of control (i.e. output, process and social control). This implies, according to Eriksson and Laan (2007) that clients can facilitate different levels of price, authority and trust in a transaction relationship through the selection and use of these different types of control. In other words, it is argued by them that clients' chosen procurement procedures and arrangements involve different types of control, which in turn affect the levels of price, authority, and/or trust embedded within a project. For instance, they suggested that bid evaluations which focus on tender price represent a price focus through 'output control'; while bid evaluations which focus on trust-based soft parameters represent a trust focus through 'social control'. It is however important to note that according to Tookey *et al.* (2001), in practice, clients do not adhere to rigid prescriptive procurement guidance and definitions, which regard construction procurement as a set of rationalistic decisions taking place within a closed environment (mechanistic-thinking approach); instead counterintuitive decisions are the norm, leading to the formation of hybrid structures.

		Asset specificity		
		Low	Medium	High
Frequency	Occasional	<i>Type 1</i> Emphasis on price: high trust: low authority: low	<i>Type 3</i> Emphasis on price: medium trust: medium authority: medium	<i>Type 5</i> Emphasis on authority: high/medium trust: medium/high price: low
	Recurrent	<i>Type 2</i> Emphasis on price: high trust: medium authority: low	<i>Type 4</i> Emphasis on trust: high price: medium authority: low	<i>Type 6</i> Hierarchical production

Figure 8.6: Eriksson's (2006) TCE-based procurement model for governance choice

8.4.4 A critical discussion upon the safeguarding problem in construction procurement

In construction, there seems to be two general approaches to selecting a procurement system. The first would focus on designing a project-organisation structure including a project operating system based on project needs and priorities, and then adapting a contractual arrangement that aligns the commercial interests of the project parties (e.g. Thomsen *et al.*, 2010) - a production oriented approach which aims to design and enhance flow processes (Koskela and Sharpe, 1994). The second is a risk based approach which is mainly concerned with overcoming transactional governance problems (see Fig. 1), and considers 'risk' to be the main criterion influencing procurement selection decisions. Advocators of this approach (e.g. Hibberd and Basden, 1996), cited in Love *et al.* (1998), suggest that contractual arrangements should be primarily conducted for risk allocation and mitigation purposes, in that way determining the type of the procurement method that would fulfil the client's objectives. Thus, a debate exists in literature upon whether procurement arrangements should be adapted to support production system requirements or tailored to transactional characteristics.

TCE has the objective of total cost minimisation (Winch, 1989; Walker and Wing, 1999). It aims to reduce both transaction and production costs (total costs). TCE,

however, recognises that making decisions about government structures encompasses a trade-off between transaction and production costs (Rindfleisch and Heide, 1997). A review of 45 empirical TC analysis articles, published from 1982 to 1996, revealed that discrepancy exists among scholars about deciding on whether transaction or production costs have a stronger impact on the choice of governance structures (Rindfleisch and Heide, 1997).

Two subsequent studies by Koskela and Ballard (2006, 2012), which aimed to criticise the underestimation of the idea of production in construction management and economic theories, claimed that TCE lacks a proper conceptualization of production and waste; and criticised Williamson's (1985) work due to its weak and biased justification against the optimality assumption. This implies, according to their argument, that no matter how efficient the chosen governance structure is, there is no optimal/perfect structure. Thus, the extent of non-optimality is waste that needs to be tackled through economising on production activities. Finally, they concluded by stressing that an *“economic organization should aim at minimisation of the sum of transaction and production costs, given that different kinds of transactions and productive activities are more efficiently governed by different modes of governance”* (Koskela and Ballard, 2012, p. 731).

In construction, there is no ready-made product to buy (Eriksson and Laan, 2007). Both the client and the project-supply-chain have to interact in order to create the final product. Hence, there are substantial trends towards collaborative ways of working as a means for improving project outcomes; it is therefore important to consider how construction clients and companies tend to protect (safeguard) their project-specific interests and assets, against perceived opportunism, during procurement procedures. Very little, if any studies, have sought to question the efficiency and effectiveness of safeguards crafted by contracting parties in construction procurement. This is an important question hence increased trustful collaboration between project parties is argued to be an appropriate remedy for many of the industry's challenges. Based on the inductive findings of this study, followed by a critical review of extant literature, this

study identified various safeguarding approaches (Table 6.2) and analysed their impacts on supply-chain performance and project outcomes (See Figures 8.3 and 8.7).

Table 8.2: A categorisation of safeguarding approaches in construction procurement, according to their underpinning theoretical perspective and level of prevalence

Conventional safeguarding approaches based on 'risk allocation' considerations	Less prevalent safeguarding approaches based on 'process flow' considerations
Standard forms of contract	Relational contracting
Use of Disclaimer/Exculpatory clauses	Shared risks and rewards
Traditional insurance arrangements/products	Single project insurance
Collateral warranties	Latent defects insurance

As critically discussed earlier, these 'risk averse' safeguarding approaches based on transactional considerations offer little incentive for cooperation to emerge; instead they entrench wasteful processes across the supply chain and throughout the project life cycle (e.g. opportunism, unnecessary premiums, claims and disputes). By tailoring procurement decisions to 'transactional' characteristics, clients (or focal companies) concentrate on formal risk allocation, through contractual arrangements, in an attempt to maximise their own profits; thereby neglecting the significance of maintaining and enhancing the flow of production processes, and overlooking the interdependency between project partners in their efforts to maximise value. For these reasons, this study stresses that procurement arrangements should be crafted to suit the chosen project delivery system and improve flow processes, rather than being tailored to transactional characteristics and dictated by the selected contract type.

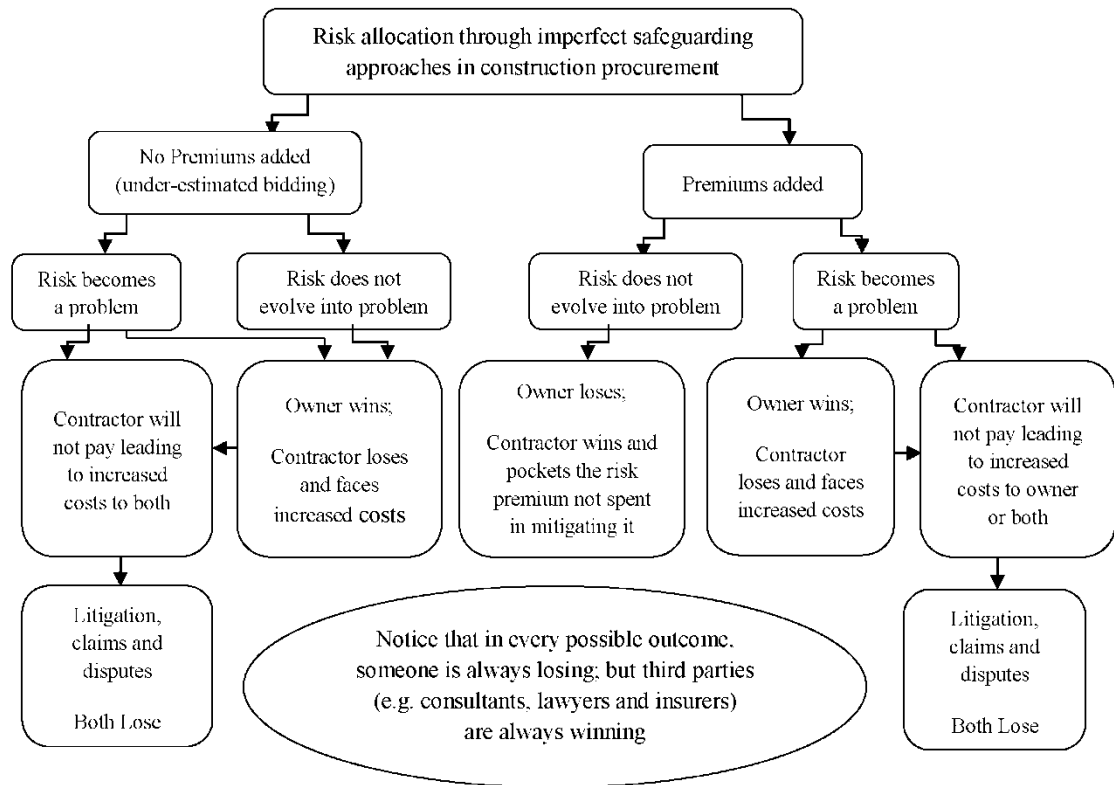


Figure 8.7: A simplified model of general potential impacts of the use of risk-averse safeguarding approaches on project performances and outcomes - Modified from Zaghloul and Hartman (2003)

8.5 The Complex and Dynamic Nature of Waste in Construction

It is important to stress that construction processes are non-linear, interrelated and take place within a dynamic environment that includes lots of variables. Thus, relationships between different kinds of waste are very complex (Formoso *et al.*, 2015). Figure 8.8 shows the interconnectedness and dependency nature between different causes of waste, which occur as a result of the use of prevailing inefficient procurement practices (Figure 8.2). This diagram was developed using NVivo matrix-coding query (in association with a careful data-verification of the resulting patterns) and sketched using Insights Maker (a web-based modelling tool) to reveal the complexity and interactive nature of waste existing at the procurement and supply-chain level. Indeed, it was found that this dynamic ‘causal network of wastes’ (Figure 8.8) leads to the consequential wastes identified by this study (see Figure 5.6 in Chapter 5).

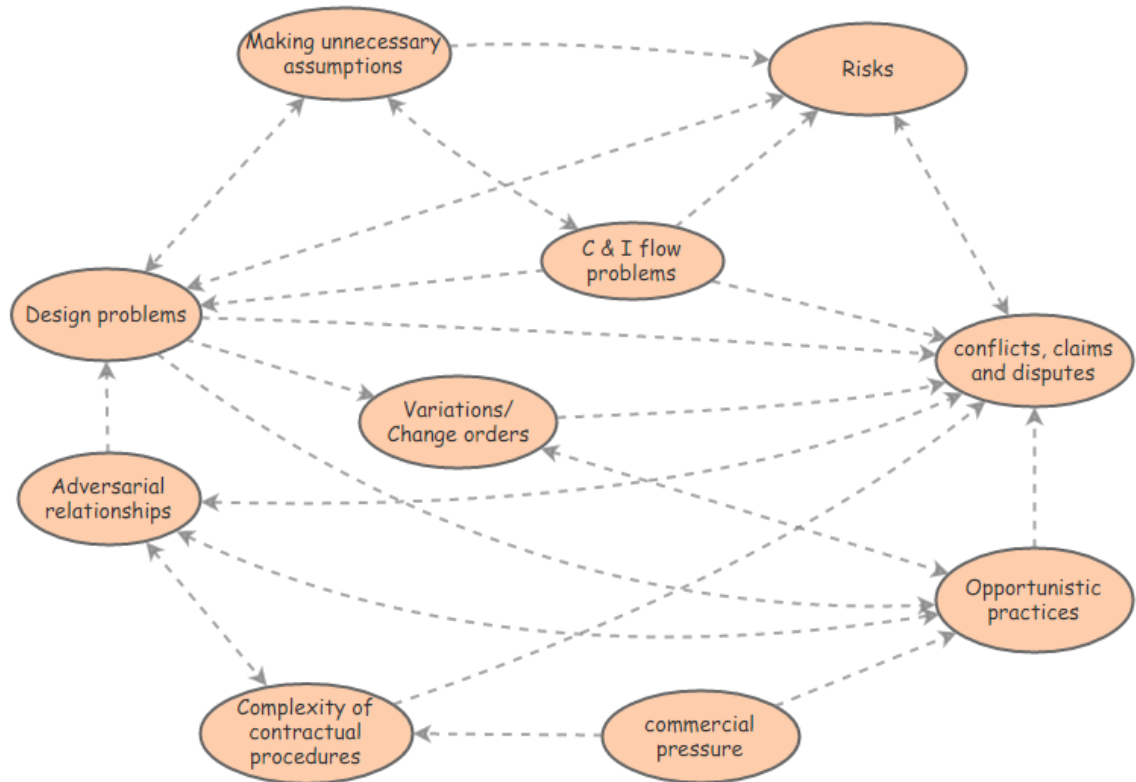


Figure 8.8: The dynamic and interactive nature of waste existing at the procurement and supply-chain level

This phenomenon is relatively similar to what Koskela *et al.* (2013) referred to as a ‘chain of wastes’, with one waste acting as a ‘core’ or ‘lead’ waste. In their study, ‘Making-do’, in particular, was argued by them to be a core waste in construction (at the production-level of analysis) with substantial negative impact on the production system. Subsequently, Formoso *et al.* (2015) suggested that by attacking this core, one can also eliminate the wastes caused by it. According to them, the causal connections between wastes are not necessarily uni-directional; they can also be reciprocal (A leads to B while at the same time B leads to A). Thus, devising operational strategies focusing on the reduction of the effects would still be useful, as it can help to generate a root-cause analysis leading to the core wastes in the system (for example, this could be achieved using LPS). They concluded their study by offering a preliminary causal analysis of waste generated on site, with a focus on the production (design and construction) stage. They also reflected on their reasoning approach as follows:

“Our line of reasoning has taken us from the conceptualization of a linear chain with clear causes and effects to a complex network with both uni-directional and interactive connections between the nodes. In such a complex network we may not be able to identify and analyse all the connections. We see a pattern, but are not able to decompose or decode the network in all its components and interconnections” (Formoso *et al.*, 2015, p. 457)

The conceptual model, which shows the causal networks of waste, developed in this study (Figure 8.8) is relatively consistent with the conceptualisations offered by Koskela *et al.* (2013) and Formoso *et al.* (2015). However, this study adds to their works by offering different perspectives and explanations; hence this study was based on a different level of analysis (i.e. institutional, procurement and supply-chain level) underpinned by various theoretical perspectives (see Figure 8.1), and approached using a reflexive grounded-theory methodology (see Chapter 3).

Given that construction procurement systems are formed of various procurement subsystems and options, leading to hybrid governance structures (see Figure 2.1 and Table 2.3 in Chapter 2); it is important to consider the influence of the interactions between the sub-systems on the output of the main procurement system (Kumaraswamy and Dissanayak, 1998). It is also critical to ensure the compatibility of the chosen procurement options from within each sub-system with the selected project delivery system, client and project needs, and other contextual conditions that bear on the project (Kumaraswamy and Dissanayak, 1998). For instance, it may be unsuitable to choose a cost-reimbursement pricing option for a traditionally procured project (Love *et al.*, 1998). Similarly, it would be inefficient to adapt a bid evaluation strategy based on lowest tender price for the selection of project team members of a partnering project (Eriksson *et al.*, 2008). Thus, it makes sense to emphasise that procurement arrangements should be crafted to support production system requirements and improve flow processes, rather than being based on cost and risk-averse considerations that may lead to sub-optimisation. The premise here is based on 'optimising the whole' rather than 'optimising the parts'.

This study has shown how inefficient construction procurement governance arrangements can lead to a complex ‘causal network of wastes’ at the procurement and supply-chain level, contributing to the generation of consequential wastes. Indeed, the study has, in particular, identified various prevailing procurement and contractual arrangements, which are taken-for-granted and impede efficiency and improvement efforts in construction (Figure 8.2). The study also exposed to clients and decision-makers some of the unnecessary waste they embed into their projects by adhering to these prevalent governance arrangements (for example, see Figures 8.3, 8.7 and 8.8 above, and also Figures 5.1 and 5.6 in Chapter 5). Thus, it makes sense to propose that if clients stopped adhering to these prevailing inefficient procurement practices, they could by this way eliminate or reduce the substantial negative impacts of these inefficient procurement arrangements on the production system; thereby enhancing process-flow, eliminating or reducing the consequential wastes, and minimising total project costs (transactional plus production costs).

That said, it is arguably more crucial to address the institutional factors and underlying fundamental paradigms, which influence construction procurement choices and lead to the persistence of waste in construction. In other words, it would be unwise to tackle procurement processes solely, without exploring the institutions and the context influencing the people involved in the construction procurement process. To say that waste is created due to human error is unhelpful; blame arguably fails to facilitate learning to ‘do better’ and similarly fails to lead us towards effective methods of reduction or prevention. Human behaviour is always influenced by the context in which it takes place (i.e. broader organisational system or institutional environment). Without a deep understanding of the institutional factors contributing to poor decision-making, it is very likely that similar flawed or risky decisions will recur.

Institutions influence beliefs, norms and actions; thus they shape performance and outcomes. According to institutionalists (for example see Dequesh, 2002; Phua, 2006), there are at least three types of influences that institutions have on behaviour (Dequesh, 2002, Phua, 2006): (1) constraints on behaviour (i.e. restrictive function), (2) influence

on perception or reception of reality (i.e. informational-cognitive function), (3) influence on end goals that people pursue (i.e. motivational or teleological function). The next section, therefore, provides a discussion on various institutional factors influencing construction procurement, as identified by this study, and explains how these prevailing institutions contribute to the entrenchment of waste in construction. It is argued that these institutional factors are the main reasons for the persistence and prevalence inefficient procurement practices in construction.

8.6 Causes of Prevalence and Entrenchment of the Current Construction Model

This study identified various inefficient procurement and governance practices that are common in construction projects (Figures 8.2 and 8.5), leading to frequent unsatisfactory performances and outcomes (See Figures 8.3, 8.7, 8.8, 5.1 and 5.6). This raises the question as to why these inefficient conventional procurement practices remain very prevalent, as opposed to newer and more collaborative forms of procurement that are deemed to be more beneficial and efficient. This is a valid fundamental question hence there are substantial trends towards establishing trustful collaborative ways of working between project parties, as a means for improving project performance and outcomes (see e.g. Eriksson *et al.*, 2008; Xue *et al.*, 2010; Sebastian, 2011; Walker *et al.*, 2017).

Previous studies, in main stream construction management or economics literature, have provided different explanations that helped to partially explain the reasons of coherence of prevailing approaches to construction project procurement. For example, Brensen and Haslam (1991) linked this to the "habituation" phenomenon that occurs as experienced clients establish a 'close-minded' approach to building, thereby merely utilizing those procurement procedures that are most familiar to them (Love *et al.*, 1998). This was also related to the fact that the construction industry operates in a very competitively cost-driven environment (Bresnen and Marshall, 2000). Subsequently, a study by Greenwood (2001) investigated whether relationships between main-contractor and subcontractors are improving following the Egan's report, by assessing contactors' compliance with the code of practice for the selection of subcontractors (CIB, 1997) and

the Housing, Grants, Construction and Regeneration Act (1996). Compellingly, it was found in Greenwood's study that the typical main contractor - subcontractor relationship is still traditional, cost-driven, and potentially confrontational. Evidence from their survey revealed that some main contractors were adopting sub-contractor partnering approaches but merely for mere-ceremony purposes (Meyer and Rowan, 1977); while the majority of the main-contractors were still utilising 'business as usual' approaches.

Furthermore, in a study by Eriksson *et al.* (2008), it was suggested that clients lack the incentives for the use of partnering due to inadequate awareness and understanding of how their procurement procedures influence their likelihoods of creating a cooperative environment. Other reasons found by them included lack of top management commitment and resistance to change. Interestingly, Phua (2006) attributed this to the lack of dominating industry norms that advocate the use of partnering (e.g. government policies and guidelines, technologies, beliefs and expectations).

Studies based on production management perspectives, particularly lean construction theories, have also provided useful insights. For instance, Koskela and Howell (2002) argued that traditional project management theories and methods are counterproductive and "create self-inflicted problems that seriously undermine performance" (p. 11). They criticised the theory of 'projects as transformation' and theory of 'management-as-planning', which underlie the theoretical foundation of traditional project management as advocated in the PMBOK Guide by PMI and widely applied in practice. The deficiency of these theories was exposed by comparing them to theories of 'TFV of production' and 'management-as organisation' that were systematically argued to be more empirically valid.

Furthermore, a literature review study by Bølviken and Koskela (2016) offered eight possible reasons as to why waste-reduction has not conquered construction, in comparison to other industries like manufacturing. Four out of their eight reasons could be seen as directly related to the relationship between construction procurement and waste in construction. The first is that traditional construction management is focussed on management of contracts rather than the management of production. This argument

aligns with this study’s inductive findings. The second relates to the fire-fighting culture and mentality to solving problems in the construction industry. This forms part of the current study’s explanations as to how ‘consequential wastes’ reinforce institutional factors, leading to vicious cycles of inefficient safeguarding practices. The third suggests that the prevalence of the task-centred view to construction, as opposed to the flow perspective, has effectively shifted attention away from waste. This explanation aligns with the study’s argument that construction procurement arrangements should be designed to support process-flow rather than being mainly based on transactional risk-averse considerations. The fourth is attributed to treating the construction project as a temporary organisation, which leads to a fragmented value-chain due to lack of long-term supply-chain relationships. This aligns with the study’s identification of ‘lack of continuous learning and improvement due to change of suppliers’ as an example of waste of human potential and/or value-loss. Overall, the empirical results of this study (See Chapter 4, 5 and 6) are relatively consistent with Bølviken and Koskela’s (2016) conceptual explanations mentioned above. However, this study supplements their work by providing empirical evidence to their arguments. Furthermore, this study adds to previous knowledge by exploring the ‘institutional’ factors influencing approaches to construction procurement (Figure 8.9). The findings of this study, as supported by the evaluations of various UK industry experts, revealed that these institutional factors combine to create the coherent, and yet wasteful, prevailing model for construction project delivery (See Chapters 6 and 7).

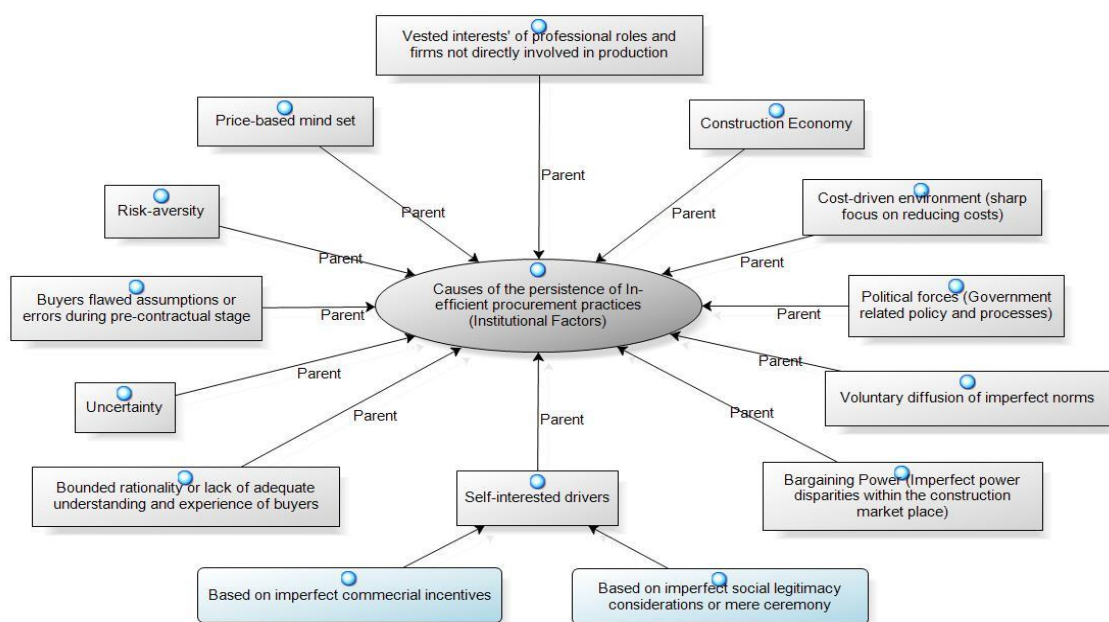


Figure 8.9: Institutional Sources of Waste in Construction

A number of theoretical perceptions exist in literature to predict and explain the reasons for the establishment, process and outcomes of several forms of institutional and organisational arrangements. Out of these, two principal theories are seen to provide profound conceptual insights: (1) Transaction cost economics (TCE) (see for example, Williamson, 1975, 1985, 2000; North, 1994); and (2) Neo-institutional theory of organisational studies (see for example, Meyer and Rowan, 1977; DiMaggio and Powell, 1983; Scott, 2005). Despite the distinctive differences underpinning each of these two perspectives, an overarching assumption common to both is that (social or economic) actors make rational, albeit bounded, and purposive decisions about the types of contractual and organisational arrangements, that they would form or join, depending on what they conceive to be most beneficial (Phua, 2006).

From an economic perspective, it is easy to understand why economic actors are more likely to conform to institutional forces, as this will be based on obvious cost and efficiency-based considerations; and also due to the prevailing “*norms that provide legitimacy to a set of rules*” (North, 1994, p. 366). However, the social perspective argues that the compliance with institutional processes is not necessarily based on efficiency considerations. Instead, conformance is principally based on social legitimacy drivers (Scott, 2012). The premise of institutional theory is that individual (i.e. persons) and collective (i.e. organisations) social actors are expected to comply with institutional forces imposed on them, because those that conform are rewarded through increased legitimacy, survival capability, social support, stability, access to resources, acceptance in professions, and expedience to avoid questioning (Oliver, 1991, Scott, 2005).

When the same institutional forces continue to exist over time, firms within relatively circumscribed fields that are bounded by shared understandings and mutual dependence (Scott, 2012) become more homogenous (DiMaggio and Powell, 1983); and thus a dominant organisational arrangement, or 'proto-institution' (Lawrence et al., 2002), is likely to occur (Phua, 2006). Thus, as a corollary, it is argued that the extent to which

actors are inclined to the use of prevalent procurement arrangements (e.g. traditional procurement systems), that are supposed to be inefficient in comparison to other more innovative and collaborative approaches, is a function of how deeply entrenched the institutional environment is with respect to rules, norms, beliefs and expectations that are associated with the concerned field and practices.

The findings of this study revealed that many construction buyers conform to prevalent (inefficient) procurement procedures, due to institutional pressure imposed on them. Furthermore, most of the clients, who procure construction projects, lack experience and may only ever build once or twice (Love *et al.*, 2010). Thus, they invariably rely on taking professional advice from consultants, financiers, and legal advisers. These actors who are relatively powered than other (Winch, 2000a), may have a vested interest (i.e. social and/or economic motivations) in the wide-spread use of specific procurement arrangements; thereby dictating the rules of the game - the way we do business. Furthermore, the findings of the study demonstrated that procurement arrangements are often shaped by institutional forces. These forces do not necessarily guarantee better value services (North, 1994); they are more likely to serve the interests of large industry players (e.g. Tier-1 contractors) with the bargaining power to create new rules. Thus, these institutions influence approaches to construction procurement. Consequently, as procurement (institutional) arrangements prevail, they influence and govern the way that project partners behave and interact, leading to common and repeated unsatisfactory performances (see Figures 8.3 and 8.8) and consequential wastes (see Figure 5.6).

Furthermore, it was found in this study that institutional factors and procurement arrangements can be reinforced by their own consequences (e.g. attempting to control outcome costs through excessive use of competitive price tendering, leading to claims planning. They are also reinforced by contingent events (e.g. the discovery of unexpected ground conditions leading to attempts to transfer risk). The study also explored the safeguarding problem in construction procurement, and revealed how conventional safeguarding governance and approaches can lead to irreconcilable and self-perpetuating cycles of waste. These safeguarding practices, although underpinned by the drive to reduce costs, often have the opposite effect causing parties to safeguard

their own financial position, leading to margin slippage, adversarial relationships, and costly and time consuming disputes.

This study also identified buyers' flawed assumptions or errors during pre-contractual stage (Figure 8.10), and argues that these fundamental paradigms (cultural-cognitive institutions) contribute to the apparent coherence, yet, wastefulness, of the current prevailing construction procurement and business models. For example, the findings of the study revealed that buyers' general focus on managing construction projects through contract-control rather than production-control, leads to what this study has conceptualised as inefficient 'historical clauses'. These historical clauses are formed over the years due to treating symptoms rather than getting to the root-causes, resulting in the poor functionality of contracts becoming more compounded. This phenomenon has been described by various participants of this study in different ways. For example:

"I will tell you having been an owner for 10 years, I ask those questions: why are we doing this? Because we always have...and in many cases it goes back to one instance when something did not go the way it was supposed to, and rather than addressing the root-cause to that problem, people ended up changing the procurement policy and contract in order to never have that problem again. So they did not really fix the problem. All they did is to put a bandage on it, and sooner or later you start to look like a 'mummy' from all the bandages as opposed to really trying to focus on how to address the root-cause of the problem" (President of a consultancy company, November 2015, Interview).

Similarly, a senior consultant and fellow member of the Institution of Civil Engineers (FICE) asserted the following:

"Specific clauses grow up within organisations as a history of things which have happened to organisations. So, it's a history of things that have gone wrong that the client then seeks to address by amending a contract in a particular way; and so it becomes a history. I guess the danger at it is that sometimes the reasons that something has gone wrong are not always fully addressed. And therefore,

the client ends up introducing an inappropriate contract solution for the problem. (Senior Consultant (FICE), Oct 2015)

Based on the arguments above, it becomes clear that buyers' habit of adding or amending contractual clauses to avoid problems from happening again, without fully addressing the root-causes or considering the suitability of the amended clauses in a different context, often complicates the problem rather than solves it; thereby, leading to vicious cycles of waste. There are various other reasons for how and why the industry fails to take appropriate measures to ameliorate the reinforcement loops of waste (as shown in Figure 4.1). For instance, the construction industry is generally renowned for its blame culture (Egan, 1998) and fire-fighting mentality to problem-solving (Bølviken and Koskela, 2016); these factors inhibit the industry's capacity for improvement. In addition, there tends to be less opportunities for learning from project outcomes, due to the one-off nature of many construction projects and the short-term focus characterising many construction clients and decision-makers. Adding to this, the construction industry, as an organisational field (DiMaggio and Powell, 1983), is particularly characterised by its high levels of complexity and industry specific uncertainties and interdependences (Dubois and Gadde, 2002). These contextual factors force many construction buyers and organisations to adhere to prevailing procurement practices and ways of working, imitate each other, and to strictly follow advice from consulting firms and professional institutions.

Furthermore, the construction industry is generally characterised by a lack of a learning curve (Carrillo *et al.*, 2012; Hartmann and Dorée, 2013), where existing values and beliefs are not open for questioning; and this constitutes a general barrier to change, improvement and innovation (Kululange *et al.*, 1999). These arguments have been validated by five industry experts, who were invited to evaluate the main findings of this study (see Chapter 7, for a fuller review); so for example:

"I'd largely agree with it on the basis that the response to manifest waste is often institutionalized by the personal agendas of actors within it attempting to preserve or promote their own careers. I believe institutional tolerance of

personal failure in the construction industry tends to be low rather than learning. So, the response tends to be to apportion blame, dispense with the opportunity to learn from accumulated experience, introduce a ‘hero’ with a new approach – repeat” (Senior Consultant (FICE), Oct 2015)

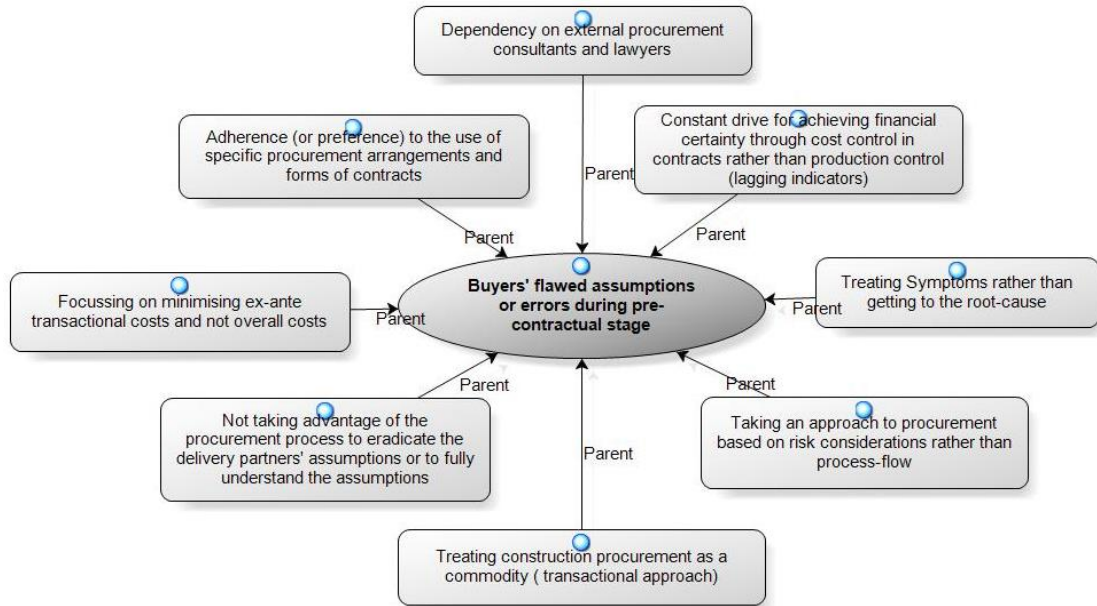


Figure 8.10: Construction buyers’ flawed assumptions or errors during pre-contractual stage

Accordingly, it has been shown in this study that the current institutional factors surrounding construction procurement context lead to more social legitimacy and/or use of risk-averse safeguarding approaches in procurement, which deter attention away from core-efficiency purposes (i.e. production); thereby restricting value creation and possibly decreasing revenues for all project parties. When the same or similar institutional pressures continue over time, isomorphism (DiMaggio and Powell, 1983) leads to (inefficient) construction procurement arrangements becoming more homogeneous, and as a result, standardised patterns of (wasteful) behaviours, performances and consequential wastes occur. Consequently, as construction buyers remain to react defensively on the basis of personal or organizational self-interest, or continue in taking inappropriate measures to problem-solving due to their flawed assumptions or because of resource constraints that limit ideal response modes, the reinforcement loops increase leading to the ‘institutionalisation of waste’ in

construction. These findings and explanations are relatively consistent with arguments made by Winch (2000a) who stressed, albeit through a relatively limited economic basis that lacked empirical evidence:

"Just as patterns of behaviour become institutionalized so that they act back upon the actors through the process of structuration (Giddens, 1984), the rules of the game come to be seen as given, normal, the only way to do things. Careers and status become dependent upon certain rules; threats to those rules become personal attacks". (p. 90)

8.7 A Reflection on Thomas Kuhn's Conceptual Model of 'Paradigm Shift'

Thomas Kuhn is an American physicist who wrote extensively on the nature and history of science. One of his major contributions to knowledge is introducing the conceptual model of 'Paradigm Shift', which presented a radical view of the philosophy behind science. In his influential book *The Structure of Scientific Revolutions* (Kuhn, 1962), he argued that science undergoes periodic paradigm changes, as opposed to progressing in a linear, continuous and snow-balling way. In the book's second edition, Thomas Kuhn (1970) used and defined the term 'paradigm' in two main, but different, senses. In one sense, he stated that 'paradigm' stands for "*the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community*" (Kuhn, 1970, p. 175). In another sense, it was defined by him as "*the concrete puzzle-solutions which, employed as models or examples, can replace explicit rules as a basis for the solution of the remaining puzzles of normal science*" (Kuhn, 1970, p. 175). His work illustrated how all scientific fields go through the same basic cycle of 'paradigm shift' (Fig. 8.11).

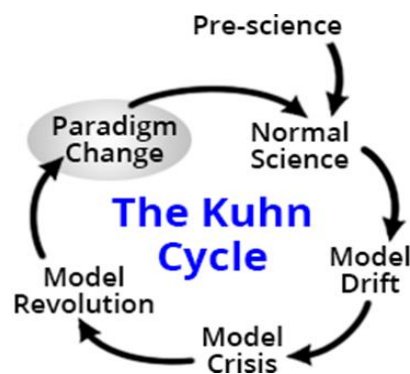


Figure 8.11: An illustration of Thomas Kuhn's cycle of 'Paradigm Shift' (Adopted from Thwink, 2014)

According to Kuhn's cycle of paradigm shift, any scientific field begins in 'Pre-science', where scientists and researchers have a problem area of interest but are unable to solve it or make much progress. Once they manage to establish a guiding model of understanding (i.e. Field's Paradigm) that works for them, they advance to 'Normal Science' stage, where they remain most of the time except when their paradigm undergoes a cycle of paradigm shift.

'Model drift' is caused by anomalies, which is described by Thomas Kuhn as unexpected discovery of problems that a prevailing paradigm cannot solve or explain. Typically a paradigm, in the same way as a theory matures, can be modified to accommodate anomalies; however, if too many fundamental anomalies build-up, then an advancement to the next stage of 'Model Crisis' takes place. At this step of the cycle, the scientific field's efforts and attentions are best spent constructing a new model that works. However, Thomas Kuhn argued that the route to recognising that a prevailing paradigm model is in crisis, and acting upon it, is not direct and is usually delayed due to the following reasons:

In science...novelty emerges only with difficulty, manifested by resistance, against a background provided by expectation. Initially, only the anticipated and usual are experienced even under circumstances where anomaly is later to be observed" (Kuhn, 1970, p. 64)

Thomas Kuhn, deliberately, used the term 'shared paradigms' rather than 'shared rules and assumptions', when attempting to explain the main cause of coherence for normal research traditions. One of the main reasons for giving paradigms a status prior to that of shared rules and assumptions, as suggested by him is that "*rules...derive from paradigms, but paradigms can guide research even in the absence of rule*" (Kuhn, 1970, p. 42). This conceptualisation of 'shared paradigms' in normal science suggests that a (flawed) research paradigm may prevail and persist for a long time, even if its central theories can no longer explain discovered anomalies. This prevalence can occur as shared paradigms become taken-for-granted, thereby making it difficult for researchers to pursue problems beyond the initial layer of observations. It could

possibly also prevail because of internal change resistance (Kuhn, 1970) and vested interests of key scholars in the field, as asserted by Bolton (2005, p. 21) as follows:

“Ironically leading scientists in the field may be the least likely to recognise anomaly or to accept a new paradigm because they are entrenched in the accepted paradigm. This is due at least in part to their substantial role in creating and governing the major institutions of the contemporary normal science establishment”.

Subsequently, the ‘Model Revolution’ stage of Kuhn’s cycle occurs once one or more competing new theories or paradigm models emerge and find their way out of the crisis. This stage is revolutionary in nature, as it requires changes to core assumptions, habits and values; it is thus frequently seen as threatening to the roles and norms of participants in the field. The transition from a paradigm in crisis to a revolutionary model, however, requires radical system-wide change rather than improving the pieces as per incremental change. This argument is supported by Kuhn (1970, pp. 84-85), who stressed that:

The transition from a paradigm in crisis to a new one from which a new tradition of normal science can emerge is far from a cumulative process, one achieved by an articulation or extension of the old paradigm. Rather it is a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field’s most elementary theoretical generalizations as well as many of its paradigm methods and applications...When the transition is complete, the profession will have changed its view of the field, its methods, and its goals”

The ‘Model Change’ stage then becomes complete when the new paradigm becomes the generally accepted and prevailing guide in the field, progressing to the ‘Normal Science’ stage where the cycle starts again. It is important here, however, to clarify that continuity in a paradigm (a prolonged normal science stage) is not necessarily a bad thing, as it enables researchers to share a common understanding and to organise, modify and refine the vast amount of knowledge that grows through the cumulative process of scientific inquiry. The danger, however, is when the prevailing paradigm

becomes so embedded to an extent that any new way of thinking becomes seen as incomprehensible and/or unacceptable, and thus resisted or completely rejected.

Having provided an overview of Kuhn's cycle of 'Paradigm Shift', it can be argued that Kuhn's Cycle is not only limited to the field of science; instead it can be applicable to any research field or group of professionals using a shared model of understanding to solve their problems. It also seems that Kuhn's concept of 'paradigms' as the source of coherence for normal science and research traditions, resembles with and supports the study's developed concept of 'institutional waste', particularly, the institutional factors identified within this study as causes for the coherence, and yet wastefulness, of the current prevailing construction model (see section 8.6). By referring to this study's conceptual model (Figure 4.1) and main findings, it is suggested that the construction industry, as an organisational field, is currently going through a stage that kind of sits in-between the 'Model Crisis' and 'Model Revolution' steps of Kuhn's cycle. At this stage, as demonstrated in this study, the prevailing current construction model has become so embedded and so entrenched, despite being so wasteful. Further, as found in this study, prevailing approaches to problem-solving (e.g. through conventional safeguarding approaches to construction procurement) appear to complicate problems rather than solve them, leading to vicious cycles of waste (see section 8.4 above).

Based on the findings of this study, it is proposed that there is a crucial need for scholars, practitioners and decision-makers within the construction industry to recognise and act upon the prevailing 'institutional sources of waste' identified in this study, with a primary focus on the underlying 'paradigms' or 'cultural-cognitive institutions' (e.g. construction buyers' flawed assumptions or errors during pre-contractual stage). Further, it is suggested that the construction industry might advance to 'Model Change' once alternative ways of looking at the world (e.g. via the lens of the TFV theory of production) become more generally accepted and prevalent than the current prevailing puzzle-solving approaches based on theories of construction economics that are inherently flawed (see Koskela and Ballard 2006 and 2012; Koskela, 2018).

8.8 Implications and Future Research

This study explored the role played by institutional forces within the construction procurement context in embedding process waste in construction projects (see Fig 6.3). The findings of the study demonstrated that construction procurement arrangements are shaped by institutional structures, beliefs and attitudes as well as project characteristics. In particular, the study identified various prevailing inefficient procurement practices, and found that they often mirror institutional factors. These inefficient procurement practices lead to the generation of dynamic ‘causal networks of waste’ (Figure 8.8), which contribute to consequential wastes in terms of financial losses or cost overruns, time waste, quality loss or value-loss in design, and/or waste of human potential throughout the production stage (design and delivery of design) of construction projects.

The complex, interactive and reciprocal nature of waste, revealed by this study, is relatively consistent with the conceptualisations of ‘waste in construction’ offered Koskela *et al.* (2013), Formoso *et al.* (2015), and Bølviken and Koskela (2016). However, this study contributes to knowledge in two different ways. First, this study supplements aforementioned studies by investigating the nature of waste within the institutional, procurement and commercial environments surrounding the design and delivery of construction projects. Thus, the study investigated waste at a different level that is underexplored. Secondly, this study provides a novel perspective to the generation and persistence of waste in construction. As stressed by an industry expert with more than thirty years of industry experience:

“Exploring the factors that influence waste at an institutional level looks at the industrial and social contexts that lead to waste as opposed to trying to ‘fix waste’ at a task level. The industrial and social contexts in which projects are conceived, promoted, procured and delivered has a far greater bearing on efficiency outcomes than task efficiency itself – which is after all only acted out in whatever context construct has prevailed” (Senior Consultant and Fellow Member of the Institution of Civil Engineers, 26th March 2017).

At a production level, it has been argued by aforesaid studies that by attacking the core wastes, one can also eliminate the wastes caused by it. There can also be good reasons to focus on the resulting waste, as focusing on the reduction of the effect can help to trigger a root cause analysis leading to the core wastes in the system. As a corollary, the findings of this study suggest that research and industry efforts should be focussed on addressing the institutional factors and underlying paradigms influencing approaches to construction procurement, as root-causes of problems. Clients and buyers in general would also benefit from ‘not’ adhering to the prevailing inefficient procurement practices identified by this study; as by eliminating these practices they could also eliminate the resulting complex network of ‘causal wastes’, which lead to substantial negative impacts on production.

Remarkably, there has not yet been a commonly agreed list of ‘core waste’ for production in construction. However this study managed to identify various regulative, normative and cultural-cognitive institutional factors that contribute to the generation and persistence of waste in construction. There have been efforts investigating the impact of regulative institutions (e.g. government, political, and market related factors) on construction projects (see for example, Winch, 2000; Wijewardana, 2013; Vadali, 2015). However, less attention has been given to normative and cultural-cognitive systems, which are vital forces (Scott, 2012) affecting the success of construction projects. As emphasised by an industry expert who participated in evaluating the findings of this study:

“Your use of the phrase imperfect normative and cultural-cognitive institutions is relevant, as poor practice has been normalised and embedded in the industry with little real criticism and research into how these norms can be challenged”
(Senior Project/Contracts Manager, 20th March 2017, Evaluation Exercise).

This study identified buyers’ flawed assumptions or errors during pre-contractual stages of construction, as a cultural-cognitive institution influencing construction practice and leading to the persistence of waste in construction. It is therefore stressed in this study that without addressing these fundamental paradigms, wasteful procurement systems are

more likely to prevail, persist and even deteriorate. It has been suggested by a research expert that these findings could form the “*basis of a useful check-list of do's and don'ts for procurers*”. The author agrees that using these findings as a *list of don'ts* for procurers’ could help to solve many of the industry’s institutionalised problems, but at same time, the author believes that a prescriptive *list of do's* would require further research and considerations. As stated by Sutton and Staw (1995) in their study of ‘what theory is not’, the author of this study also stresses that “*the problem is more complex and the solutions [are] complicated* (p. 383, word in bracket added by author).

The study, also, exposed the safeguarding problem in construction procurement as a cause of waste, hitherto unacknowledged, leading to irreconcilable and self-perpetuating cycles of waste. In particular, the study demonstrated how conventional safeguarding processes adopted by construction clients as part of their approach to procurement often complicate the problem rather than solve it. Furthermore, the study revealed the usefulness of using principles of Lean Construction (LC) in association with TCE when analysing and deciding on appropriate construction-procurement governance arrangements. More specifically, the study demonstrated how that when viewing these transactional-based safeguarding approaches through a "lean" lens, it can be observed that they are wasteful and/or create waste. These findings enabled the study to develop categorisation of various safeguarding approaches within construction procurement according to their underpinning theoretical perspective and level of prevalence (see Table 8.2). This categorisation could be useful in helping procurers and decision-makers to consider alternative procurement arrangements and organisational techniques that could be of value and support collaborative ways of working.

There have been moves within the construction industry towards more collaborative procurement and project delivery approaches; however a replicable recipe for aligning interests and keeping good intentions in place is still missing. This study has shed empirical light up on various professional roles and firms that could have a vested interest in the wide-spread use of inefficient construction procurement arrangements and options. These include lawyers, QSs, accountants, procurement consultants, tier-1

contractors, and concept architects (see section 6.2.11 in Chapter 6 to view the full list). Typically those professionals do not take a central stake in the project outcome, only a stake in the process by which the project is delivered. In other words, none of those professionals is directly involved in production (design and construction). Thus, it is suggested in this study that there is a crucial need to assess the varying cultures, beliefs, structures, systems and behaviours of the identified professions and the environments in which they operate.

Such an evaluation, however, needs to draw upon theory from disciplines outside both construction and manufacturing such as economics, law and sociology, in order to unfold the existing deeply-rooted normative and cultural-cognitive institutions leading to the coherence and yet wastefulness of the current approaches to construction projects. The underlying premise is that by understanding the detailed causes of the apparent coherence for the prevailing mind-sets and construction models and revealing the consequential waste, then the adoption of more efficient and collaborative business and project delivery models may become more effective and widespread. Figure 8.12 below provides a proposed guide map of how and where future studies should start. This approach resonates with Matos-Castano's (2014) assertion that providing an enabling environment for newer and more collaborative construction business and procurement models entails a combination of changing existing institutions influencing project procurement and creating supporting institutions that build trustful collaboration between and among stakeholders.

Where do we start?

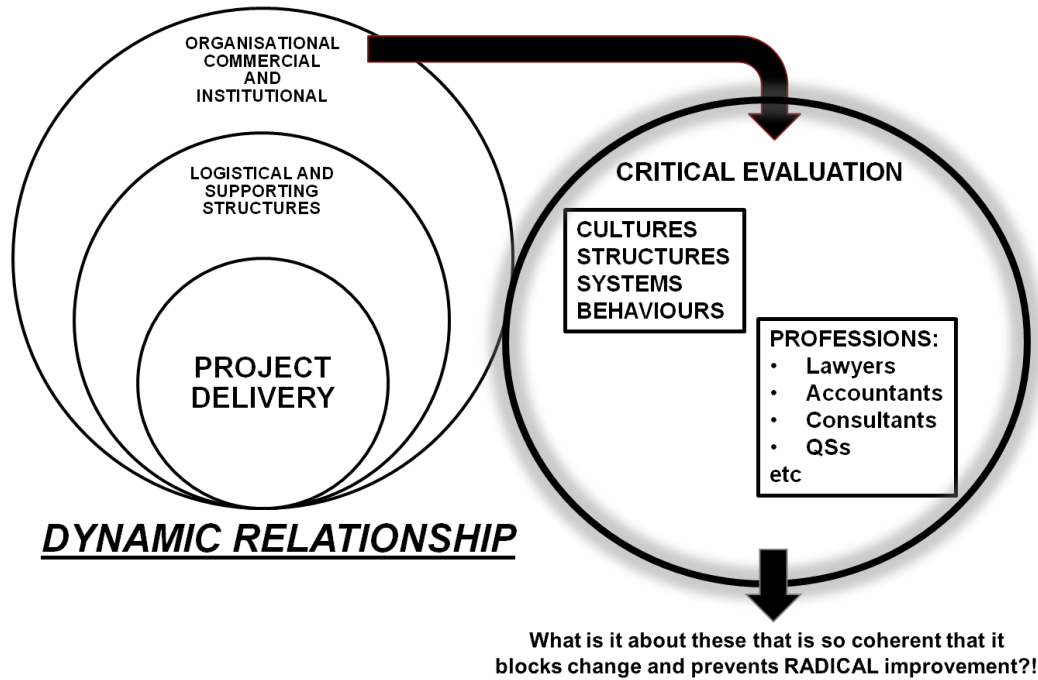


Figure 8.12: Proposed guide map for future studies

8.9 Summary

This chapter provided a detailed discussion of the main findings and developed conceptual model and the implications of this study on theory and practice. The next chapter presents a conclusion to the research and a final reflection on the overall research processes.

CHAPTER NINE: CONCLUSION AND RECOMMENDATIONS

9.1 Introduction

This chapter presents conclusions and recommendations of the study of institutional waste within the construction industry. The chapter commences by providing a summary of how research objectives were achieved. This is followed by a summary of the main findings of the study. The main conclusions of the study are then presented before discussing the study's contributions to knowledge. Finally, a reflection of the study's limitations is provided and consequently recommendations for future research are discussed.

9.2 Achievement of Research Objectives

The construction industry is often criticised for being wasteful, confrontational, and for lacking trust and capacity for learning and improvement. Numerous industry reports have been commissioned by the UK Government and various industry organisations, with the aim of calling for industry-wide change and improvement. A wide range of different solutions have been recommended in these reports including the use of partnering arrangements, project bank accounts, new models of construction procurement, and Building Information Modelling (BIM). However, despite the many criticisms and the different solutions promulgated by industry reports and academic studies, the construction industry persistently resists the radical change demanded of it. There seems to be a particular project delivery mind set embedded in the organisational fabric of the industry that prevails regardless of the attempts to address the recognised inadequacies. These issues led to the development of an overarching research question as to why the prevailing construction model is so embedded and so entrenched, despite the substantial attempts to address its recognised inadequacies.

Eliminating (process and physical) waste from construction design and delivery, as advocated by lean ideals, is a necessary step towards achieving efficiency improvements. However, waste-reduction understood simply as the improvement of current processes, rather than fundamental system redesign, is insufficient. Obtaining a

wider understanding and conceptualisation of waste in construction is crucial, in order to prepare the industry for the radical demanded of it. The main aim of this study, therefore, was to develop a conceptual model of ‘institutional waste’ in construction, by exploring the institutional, procurement, and commercial environments surrounding the design and delivery of construction projects in the UK. The underlying premise is that if we can understand the detailed causes of prevalence and entrenchment for the current construction model and reveal the consequential wastes, then the adoption of more efficient and collaborative business and project delivery models may become more effective and widespread. Accordingly, five main research objectives were formulated and achieved through the application of a rigorous research methodology presented in Chapter Three. Table 9.1 presents a summary of how each research objectives was achieved and where it has been discussed. The conclusions on each research objective are subsequently discussed.

Table 9.1: A summary of how research objectives were achieved

ID	Research Objective	Method of achievement	Discussed in:
R1	To critically review the current understanding of the concept of ‘waste’ in construction	A contextual review of literature on waste in construction	Chapter Two
R2	To conceptually analyse theories from other disciplines outside both construction and manufacturing (e.g. social science and economics), which can help to predict or explain the reasons for the establishment, process and outcomes of several forms of institutional and organisational arrangements	A contextual review of theories of TCE (including NIE and Agency Theory) and Neo-Institutional theory of organisational studies. The findings of R1 and R2 led to the development of a preliminary conceptual model and six guiding propositions.	Chapter Two
R3	To investigate the relationship between construction procurement and waste in construction	In-depth and iterative semi-structured interviews with 24 senior professionals within the UK construction industry, using a reflexive grounded theory methodology. This included a review of supplementary documents offered by the interviewees to provide evidence or better explanations to their claims and arguments raised during interviews. In addition, the findings and emerging concepts were constantly compared with extant literature on construction procurement.	Chapters Four, Five, Six, Seven, and Eight
R4	To explore the factors (root-causes) leading to the persistence of inefficient procurement practices in construction		

R5	To develop and evaluate a conceptual model that contributes to the overall understanding of waste in construction	The conceptual model of ‘institutional waste’ within the construction industry was developed based on the analysis and findings of the collected data. The developed model was then evaluated on two stages. First, through a preliminary unstructured interview with a distinguished Professor. Then, through an evaluation exercise that was conducted with five industry experts	Chapters Four, Five, Six, Seven, and Eight
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9.2.1 A review of the concept of waste in construction (R1)

The first objective was to explore the current understanding of the concept of ‘waste’ in construction, in order to seek explanations for the persistence of waste in construction, and also to present the study within contemporary academic discourse. In order to achieve this objective, the study reviewed waste-related studies in lean construction and main-stream construction management and economics literature. This objective was achieved and discussed in chapter two. An overall analysis of the concept of waste as understood in construction revealed that: (1) research efforts aimed at understanding the concept of ‘waste’ are relatively limited when compared to other topics in construction, considering its relevance and significance to the field of construction management; (2) most academic and industry efforts are directed towards finding means for reducing construction material waste (physical waste); other important issues such as time waste and value creation are much less explicitly explored; (3) a small but growing number of studies have attempted to investigate the influence of procurement processes on the generation of waste in construction projects; however, most of these studies, if not all, have limited their attention to physical (material) waste as opposed to process waste and value creation or loss; (4) the prevailing understanding of waste, arguably, encourages the improvement of current processes rather than fundamental system redesign; (5) the concept of institutions is not well established in construction management and economics research in general, and in waste-related literature in specific; and (6) very limited, if any, waste-related studies have devoted attention to exploring performance-shaping mechanisms (i.e. systems and structural arrangements), as well as the institutional context in which human actions and decisions are constituted. Based on these findings, it was concluded that there is a crucial need for obtaining a wider

understanding and conceptualisation of waste in construction, and developing construction-specific lists of wastes that are relevant and motivating for action. These conclusions align with the aforementioned aim of this study.

9.2.2 A conceptual analysis of theoretical explanations and predictions in relation to the establishment, process and outcomes of institutional and organisational arrangements (R2)

The second objective was to seek theoretical insights that could have the potential to explain or predict the reasons for the formation, process and outcomes of several forms of institutional (construction procurement) arrangements, and to be used for critically evaluating the behaviours and actions of the different professions and organisations involved within the construction procurement context. This objective was achieved and discussed in chapter two. Two principal theories were seen to provide profound conceptual insights: Transaction Cost Economics (TCE) and Neo-institutional theory of organisational sociology. The main outcomes of this analysis are (1) developing a basic conceptualisation of construction procurement governance problems and solutions; and (2) demonstrating how neo-institutional theory has the potential to be used as an analytical lens to deliver a more explicit theory of waste relating cause and effect within the wider aspects of construction procurement systems and relationships. These processes and outcomes enabled the study to outline the concept of ‘institutional waste’ in construction, and develop a preliminary conceptual model that comprises of six guiding propositions. This preliminary model was useful in terms of guiding the research effort during the collection of primary data.

9.2.3 An investigation of the relationship between construction procurement and waste in construction (R3)

The third objective was developed in order to address an existing gap in knowledge (see section 1.2). To achieve this objective, in-depth and iterative semi-structured interviews were conducted with 24 senior professionals within the UK construction industry. This included a review of supplementary data provided by the interviewees. In addition, the findings and emerging themes and relationships were constantly compared with extant literature on construction procurement. This resulted in a review of in-depth critical

review of 76 construction procurement and contractual related articles, ranging from 1994 to 2016. Furthermore, the findings were subject to an evaluation exercise with various industry experts who were invited to comment on the quality of the findings (See Chapter 7). This objective was achieved and discussed in chapters four, five, six, seven and eight. In summary, this study found that construction procurement arrangements influence project-team performances and behaviours, and thus impact on project outcomes. In particular, the study identified a number of construction procurement practices, which are taken-for-granted and impede efficiency and improvement efforts in construction (see section 9.3 below for a list of these practices). These prevailing procurement practices were identified by the participants of this study as major ‘causes of waste and inefficiencies’ in construction projects. Interestingly, it was also found that these procurement practices lead to dynamic a causal ‘network of process wastes’ (see Figure 8.2 in Chapter 8), which in turn contribute to the consequential wastes conceptualised by this study (financial losses and cost overruns; time waste; quality-loss; and waste of human potential)..

9.2.4 An exploration of the (institutional) factors contributing to the prevalence and persistence of inefficient procurement practices in construction (R4)

The fourth objective was to seek novel explanations as to why inefficient procurement practices prevail and persist. This objective was achieved using the same research procedures used for achieving the preceding objective (i.e. iterative interviews, review of supplementary empirical data provided by interviewees, comparing findings with extant literature on procurement, root-causes of waste in construction, and behavioural explanations, followed by an evaluation exercise with a small sample of industry experts). Discussions up on the achievements of this objective are presented in chapters four, five, six, seven and eight. In summary, the study identified various institutional factors (see section 7.3 below for a list of these factors), which influence construction project procurement practices and outcomes. These institutional factors combine to create the current prevailing model for construction project procurement and delivery, and their identification will, arguably, help the development of more efficient and effective business and project delivery models.

9.2.5 Developing and evaluating a conceptual model that contributes to the overall understanding of waste in construction (R5)

The fifth objective of the study was to develop and evaluate a theory or a conceptual model that can contribute to the overall understanding of waste in construction. The study achieved this objective by developing a conceptual model of ‘institutional waste within the construction industry’ that is grounded in the data collected for this study (See Chapters 4, 5, 6 and 7). The developed conceptual model provides novel insights as to why the current (wasteful) construction model is so prevalent and embedded. The model also provides novel explanations to the generation and persistence of waste in construction projects. An evaluation-exercise was conducted with a sample of industry experts to assess the quality and rigour (i.e. credibility, originality, resonance, and usefulness) of the developed model and main findings of the study. The results of this assessment demonstrated that the study’s developed conceptual model has met the aforementioned quality criteria (See Chapter 7).

9.3 Summary of Main Findings

The main findings of the study could be summarised as follows:

- Construction procurement arrangements often mirror institutional forces. The study identified various institutional factors that lead to the prevalence and persistence of inefficient procurement practices in construction. These are as follows: (1) Bargaining power (power disparities within the construction market place); (2) Bounded rationality or lack of adequate understanding and experience of clients; (3) Buyers’ flawed assumptions or errors during pre-contractual stage; (4) Construction economy; (5) Cost-driven environment (sharp focus on reducing costs); (6) Political forces (Government-related policy and processes); (7) Price-based mind set of procurers; (8) Risk-aversity; (9) Self-interest (based on social legitimacy or commercial drivers); (10) Uncertainty (behavioural, transactional, and budget and funding uncertainties); (11) Vested interests of professional roles and firms not directly involved in production; and (12) Voluntary diffusion of imperfect norms. These twelve institutional factors combine to create the apparent coherence, yet

wastefulness, of the current prevailing model for construction procurement and project delivery.

- Inefficient procurement practices that prevail in the construction industry include: (1) Complexity of contractual procedures and mechanisms; (2) Exclusion or late involvement of key actors during pre-construction stages; (3) Lowest price selection criteria; (4) Non-joint specifications of design; (5) Non-value adding performance monitoring and reporting arrangements; (6) Onerous pre-selection of suppliers; (7) Poor payment terms and arrangements; (8) (Price-based) Tendering as an expensive non-value adding activity; (9) Safeguarding practices in construction procurement; (10) Separated procurement methods (Separating design from construction); and (11) Sub-optimisation (optimising the parts rather than the whole).
- Clients and decision makers often tend to safeguard their project-specific assets, against opportunism and exploitation, through the deployment of formal contractual arrangements and governance structures. These arrangements and structures typically dominate the management of the project delivery often to the detriment of the project itself; but because there is a belief that interests are safeguarded, clients and decision makers feel they have taken the best course of action.
- Safeguarding approaches commonly used in the construction industry include the use of: standard forms of contracts in the absence of strong relational norms; disclaimer, exculpatory and privileged clauses of contract; traditional (multiple) insurance arrangements; performance bonds; collateral warranties; overly prescribed design specifications as opposed to performance specifications; and aggressive price-negotiations based on direct contact with tier 2 suppliers. These safeguarding approaches to construction procurement, based on transactional and risk-averse considerations, lead to irreconcilable and self-perpetuating cycles of waste in construction projects.
- Construction procurement practices influence the way that project-parties behave and perform throughout the project. This study, therefore, identified the impacts of

the use of inefficient procurement practices on project-team performances and behaviours, as follows: (1) Adversarial relationship problems; (2) Conflicts; (3) Claims and disputes; (4) Increased commercial pressure; (5) Communication and information-flow problems; (6) Design issues and problems; (7) Increased risks or failure to mitigate risks at early stages; (8) Making unnecessary assumptions; (9) Opportunistic practices; and (10) Variations and change events/orders.

- Construction procurement practices could lead to or support inefficient performances and behaviours, which in turn lead to consequential wastes. Four broad classifications of waste emerged out of this study: (1) Financial losses and cost overruns (Cost waste); (2) Time waste; (3) Quality loss (and Value loss in design); and (4) Waste of human potential.
- Poor project outcomes due to consequential wastes may re-inforce institutional factors (e.g. self-interest and risk-aversity); thus encourage clients to adopt inefficient safeguarding procurement practices, which in-turn lead to vicious cycles of wasteful behaviours and practices.
- ‘Institutions’ can be imperfect, and even deteriorate, due to increasing and changing societal demands and values over time (Godard; 2011; and Ackers, 2014), inability of the industry to learn from project failures (e.g. due to blame culture, fire-fighting mentality, treating symptoms rather than root-causes, vested interests, self-interest, uncertainty, risk-aversity, and buyers’ flawed assumptions and approaches to project delivery), or due to the fact that formal rules are often created to serve the interests of those with the bargaining power (e.g. tier 1 contractors) to create those rules.
- The nature of waste within the construction procurement context is complex, dynamic, interrelated, and reciprocal. The use of inefficient construction procurement arrangements can lead to the generation of a causal ‘network of process wastes’, which in turn lead to consequential wastes.

9.4 Main Conclusions of the Research

The main conclusions that can be drawn out of the findings of the study are as follows:

- The overall conclusion is that the current prevailing (yet wasteful) construction model will persist, and even deteriorate, unless a holistic consideration of the institutional, transactional and production aspects of construction is taken. This implies that any industry-wide initiatives for improvement (e.g. BIM, Partnering, LPDS, LPS and IPD) will stall or at least fail to achieve its full potential, unless the prevailing institutional factors (identified within this study) are addressed.
- Waste, as understood in Lean construction, does not feature in modern construction economics or management theory. These approaches fail to recognise the (wasteful) systems in which entities not only operate inefficiently, but additionally protect themselves by adding contingency and behaving opportunistically. The effect of these practices is to embed inefficient and wasteful processes across the supply chain and throughout the project life cycle. Consequently, they have become part of the institution of the construction industry – ‘the way it does business’.
- Whilst safeguarding is critical in construction projects, the drive towards economising the transaction cost moves the institutional arrangements away from effective 'safeguarding' towards the use of cheaper 'adaptation' and 'performance evaluation' as governance methods. This explains why the construction industry persists in using the market or “buying” as a solution to project delivery and leads to safeguarding. The outcome of safeguarding approaches, based on transactional considerations, is a lack of control on opportunistic behaviours and the reduced effectiveness of in-house or cooperative arrangements. Inefficient safeguarding mind-sets and practices adopted by construction buyers as part of their approach to procurement often complicate the problem rather than solve it, and are major sources of institutionalised waste in construction.

- Construction procurement arrangements should be crafted to suit the chosen project delivery system and improve flow processes, rather than being tailored to transactional characteristics and dictated by the contract type.
- The study offers two main explanations for the prevalence and persistence of inefficient procurement governance arrangements in construction. First, it was found that clients and decision makers, in their attempt to overcome the safeguarding problem, mainly focus their attention and efforts on reducing ex-ante (i.e. pre-construction phase) transaction costs while giving less attention to the impact of their chosen procurement arrangements on ex-post costs (production costs). In that way, procurement decisions tend to be ultimately focussed on contract administration and shifting risks; and, arguably, risk aversion often distracts attention away from core efficiency purposes (Williamson, 1985). The second explanation is based on an institutional perspective (DiMaggio and Powell, 1983; Oliver, 1991). By putting the safeguarding problem into context, it appears that clients and construction buyers conform to wasteful conventional procurement procedures due to institutional pressure exerted on them from third parties (e.g. consultants, quantity surveyors, lawyers, insurance companies, and banks). Clients rely heavily on professional advice from these third parties who may have a vested interest (i.e. social and/or economic motivations) for the wide-spread use of these inefficient procurement procedures. The institutional factors, identified in this study combine to create the prevailing current model for construction project delivery, and their identification will help the development of more efficient and effective business and project delivery models.
- Construction buyers' main flawed assumptions or errors during pre-contractual stage are: (1) Treating construction procurement as a commodity; (2) Focussing on minimising ex-ante transactional costs and not overall costs; (3) Adherence to the use of specific procurement arrangements and forms of contracts (4) Taking an approach to construction procurement based on risk-averse transactional considerations rather than process-flow; (5) Dependency on external consultants and lawyers; and (6) Treating Symptoms rather than root-causes; and (7) Not taking

advantage of the procurement process to fully understand or eradicate the delivery partners' assumptions.

9.5 Contributions to Knowledge

This research has contributed to the existing body of knowledge in relation to the concept of waste in construction, construction procurement, and grounded-theory. The next sections, therefore, present the main theoretical, methodological and practical contributions of this study.

9.5.1 Theoretical contributions

The main theoretical contributions of this research study are as follows:

- The most important contribution to knowledge in this research is the development of the new conceptual model of 'institutional waste in construction' itself. The conceptual model provides a novel perspective to the generation and persistence of waste in construction. It also provides novel explanations as to why the prevalent current construction model is so embedded and so entrenched, despite the substantial attempts to address its recognised inadequacies. The model also provides novel explanations as to why inefficient procurement procedures prevail and persist in the construction industry.
- Exposing the complex, dynamic and reciprocal nature of waste within the construction procurement context. To the best of the author's knowledge this is the first study to explore the concept of waste within the institutional, procurement and commercial environments that surround the design and delivery of construction projects.
- The study developed a theoretical foundation that demonstrates that conventional safeguarding approaches to construction procurement, based on 'transactional risk-averse' considerations are sources of waste, hitherto unacknowledged - Introducing the concept of the 'safeguarding problem in construction procurement'.

- To the best of the authors' knowledge, this study is the first to demonstrate the usefulness of using principles of Lean construction in association with TCE when analysing construction-procurement related issues. In particular, the study shows how that the use of a 'lean' lens helps to expose the impact of taken-for-granted procurement governance arrangements on process flow. Thus, when viewing these transactional-based procurement approaches through a "lean" lens, it can be observed that they are wasteful and/or create waste.
- Demonstrating that neo-institutional theory, a branch of organizational sociology, has the potential to be used as an analytical lens to deliver a more explicit theory of waste relating cause and effect within the wider aspects of construction procurement systems and relationships.
- Providing a potential research agenda that supports the development of prescriptive conceptual frameworks for causal analysis of waste in construction projects (integrating the causes and effects of waste in-between procurement and production levels). This could be achieved by integrating the findings of this study, as shown in Figures 4.1 and 8.7 (focussed on the nature of waste within the construction procurement context) with the findings of Formoso *et al.* (2015) who investigated the nature of waste at the production level.

9.5.2 Methodological contributions

The aim of this study was to contribute to the concept of waste in construction by exploring the construction procurement and commercial contexts that surround the design and delivery of construction projects. The philosophical assumptions and exploratory nature of the research led the study to adapt a qualitative research strategy; thereby challenging predominating quantitative research paradigms. The research therefore responded to widespread criticisms related to the extensive use of quantitative methods, associated with positivism, in construction management research (for example, see Seymour and Rooke, 1995; Seymour *et al.*, 1997; Koskela, 2017).

Commercial studies can be notoriously difficult to mine truth from, especially if attempted through direct observation of live procurement processes. Construction practitioners and companies are sensitive about the issues they disclose and the implications for their immediate or future commercial positions. The author tried to gain access to several case studies, but all negotiations and requests were refused due to commercial sensitivity reasons (See Chapter 3). As asserted by one of the most senior and experienced participants of this study:

“This may be a key area of ‘Waste’ in that ‘Accurate Shared Learning’ is rarely obtainable in relation to commercial issues...People will share good news but not necessarily the bad. And the links between cause and effect in the case of both are rarely accurately assigned” (Fellow Member of the Institute of Civil Engineers (FICE), Senior Consultant, UK, 8th September, 2015, E-mail message).

Thus, a grounded theory (GT) approach helped to overcome these methodological challenges by allowing the coverage of a wider variety of cases, while at same time putting participants on ease and ensuring that they remain anonymous. It is important however to stress that in GT, the unit of analysis is not the individuals themselves, but incidents in the data (Glaser and Strauss 1967). In addition, GT is of particular value when the research challenge is to interpret complex social processes where holistic explanations are lacking (Hinton and Hamilton, 2015); thus GT is appropriate for use when the researcher hopes to develop a conceptual overview of the social phenomena under investigation. Furthermore, the inductive focus of GT makes it suitable for exploring a topic of interest or a substantive problem area that there is little known about it (Strauss and Corbin, 1998). Therefore, the use of grounded theory aligned with the research motivation, aim, objectives, intent, and exploratory nature of this study. To the best of the author’s knowledge, there are very few, if any, studies that explored the ‘concept of waste’ within construction using a grounded-theory methodology.

This study also contributes to the existing body of knowledge in grounded-theory literature. Most grounded-theory studies follow either the Glaserian (traditional) or the

Straussian (evolved) approaches to grounded theory. The first adopts a purely inductive approach to GT, while the later tentatively utilises a deductive-inductive approach. Both of those two versions of GT, however, assume that work should be defended from a positivist perspective of the world, and both overlook the analytical power of abduction in their writings. For these reasons, Charmaz, developed the constructivist version of GT and explicitly emphasised the importance of adopting abductive reasoning in GT (see for example Charmaz, 2008), so as to enable grounded theorists to move beyond the limitations of ‘induction’ and instead develop novel insights based on abductive reasoning. According to her *“Grounded theory begins with inductive analyses of data but moves beyond induction to create an imaginative interpretation of studied life. We adopt abductive logic when we engage in imaginative thinking about intriguing findings and then return to the field to check our conjectures”* (Charmaz 2009:137–38). However, Charmaz’s perspective positions abduction as secondary to induction, and thus can be criticised for limiting abduction’s potential to foster theoretical innovation from the beginning of the research inquiry (Timmermans and Tavory, 2012).

This study supported the theoretical strand of evolved GTM (Strauss and Corbin, 1990, 1994, 1998), which argues that previous knowledge about the world and scientific theories (prior to data collection) are useful (Reichertz, 2010). Data analysis was also informed by Strauss and Corbin’s (1998) formal coding scheme (open, axial and selective coding procedures). The study was guided by the interpretative stance of both evolved and constructivist approaches to GT that recognise the role of the researcher in theory building. Additionally, the research was inspired by Charmaz’s (2008, 2009) explicit adoption of abductive logic during data collection and analysis stages. However, this study adopted an A-D-I-A approach to theory building, at which abduction was adopted during data collection and analysis to foster theoretical innovation, but also used during research initiation to pave the way towards the contextual choice of topic guides. To the best of the author’s knowledge, there are very few, if any studies, which have adopted a reflexive A-D-I-A approach to GT. The quality of the findings and novel contributions of this study to knowledge, therefore, demonstrate the rigour and usefulness of the methodology developed in this study.

9.5.3 Practical contributions

The main practical contributions of this study can be summarised, as follows:

- The identification of ‘*institutional wastes*’ in construction could guide the industry towards addressing the regulative, normative and cultural-cognitive institutions influencing approaches to construction procurement and project delivery. By addressing these identified institutional factors and underlying paradigms, this could also help to eliminate their resulting causal wastes at the procurement and supply-chain level, and thus eliminate or reduce their substantial negative impacts on production.
- This study has shed empirical light on various prevalent procurement arrangements that encourage wasteful behaviours and embed inefficient processes across the supply chain and throughout the project life cycle. The findings of this study could, therefore, serve as a useful compendium for researchers and industry practitioners to access, in order to gain a better understanding of the impact of prevailing (inefficient) construction procurement practices on project-team or supply-chain dynamics.
- This study analysed the reasons for the apparent coherence of the current construction project delivery model. The findings of this study could therefore act as useful foundation for preparing a route to the radical change required to move to lean methodologies and collaborative project delivery approaches. Currently, the development of efficient project-organisation and management techniques is far in advance of their implementation. Therefore, the findings of this study could serve as comprehensive summary of ‘*institutional barriers to improvement*’; so clients, procurers and decision-makers may benefit from studying the findings and using them to inform their practice. The study could also help to increase buyers’ and practitioners’ awareness of the effects of ‘*institutional thinking*’ (as opposed to silo-thinking) on the outcomes they achieve.
- The study exposed to clients and decision makers the amount of waste (and unnecessary cost) they create and embed by adhering to (transactional) safeguarding

mind-sets and approaches to construction procurement. Thus, the findings of this study could enable them to secure better value by reducing the waste generated through their suppliers' reactions to inefficient procurement and contractual arrangements. The study has also shed light on alternative procurement arrangements and organisational techniques (See Table 6.2 in Chapter 6), based on process-flow considerations, which could be of value and support collaborative ways of working.

- This study has shed empirical light on how 'self and vested interests' absorb a huge proportion of the industry's intelligence and professional vigour. Thus, the author believes that the outcomes of this study can lead to the future re-shaping of the roles and responsibilities of the professions and wider participants involved within the construction sector, in order to increase the production efficiency and effectiveness of the industry. The recommendations out of the initial publications of this research study (see section 9.6.2) has already led to an on-going PhD study at Nottingham Trent University that aims to investigate collaborative approaches to project costing, with a particular focus on examining the role of Qs in collaborative practice.

9.6 Research Publications

As part of the contribution of this research study to lean construction and construction procurement body of knowledge, the following papers have been developed and published from this research so far. A list of future publication plans to follow is also presented.

9.6.1 Journal publications

Three peer-reviewed journal papers have been published out of this research study so far, as listed below:

1. **Sarhan, S.**, Pasquire, C., King, A., and Manu, E. (2018) 'Institutional Waste within the Construction Procurement Context', *Engineering Project Organisation Journal*, 8 (January 2018), 36-64

2. **Sarhan, S.**, Pasquire, C., Manu, E. and King, A. (2017a) 'Contractual governance as a source of institutionalised waste in construction: a review, implications, and road map for future research directions', *International Journal of Managing Projects in Business*, 10 (3), 550-577
3. **Sarhan, S.**, Pasquire, C., and King, A. (2017b) 'The concept of Institutional Waste within the Construction industry: A potential theoretical framework', *Lean Construction Journal*, 2017 Issue, pp 12-24

9.6.2 Peer-reviewed international conference papers

Three peer-reviewed international conference papers have been published out of this research study so far, as listed below:

1. **Sarhan, S.**, Pasquire, C. and King A. (2014) 'Institutional Waste within the Construction Industry: An outline', *Proceedings of the 22nd Annual Conference of the International Group for Lean Construction (IGLC-22)*, Oslo, Norway, June 2014, pp 895-906. [Selected for 'Plenary Sessions' - Only 9 papers out of 160 accepted papers were selected for the plenaries].
2. Pasquire, C., **Sarhan, S.**, and King, A. (2015) 'A Critical Review of the Safeguarding Problem in Construction Procurement: Unpicking the coherent current model', *Proceedings of the 23rd Annual Conference of the International Group for Lean Construction (IGLC-23)*, Perth, Australia, July 2015 [Selected for 'Longer Presentation Sessions'].
3. **Sarhan, S.**, Pasquire, C., King, A., and Manu, E. (2016). 'Are tier-one contractors making their money out of wasteful procurement arrangements?', Proc. 24th Ann. Conf. of the Int'l. Group for Lean Construction, Boston, MA, USA, July 2016

9.6.3 Future publication plan out of this thesis

Plans for future publications out of this PhD thesis include:

1. The Concept of ‘Institutional Waste’ in Construction: A Study Grounded in Practice and Theory
2. Institutional Sources of Waste in UK Infrastructure Projects: An Exploratory Case Study
3. Institutional Barriers to Learning from Project Failures in Construction
4. Buyers’ Main Flawed Assumptions and Approaches to Construction Procurement
5. Why do Wasteful Procurement Practices Persist?
6. A Conceptual Framework for the Prescriptive Causal Analysis of ‘Institutionalised Waste’ in Construction
7. Integrating Abduction, Deduction and Induction Approaches to Develop the Concept of ‘Institutional Waste’ in Construction

9.7 Research Limitations

The study included some limitations, which are discussed below:

- As demonstrated in this study, the nature of waste within the construction procurement context is very dynamic, interactive and complex. In such a complex network of ‘causal wastes’ leading to reciprocal cycles of consequential wastes, the study was not able to analyse all the connections in detail, due to time constraints and the complexity of the task. The study was able to observe patterns of waste and establish relationships between main categories of the developed conceptual model of ‘institutional waste’; but it was not feasible to decompose the model and illustrate the cause and effect’ relationships of each individual subcategory (e.g. procurement option). This partly, explains why the study recommends addressing the ‘institutional factors’, as core or main sources of waste in construction procurement. Perhaps, the use of simulation models could help to solve this research challenge; thereby support decision making.

- The conceptual model does not include a measurement of magnitude, which could show an increase in the amount and costs of downstream waste (i.e. consequential wastes) generated by upstream causes of waste (i.e. institutional and procurement arrangements). As mentioned by one of the industry experts involved in the evaluation exercise of the developed conceptual model:

“It is not an easy exercise to measure benefits for changing the current state. It is very easy to measure physical wastage (concrete) but no so easy to measure institutional waste. I also believe that there would be a lot of reluctance for clients to admit that they operate in this manner, there is an unwritten rule that the contractor is always to blame for project failures, largely because this is the tip of the iceberg, tangible figures which can show profit and loss” (Construction Manager, 13th June 2017).

There is almost no doubt that such a cost measurement model could help to convince politicians, clients and decision-makers about the benefits for change. In general, the number of studies in literature on the development of methods for measuring waste is small and mainly limited to measuring construction material waste (Formoso *et al.*, 2015). However, it is important to stress that *“not everything that matters can be measured, and not everything that can be measured matters”* (Cameron, 1963; Brian *et al.*, 2015). In a trend report published by UNESCO in 1956 on political sciences in the United States, Dwight Waldo warned about the limitations of ‘quantifying true value’ by his statement in the report that *“there are those who see the movement as diverting political science from important to trivial matters simply because the latter lend themselves to study by the fashionable techniques (‘what counts can’t be counted’)* (Waldo, 1956, p 30). Furthermore, in a Noble Memorial lecture in 1974, Friedrich von Hayek reported on how that exclusive concentration on quantitatively measurable phenomena has led to the production of policies which made matters worse, and how that important economic phenomena (e.g. inflation and unemployment problems at that time) were disregarded by many mathematical economics because their operation could not be confirmed by measures of magnitude (Hayek, 1974, p. 179-184; Hayek, 1989). In line with these preceding arguments, this research study revealed how that relying

on economic theories and perspectives does not allow us to observe the wastefulness of conventional safeguarding procurement practices and their role in embedding waste in the system place.

- This study adapted a GTM, which encompassed in-depth and iterative interviews with twenty-four senior professionals within the UK construction industry, as a primary method for data collection. The main findings of the study were then evaluated by five UK industry experts. The scope of this study is commercial and industrial construction as well as smart-motorway infrastructure projects in the UK. The fragmented and interdependent nature of the industry meant that a large number of cases would be needed in quantity, to generalise the findings. However, it is important to stress that GTM does not seek representativeness to achieve statistical generalisability, but instead aims to explain or predict phenomena based on empirical data collected from the field. The relevance, credibility, usefulness and explanatory power of the developed conceptual model, as confirmed by the UK experts who evaluated the model, suggests that the concept of ‘institutional waste’ can be generalised, following a wider deductive empirical examination. At the same time, with an exception to the varying regulative context within different countries, it could be argued that the construction culture and norms of practice are relatively universal (Rooke *et al.*, 2003). Thus, the concept of ‘institutional waste’ has the potential to be generalised across the construction industry on a global level. The concept may also have the potential to be relevant to other sectors and industries as well. Future studies are therefore encouraged to assess the concept’s compatibility, relevance and significance to other countries, sectors and industries.

9.8 Recommendations for Future Studies

- There have been moves within the construction industry towards more collaborative procurement arrangements and project delivery approaches; however a replicable recipe for aligning interests and keeping good intentions in place is still missing. Further studies are, therefore, recommended to examine the roles and responsibilities of the professions and wider participants involved within the construction procurement context. This study has shed empirical light on various

professionals who might have a vested interest for the wide spread use of some procurement and contractual arrangements (e.g. QSs, Lawyers, Cost and Procurement Consultants, Claims Managers, Concept Architects, Clerk of works, Accountants and Financial Directors, Turn-around Project Managers). Typically those professionals do not take a central stake in the project outcome, only a stake in the process by which the project is delivered. Do they need to have a bigger stake in the project outcome? Can we develop new knowledge and competencies that could enhance in transforming their functions, and enable their integration into more collaborative teams? Further studies are therefore recommended to investigate the professional barriers and silos which impede improvement and collaboration in construction.

- It was found in this study that consequential wastes (financial losses and cost overruns; time waste; quality-loss; and waste of human potential) can reinforce institutional factors, leading to vicious cycles of waste. This indicates that there is an opportunity for institutions, organisations and the industry as a whole is to learn from project losses or failures, and thus improve. However, the threat is of becoming progressively worse. A moderating variable may possibly be the absorptive capacity of the institution or organisation (Easterby-Smith et al, 2008). The construction industry has witnessed recently an increasing trend in the use of behavioural assessment in public procurement, which (arguably) allows clients to estimate how well key individuals within bidding contractors will collaborate and behave during project delivery. However, there is no evidence, yet, if this is the case. Can behavioural assessments help to solve some of the problems revealed in this study? The author's hypothesis is that such practices do not help to address the institutional sources of waste identified in this study, and thus they would probably lead to unnecessary transactional costs (i.e. waste) and complicate the problems rather than solve it (e.g. increased contingency costs). Further studies are, therefore, recommended to investigate the effectiveness of assessing personality norms and their relationship with organizational norms in the promotion and procurement of major infrastructure programmes.

- Further studies are recommended to conduct a participant action research approach, in which a detailed study within a learning-sharing organisation could take-place. This would allow future studies to record and measure the causes and effects of waste in actual real-time cases, and to devise solutions accordingly and test them. There is also scope for using the same methodological approach adapted in this study to explore the institutional factors in more detail. Additionally, more studies can be conducted with a focus on procurement systems and relationships between tier 2 contractors and their down-stream suppliers. Furthermore, an industry-wide survey is highly recommended to test and validate the findings of this study.
- Further studies are recommended to adapt the institutional theory to capture the crucial institutional knowledge required to enable an understanding of why and how lean construction practices are more successful in some countries, for example the United States, than in other developed countries such as the United Kingdom (UK).

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APPENDICES

Appendix 1: Invitation Sheet for Semi-Structured Interviews



Investigating the Relationship between Construction Procurement Arrangements and Value Generation/Loss in Construction Projects

Researcher	Saad Sarhan, PhD Candidate, MSc Civil Engineer
Contact details	Email: sarhan_com@hotmail.com ; or saad.sarhan2012@my.ntu.ac.uk
Programme of study	PhD in Construction Management
Faculty/University	Centre for Lean Projects, School of Architecture Design and the Built Environment, Nottingham Trent University, United Kingdom
Project supervisors	Prof. Christine Pasquire, Director of the LCI-UK Dr. Andrew King, Programme Leader for MSc QS Dr. Emmanuel Manu, Senior Lecturer at NTU
Project advisor	Assoc. Prof. Richard Dawe, Programme Leader at University of Plymouth

Dear Participant,

You are invited to take part in a research study as part of a PhD dissertation at Nottingham Trent University, UK. Please take time to read the following information carefully.

Is this important?

Procurement Arrangements Matter!



This research study will be conducted through exploratory semi-structured interviews. Examples of specific objectives include:

- Exploring the factors influencing the selection of construction procurement arrangements (See Appendix 1).
- Investigating the influence of procurement arrangements on project-team interaction, behaviour, and performance;
- Seeking evidence for practical examples of value loss / generation arising from construction procurement and commercial practices.

Potential Practical Contributions

- ✓ Helping clients and decision makers to secure better value for their money by reducing the waste generated by their suppliers - Enhancing Supply Chain Efficiency.
- ✓ Exposing to clients and decision makers the amount of waste (and unnecessary cost) they embed by adhering to prevailing unfit-for-purpose contractual governance approaches.
- ✓ Helping clients and decision makers to be aware of the institutional factors affecting the choice of their procurement procedures, and thus their desired project outcomes.
- ✓ Helping decision makers to consider the procurement arrangements and organisational techniques that could be of value and support collaborative ways of working.

ADDITIONAL INFORMATION

Do I have to take part?

It is up to you to decide or not whether or not to take part and you are free to withdraw at any time.

Will what I say in this study be kept confidential?

All information collected for this study will be kept strictly confidential and full anonymity of participants and employing organisations will be ensured during the collection, storage, and publication of research material in accordance with Nottingham Trent University's policies and procedures. Participants are free and have the rights to withdraw at any point. In cases, where participants provide supporting documents, they will be asked to choose and cite a unique identifier, so it can be referred to if the find they wish to withdraw their data at a later point.

What will happen to the results of this research study?

The results will be used in a doctoral thesis and participants can request a copy of the published research or take part in a debriefing exercise at the end of the project.

Contact for Further Information

If you have any concerns about the way in which the study has been conducted, you may contact the Director of this study (contact details below).

Professor Christine Pasquire

Head of the Centre for Lean projects and Director of the LCI-UK

Nottingham Trent University,

Tel: +44 (0) 115 848 2095

Email: christine.pasquire@ntu.ac.uk

Thank you for taking the time to read this information sheet

Date

October 2015

Appendix 2: Preliminary Interview Guide

Investigating the Relationship between Construction Procurement Arrangements and Value Generation/Loss in Construction Projects

Researcher: Saad Sarhan, PhD Candidate at NTU

A set of proposed questions for initial semi-structured interviews with ‘consultants’:

Part A: Factors influencing construction procurement selection decisions

1. Can you please tell me about the types of projects and size of contracts that you typically engage in?
2. Can you please talk to me about the Construction procurement system of one of your latest projects? (What is a construction procurement system? - Refer to Appendix 1)
 - 2.1. What is your most preferable procurement method (e.g. D-B-B, D&B) and choice of contract (e.g. JCT, NEC, Bespoke, PPC2000, ICE, etc.)? And why?
3. What is the process followed by your company for assisting clients on selecting suitable procurement methods and procedures? What is good about this process and what improvements could be made?
 - 3.1. What are the factors influencing construction procurement selection decisions?
 - 3.2. Who are the internal and external parties involved in the decision-making process? And how do they influence the selection process?
4. In your opinion, how and why has the traditional procurement method (D-B-B) gained such popularity, spread all over the world, and is still commonly used in various countries?
5. What forms of procurement methods and options would you like to see more use of? Why? What stands in their way?
 - 5.1. In your opinion, do construction industry bodies and trade associations have an influence on the wide-spread used of certain procurement routes and standard forms of contracts? If yes, how?

Part B: The influence of procurement arrangements on project-team interaction

6. How can construction procurement arrangements influence your own practice?
7. Do you believe that procurement systems directly contribute to project outcomes?

- 7.1. If yes, so how? Any examples?
8. Do you believe that increased collaboration between project parties is a suitable remedy for many of the construction industry's problems?
- 8.1. Can procurement decisions and arrangements affect the likelihoods of creating a cooperative or competitive/adversarial working-environment?
- 8.2. How can we enhance trust and collaborative ways of working through procurement arrangements?
9. What factors do you take in consideration when deciding to make amendments to standard forms of contracts? How do contractors often react as a result of taking on more risk? How else might contractors alter their behaviour as a result of taking on more risk?

Part C: Identifying imperfect procurement practices

10. Can you please talk to me about the main challenges/problems facing you with prevailing construction procurement and commercial practices?
- a) Given the on-going drive towards collaboration, are there any contractual conditions or procurement legislation/regulation issues standing in the way? If yes, like what?
- b) Do you consider that the types of contracts used or the process of contract administration contribute to the increased number of disputes occurring in construction? If yes, so how?
- c) What are the most common and prevalent safeguarding approaches in construction procurement (e.g. collateral warranties, insurance, etc.)? Are there better ways?
- d) What are the most common procurement practices used to overcome unanticipated changes in the transaction environment (e.g. problems associated with client or contractor's variations - RFI, Requests for Substitution, Drawing Clarification/Plan Clarification)?
11. In your opinion, why do inefficient (wasteful) procurement and commercial practices persist?
12. In your opinion, how can construction procurement arrangements be improved to enhance the chances of delivering more successful projects?

A set of proposed questions for initial semi-structured interviews with ‘contractors’:

Part A: Factors influencing construction procurement selection decisions

1. Can you please tell me about the types of projects and size of contracts that you typically engage in?

1. Can you please tell me about the types of projects and size of contracts that you typically engage in?

2. Can you please talk to me about the Construction procurement system (CPS) of one of your latest projects? What is a CPS? - Refer to Appendix 1

2.1. What is your most preferable procurement method (e.g. D-B-B, D&B) and choice of contract (e.g. JCT, NEC, Bespoke, PPC2000, ICE, etc.)? And why?

3. What are the factors influencing the selection of your supply-chain procurement arrangements and decisions?

3.1. Who are the internal and external parties involved in the decision-making process? And how do they influence the decisions and choices made?

3.2. Does the main Construction Procurement System influence your supply-chain procurement arrangements? If yes, so how?

4. In your opinion, how and why has the traditional procurement method (D-B-B) gained such popularity, spread all over the world, and is still commonly used in various countries?

5. What forms of procurement methods and options would you like to see more use of? Why? What stands in their way?

Part B: The influence of procurement arrangements on project-team interaction

6. How can construction procurement arrangements influence your own practice?

6.1. During your career, where a ‘less-than-ideal’ procurement route was selected, did your company make alterations to contracts in order to incorporate aspects of another procurement route?

7. Do you believe that procurement systems directly contribute to project outcomes?

7.1. If yes, so how? Any examples?

8. Do you believe that increased collaboration between project parties is a suitable remedy for many of the construction industry's problems?

8.1. How can procurement decisions and arrangements affect the likelihoods of creating a cooperative or competitive/adversarial working-environment?

Part C: Identifying imperfect taken for granted procurement practices

9. Given the on-going drive towards collaboration, are there any contractual conditions or procurement legislation/regulation issues standing in the way? If yes, like what?

10. How can clients' amendments to standard forms of contracts sometimes lead to increased pressure on contractors?

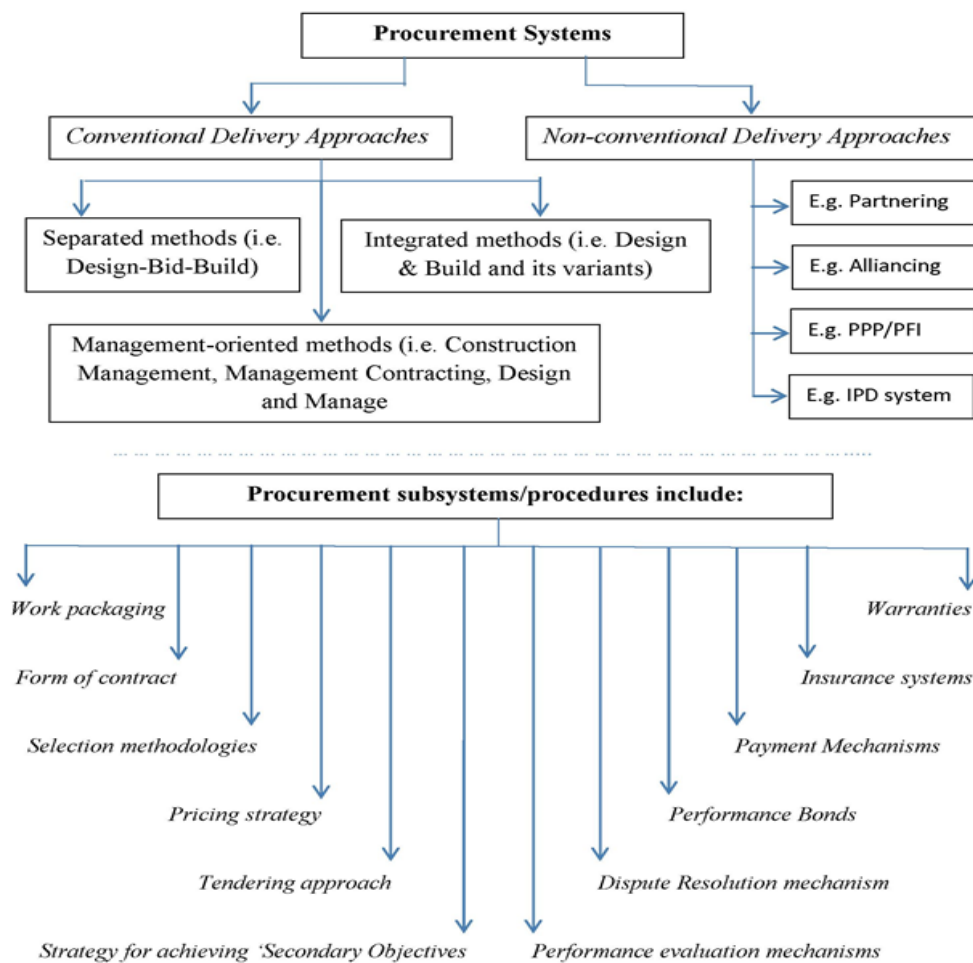
11. Can you describe to me any practical examples of unfair burdens imposed on contractors, sub-contractors or suppliers through imperfect procurement and contractual arrangements?

11.1. How can construction companies absorb or mitigate risks imposed on them?

12. In your opinion, why do imperfect/inefficient/wasteful procurement practices persist?

13. In your opinion, how can construction procurement arrangements be improved to enhance the chances of delivering more successful projects?

Appendix: Major construction procurement systems and sub-systems



Appendix 3: Ethical Clearance

ADB Research Team <ADBResearchTeam1@ntu.ac.uk>

Fri 10/16/2015 9:29 AM

To: Sarhan, Saad 2012 (PGR) <saad.sarhan2012@my.ntu.ac.uk>; 'Saad El Din Sarhan' <sarhan_com@hotmail.com>;

Cc: Pasquire, Christine <christine.pasquire@ntu.ac.uk>; King, Andrew <andrew.king@ntu.ac.uk>;

Ethical Approval

Dear Saad

I am pleased to inform you that the JICEC was happy to confirm that in its judgement there were no outstanding ethical concerns that required further discussion or exploration prior to data collection related to your application: INVESTIGATING THE RELATIONSHIP BETWEEN CONSTRUCTION PROCUREMENT ARRANGEMENTS AND VALUE GENERATION/LOSS IN CONSTRUCTION PROJECTS. It has therefore been approved.

The committee would like to wish you well in the completion of your project.

Best Regards,

Sarah Dossor
Research Office Team Leader
Maudslay 312
College of Art, Design and Built Environment
Nottingham Trent University
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Appendix 4: Evaluation/Validation Invitation Sheet and Structured (Qualitative) Questionnaire



Institutional Waste within the UK Construction Industry: An Exploratory study

Researcher	Saad Sarhan, PhD Candidate, MSc Civil Engineer
Contact details	Email: sarhan_com@hotmail.com ; or saad.sarhan2012@my.ntu.ac.uk
Programme of study	PhD in Construction Management
Faculty/University	Centre for Lean Projects, School of Architecture Design and the Built Environment, Nottingham Trent University, United Kingdom
Project supervisors	Prof. Christine Pasquire, Director of the LCI-UK Dr. Andrew King, Programme Leader for MSc QS Dr. Emmanuel Manu, Senior Lecturer at NTU

Dear Participant,

You are invited to evaluate and validate a conceptual model that provides a new perspective to the generation and persistence of waste in construction. The devised model forms part of a PhD dissertation at Nottingham Trent University, which aimed to develop a theory of waste that that considers the institutional, commercial and procurement environments that surround the design and delivery of construction projects. The underlying premise is that if we can understand the detailed causes of coherence for the prevailing imperfect construction model and reveal the consequential wastes, then the adoption of more efficient and collaborative business and project delivery models may become improved and more widespread.

Institutions Matter?!



The developed theoretical model is based on the findings of the following completed activities:

- Empirical data obtained from a specific major infrastructure project in the UK (10 Interviews + contract and document reviews)
- 14 in-depth Interviews with Senior Directors, Managers and Professionals within the UK construction industry
- Grounded-theory analysis of data (open, axial and selective coding processes)

Contact for Further Information

If you have any concerns about the way in which the study has been conducted, you may contact the Director of this study (contact details below).

Professor Christine Pasquire
Head of the Centre for Lean projects and Director of the LCI-UK
Nottingham Trent University
School of Architecture, Design and the Built Environment
Burton St, Nottingham, United Kingdom
NG1 4BU
Tel: +44 (0) 115 848 2095
Email: christine.pasquire@ntu.ac.uk

Thank you for taking the time to read this information sheet

Date

March 2017

Conceptual Model Evaluation/Validation Questions

The aim of this validation structured interview is to evaluate and validate the developed theoretical model of 'institutional waste in construction', in terms of its relevance, representation of reality, and explanatory sufficiency.

Please refer to Appendix and supplementary Power-Point Presentation. Then, kindly provide us with feedback on the developed model by answering the following questions:

1- To what extent do you consider the topic of understanding and exploring the institutional wastes within the construction industry to be relevant and useful ? Please justify your answer.

2- To what extent do you agree with the main findings and conclusion of the study (please refer to pages 10 to 20 in the power-point presentation and the Appendix below)

3- Are the relationships between the four main categories of the developed conceptual model (see Fig. 1 in Appendix below) logical, relevant to the construction industry, and reflective of the situation in real practice?

- To what extent do you agree that institutional factors influence construction procurement choices and practices?

- To what extent do you agree that construction procurement and contractual arrangements can impact on the performance and behaviour of project team parties.

- To what extent do you agree that client time and cost overruns of construction projects reinforce imperfect institutional factors (e.g. clients' flawed assumptions and errors during pre-contractual stages)?

- To what extent do you agree with the negative loop leading to the coherence of the prevailing imperfect construction business and project delivery model?

- To what extent do the main themes identified within the 'imperfect institutional factors' category sufficiently explain why wasteful/inefficient procurement and contractual practices persist?

4- The study identified a number of imperfect 'normative and cultural-cognitive institutions'. One of these was a theme named as: "clients' flawed assumptions and/or errors during pre-contractual stage". Within this theme, a number of imperfect fundamental paradigms were identified that influence clients' approaches to construction procurement. To what extent do you agree with the examples/instances identified within this theme (see Figure 2 in Appendix below)?

5- Can you please provide us with your suggestions for any of the following:

- Improving the developed conceptual model?
- Future research directions?
- Potential implications on practice?

Thank you for your invaluable insights and contribution to the study.

Saad Sarhan.

APPENDIX

Institutional Waste within the UK Construction Industry

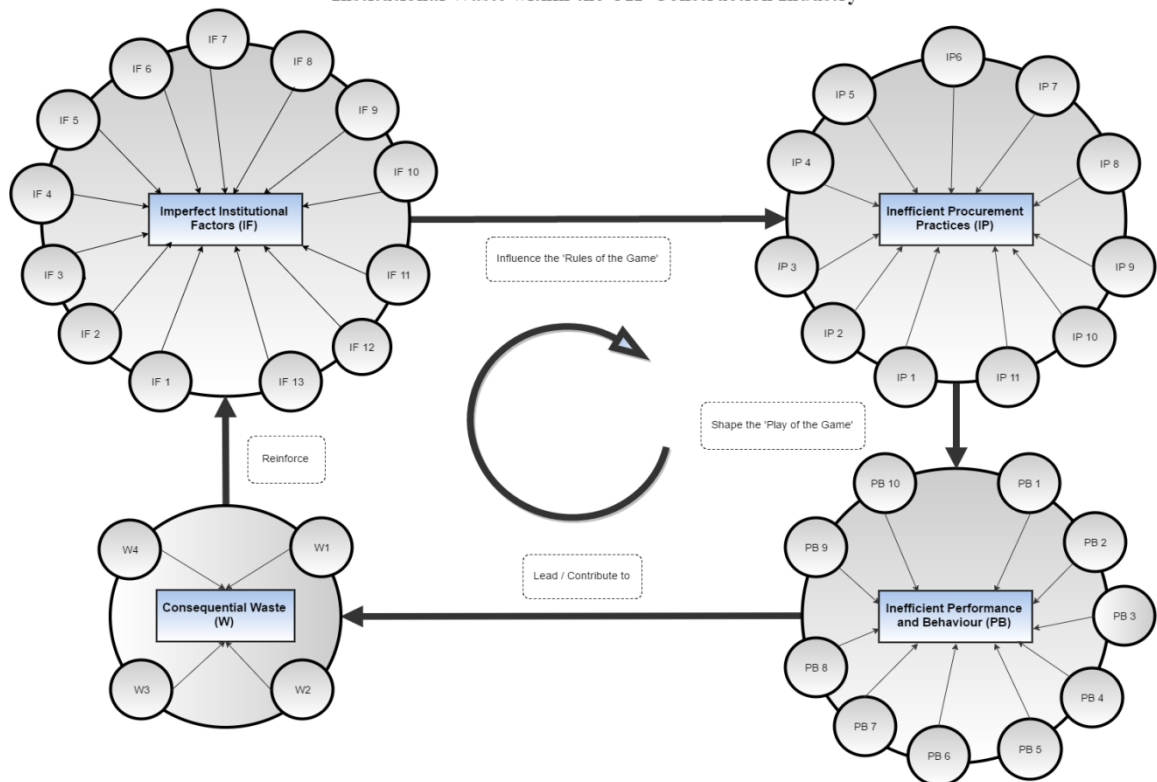


Figure 1: An overview of the concept of 'Institutional Waste in construction'

Lists of Abbreviations

Table 1: Description of themes identified as examples of imperfect institutional factors

Imperfect Institutional Factors (IF)	
ID	Description
IF1	Bargaining Power (Imperfect power disparities within the construction market place)
IF2	Bounded rationality or lack of adequate understanding and experience of client
IF3	Clients flawed assumptions and/or errors during pre-contractual stage
IF4	Construction Economy
IF5	Cost-driven environment (sharp focus on reducing costs)
IF6	Political forces (Government related policy and processes)

IF7	Price-based mind set
IF8	Risk-aversity
IF9	Self-interest based on commercial incentives
IF10	Social legitimacy/fitness self-interested drivers
IF11	Uncertainty
IF12	Vested interests of professional roles and firms not directly involved in production
IF13	Voluntary diffusion of imperfect norms

Table 2: Description of themes identified as examples of inefficient procurement practices and arrangements

Inefficient Procurement Arrangements and Practices (IP)	
ID	Description
IP1	Complexity of Contractual Procedures and Mechanisms
IP2	Exclusion or late involvement of Key actors during pre-contract stages of construction
IP3	Lowest price selection criteria
IP4	Non-joint specifications of design
IP5	Non-value adding performance monitoring and reporting arrangements
IP6	Onerous pre-selection of suppliers
IP7	Poor payment terms and arrangements
IP8	Price-based tendering as an expensive non-value adding activity
IP9	Safeguarding Practices (e.g. disclaimer/exculpatory clauses)
IP10	Separated procurement methods (Separating design from construction)
IP11	Sub-optimisation (optimising the parts rather than the whole)

Table 3: Description of themes identified as inefficient performance and behavioural impacts

Inefficient performance and behavioural impacts (PB)	
ID	Description
PB1	Adversarial relationship problems
PB2	Claims (of compensation events) and Disputes
PB3	Commercial Pressure
PB4	Communication and Information-flow problems
PB5	Conflicts
PB6	Design issues and problems
PB7	Increased risks or failure to mitigate risks at early stages
PB8	Making unnecessary imperfect assumptions
PB9	Opportunistic practices
PB10	Variations and Change events or orders

Table 4: Description of themes identified as consequential waste

Consequential Waste	
ID	Description
W1	Financial Losses and cost overruns
W2	Quality loss (Value-loss in design)
W3	Time waste
W4	Waste of human potential

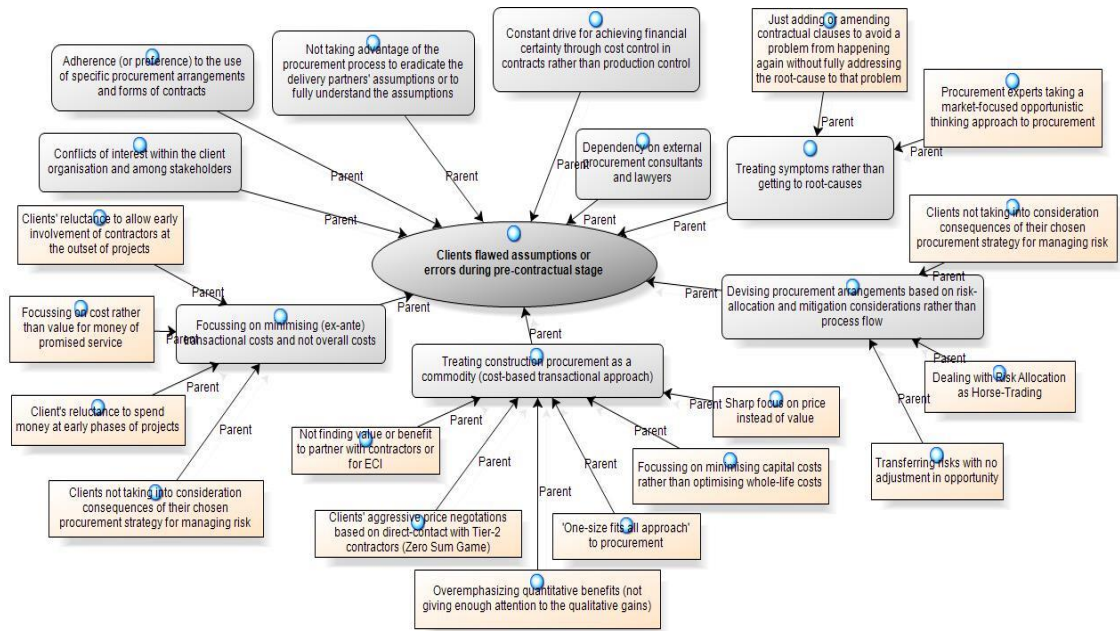


Figure 2: Clients' flawed assumptions and errors during pre-contractual stages