



A Lifecycle Analysis of Complex Public Procurement: An Agency-Institutional Theory Perspective

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Overall: Thank you sincerely for having reviewed our article again and for helping us reach its current condition.

COD E	Comment	Response	Location
EDITOR			
E1	Sorry for the slight delay from my side. On the positive side I have to say that the revised manuscript has really made big strides forward and I did not send it out again for review, but instead only have a number of minor issues to convey at this stage.	Thank you	N/A
E2	While the new sub section 3.3 is a good step forward, it seems to write the interviewee description in text like this is much more cumbersome than having this systematically in a short table (as the reviewer suggested). Also, you mention Figure 4 there, but it only turns up later; technically, you would then have to place it below section 3.3 and then later on just refer to it again. Please if you could amend these two points regarding 3.3	We agree. We have removed a majority of the text in favour of a simple table. We have now referred to figure 2 (the generic example) and simply mention that this will be expanded upon later to avoid interrupting the flow of the paper.	Section 3.3
E3	In your reply to reviewers you mention that you have used the Ekström et al paper in the final paragraph of the conclusion now, but it is not referenced there? It is in the bibliography, but not placed in the text right now? Please amend.	Our apologies, a slight miscommunication from our side. We should have written in the reply to reviewers “the final paragraph of the discussion” where the paper is referenced.	N/A
E4	When you write about the two theories you often use plural to combine both. In my view this makes it sound like you are referring to more than two theories potentially, e.g. also inspired by these theoretical foundations, while that is not the case. To make it unambiguous I suggest to repeat the word “theory” for each of these two theories to make it clear that you refer to each of them as an individual, established management	Indeed, we again agree with this point and have thus changed to what you have suggested throughout.	Section 1: Introduction Section 2.1: final sentence Section 2.3: middle of first paragraph and second paragraph Section 2.4 – theoretical view, first sentence.

	<p>theory that you then combine in your study. That implies:</p> <p>A) Introduction: “a combination of agency and institutional theories” -> I would suggest to write “a combination of agency theory and institutional theory”. Same for “both agency and institutional theories” -> please change to „both agency theory and institutional theory”, also page 12: “institutional and agency theories” -> “institutional theory and agency theory” (plus maybe switch order to agency first here as well?). P. 13 two times “agency and institutional theories” -> “agency and institutional theory”. p. 14 “institutional and agency theories” -> “institutional theory and agency theory” (plus, again, order change?). P. 26 “either agency or institutional theories” -> “either agency theory or institutional theory”.</p> <p>B) And in the abstract: “An agency-institutional theoretic perspective and a lifecycle analysis technique are combined” -> “Agency theory, institutional theory and the lifecycle analysis technique are combined”; “with agency and institutional theories” -> “with agency theory and institutional theory”; “by unique institutional pressures and agency-theoretic relationships” -> “by unique institutional pressures and principal-agent relationships”</p>		<p>Section 5 – first sentence of fourth paragraph</p> <p>Abstract – Design/Methodology. / Approach</p> <p>Abstract – Findings and practical implications</p> <p>Abstract – Originality/Value:</p>
E5	<p>I’d like to see the final version including the amendments above before recommending an “accept” decision. In case you have other proposals on some of the wording suggestions above, please let me know in another accompanying memo.</p>	<p>Thank you. We agree with all of these suggestions and have made the appropriate changes.</p>	

A Lifecycle Analysis of Complex Public Procurement: An Agency-Institutional Theory Perspective

Abstract

Purpose: The study sets out to demonstrate how a lifecycle perspective on complex, public-sector procurement projects can be used for making qualitative assessments of procurement policy and practice and reveal those procurement capabilities that are most impactful for operating effectively.

Design/Methodology/Approach: Agency theory, institutional theory and the lifecycle analysis technique are combined to abductively develop a framework to identify, analyse and compare complex procurement policies and practices in public sector organisations. Defence is the focal case and is compared with cases in the Nuclear, Local Government and Health sectors.

Findings and practical implications: The study provides a framework for undertaking a lifecycle analysis to understand the challenges and capabilities of complex, public-sector buyers. Eighteen hierarchically-arranged themes are identified and used in conjunction with agency theory and institutional theory to explain complex procurement policy and practice variation in some of the UK's highest-profile public buyers. Our findings provide a classification of complex buyers and offer valuable guidance for practitioners and researchers navigating complex procurement contexts.

Originality/Value: The lifecycle approach proposed is a new research tool providing a bespoke application of theory by considering each lifecycle phase as an individual but related element that is governed by unique institutional pressures and principal-agent relationships.

Keywords: Procurement lifecycle analysis; Procuring complex performance; Complex procurement; Agency theory; Institutional theory

Paper type: Research paper

1. Introduction

This paper concerns public-sector procurement, an area where there are increasingly very large amounts of funds flowing through complex projects (Infrastructure and Projects Authority, 2023) yet systemic weaknesses in public procurement policies and practices persist (Barrett, 2016; Calvo *et al.*, 2019; Casady *et al.*, 2023). A plausible but under-studied explanation for this is the inherent difficulty in investigating such a complex area and the lack of an accessible toolkit for researching complex procurement domains. By their nature, complex procurement projects, like all complex systems, are difficult to investigate empirically. The purpose of this paper is to utilise a lifecycle approach to partition complex procurement systems into investigable phases in order to help overcome the difficulty of undertaking meaningful empirical work, and provide contextually-appropriate comparisons across different procurement systems, elucidating relative policy, practice and performance variances and revealing the most impactful capabilities for operating effectively.

The unique focus of this paper is the use of the concept of lifecycle to examine complex procurement processes. Our premise is that all processes associated with a complex procurement project are constrained or enabled in their effectiveness by the lifecycle within which they are embedded and the procurement processes' appropriateness are largely determined by their integration into the overall lifecycle rather than as functioning standalone elements. Therefore, we investigate the wide range of concepts captured by Procuring Complex Performance (PCP) (Caldwell *et al.*, 2009; Spring and Araujo 2014; Santos and Cabral, 2022) and Complex Product Systems (COPS) (Davies and Hobday, 2005; Raddats *et al.*, 2016) as a-priori areas of interest from a lifecycle perspective in order to provide an integrated understanding of the phenomena and inform Operations Management researchers and practitioners. We use the term 'complex procurement', defined by Lewis and Roerich (2009), as "*inter-organisational arrangements that are characterised by significant levels of performance complexity (i.e. must include numerous knowledge intensive activities) and infrastructural complexity (i.e. must include substantial bespoke or highly customised hardware and software elements)*" (Lewis and Roerich, 2009, p.2).

Theoretical lens

Our research findings are interpreted using a combination of agency theory and institutional theory. In this context, agency theory defines the explicit arrangements between two parties, for example, buyer (principal) and seller (agent); institutional theory defines the origins of emergent practices (isomorphisms) within institutions (Eisenhardt, 1988). The complementary nature of the theories is used to provide a robust examination of buyer-supplier relationships in complex procurement projects. The validity of this approach has been widely cited in a range of contexts (Kuhn, 1970; Clark, 1984; Stiles, 1993; Choi and Wacker, 2011), with some literature employing both agency theory and institutional theory concurrently (Eisenhardt, 1988) but, in a departure from Eisenhardt (1988), the purpose of our invoking the two theories is not to generate hypotheses from the two viewpoints but to use both viewpoints as a means to derive a comprehensive set of interrogatable constructs that codify meaningful strategic practice within buyer-supplier relationships and their associated governance processes. Each theoretical lens offers a different explanatory perspective over different phases of the procurement lifecycle. In order to understand lifecycle procurement, we leverage the concepts

from both a-priori categories of interest (PCP, COPS) to inform our understanding of each lifecycle phase.

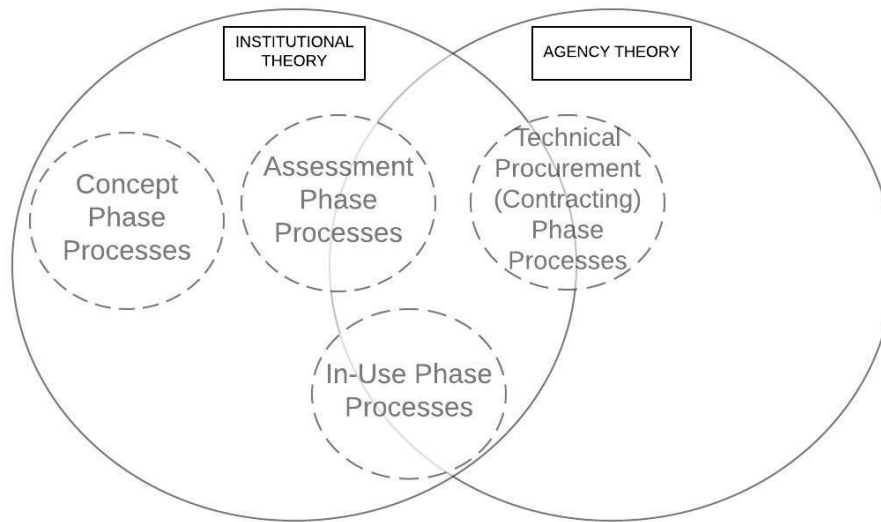


Figure 1. Theoretical positioning

Figure 1 illustrates the relative positioning of applying each theory to different phases of the overall procurement lifecycle. In the technical procurement (contracting) phase, there is a distinct principal (contractor) and a distinct agent (supplier). Thus, the organisational processes of the principal are naturally examined with reference to the agency-theoretic factors such as information asymmetry, power dynamics, risk aversion and self-interested behaviour (Eisenhardt, 1989), whereas within the concept and assessment phases, the stakeholders with direct effect over process creation are largely internal ones, with some external influencers. This does not suggest a principal-agent relationship, however, it may be interrogated through an institutional-theoretic perspective, with a number of mimetic, normative and coercive isomorphisms being readily apparent. Processes and capabilities developed within the front-end phases are influenced by principal-agent phenomena but are more directly influenced by institutional pressures such as organisational standards, government and legislative standards, mimetic pressures from non-similar industries and the unique normative pressures of the organisation.

Williams (2017) introduced the term ‘systemicity’ within complex projects - a concept that refers to the difficulty in establishing a clear line of causality within complex settings because actions and results cannot be observed in isolation. This is addressed by the concurrent application of agency theory and institutional theory, thus artificially bounding the limits of what is to be considered to be within a single lifecycle phase, reducing the inherent complexity that theory is attempting to explain. The combination of these theoretical perspectives rooted in a lifecycle view offers a novel approach to address the inherent difficulty in researching complex settings.

Partitioning the overall procurement lifecycle into its conceptually and practically distinct elements (Concept, Assessment, Procurement, In-Use) provides three advantages over perceiving the process as a whole. Firstly, cross contamination of irrelevant data from one phase with different objectives and skill-sets to other phases is avoided. For example, a tight

control of performance metrics might be prohibitive in the Concept phase but best practice in the Procurement phase. This partitioning helps address the inherent systemicity problem in complex procurement systems by reducing the ambient complexity at the point of initial analysis (Williams, 2017). Secondly, research can derive more comparable data across cases, allowing for the characteristics of one phase to be considered in opposition to the same phase in a different case. This provides more actionable insights, reducing the risk of insights being overly generic. Thirdly, the concurrently-applied theories can be better tailored, allowing the capabilities of both to be applied to the unique phases thus offsetting the weaknesses of each.

This work seeks to achieve the following objectives:

- use the lifecycle concept to develop an approach capable of making qualitative comparisons of organisations buying in complex contexts;
- contribute to knowledge in designing and managing procurement systems in complex domains;
- contribute to the empirical body of knowledge concerning complexity in public procurement by providing the ‘state of practice’ across some of the UK’s highest-profile public buyers.

The remainder of the paper is structured as follows: firstly, a review of relevant literature is undertaken, its results are then presented and organised around the key themes used to guide the lifecycle investigation as a list of a-priori constructs. Next, the methodology and results are presented. Lastly, we discuss the emergent categories of complex procurement situations and the implications for practice and future research.

2. Literature Review

The literature review comprises three components adapted from systematic approaches by Denyer and Tranfield (2009) and Colicchia and Strozzi (2012). First, there is a general narrative review in order to establish the relevant topics, second is a systematic component used to identify papers that acutely fit the areas of interest, the papers from which are used to inform the protocol and the concepts under investigation establishing a foundation of key authors and concepts that ‘snowball’ into an in-depth, third-stage, concept review.

2.1 The Lifecycle View

Variations on the lifecycle concept have been used in a number of related fields, for example, organisational change (Van de Ven and Poole, 1995), infrastructure procurement performance (Prasad, 1999), maintenance (Tsutsui and Takata, 2012) and supply chain agility (Roscoe *et al.*, 2020). The lifecycle concept is often used as an analogy to the biological context of a developing organism. It is this same analogy that applies within this paper:

“The typical progression of change events in a life-cycle model is a unitary sequence (it follows a single sequence of stages or phases), which is cumulative (characteristics acquired in earlier stages are retained in later stages) and conjunctive (the stages are related such that they derive from a common underlying process). Each of these events contributes a piece to the final product, and they must occur in a prescribed order, because each piece sets the stage for the next.” (Van de Ven and Poole, 1995:515).

The above quotation underpins the fundamental logic of investigating a complex operations management phenomenon through a lifecycle perspective, where each functional practice such as governance, contracting or procurement is interrelated along a linear timeline, initiated and refined at different stages and influenced by different pressures. Developing an in-depth understanding requires that these factors be observed in relation to each other. This concept has precedence: within the context of organisational change, lifecycles have been used to show how change is “mediated by the immanent logic, rules, or programs that govern the entity's development” (Van de Ven and Poole, 1988, p. 37). This study considers that these rules change starkly depending on the procurement phase, and so each phase of a lifecycle with its unique set of pressures and objectives should be considered in sequence (Santos & Cabral, (2022). A similar point is made by Liu *et al.* (2018), within the context of infrastructure procurement, who recommend that it is necessary to understand an even wider lifecycle view that accommodates the antecedent processes prior to the formation of a business partnership and through to its subsequent servitised phases. This variation on the suitability of competencies and capabilities across lifecycle phases is also discussed by Aaltonen and Turkulainen (2018), but from a perspective of relational capital which in turn dictates appropriate governance mechanisms. This breadth provides the capability to understand the range of interdependent contextual elements at play.

From a theoretical perspective, each phase of a complex procurement lifecycle has a different set of institutional isomorphisms (Eisenhardt, 1988) that influence process formation. In early phases, these may be largely internal pressures, in later phases they may be heavily influenced by legislative compliance or external pressure. This provides an opportunity to cross examine each phase using a combination of theoretical viewpoints demonstrated here through the concurrent application of agency theory and institutional theory.

2.2 COPS and PCP

COPS pertain to large-scale, capital-intensive projects often based in highly-servitised, manufacturing-intensive contexts such as Defence. PCP is concerned primarily with the procurement activity of organisations operating within COPS environments. The PCP literature acknowledges a number of interacting phenomena that define the problem landscape such as: oligopolistic supplier environments (Caldwell and Howard, 2014), product and service bundling (Stremersch *et al.* 2001), extended servitised product lifecycles (Wieland *et al.*, 2017) and diverse performance-based contracting (Hypko *et al.*, 2010). PCP was described extensively by Lewis and Roehrich (2009) who referred to it as “inter-organisational arrangements that are characterised by significant levels of performance complexity and infrastructural complexity”. The notion of performance complexity in this context can be thought of as the interrelatedness of knowledge-intensive activities required to ensure an effective outcome to relevant parties (Wieland *et al.*, 2017). This definition keeps PCP broadly aligned to the classification of COPS proposed by Ren and Yeo (2006). Infrastructural complexity refers to the systemic complexity in the tools, processes, infrastructure, and technologies required to execute any particular action (Brady *et al.*, 2005). PCP in a servitised environment is a concept that straddles the traditional view of both procurement and outsourcing and can be described from either perspective. It is principally the procurement of goods and services within the domain of COPS. COPS typically deal with highly-integrated and complex asset and service acquisitions but does not cover procurement specifically, rather focusing on innovation. Technical complexity necessitates that COPS and PCP require

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3 competencies more closely aligned to strategic outsourcing than to high-throughput
4 purchasing. The lifecycle view of procurement is critical to PCP, as major procurement projects
5 in complex environments mimic the complexity and practices observed within megaprojects,
6 where it is understood that a whole lifecycle perspective is necessary (Gil and Fu, 2021).
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9 We propose that there is an interplay between contract management (Bloomfield *et al.*, 2019),
10 relationship management (Roehrich *et al.*, 2019, 2020; Kalra *et al.*, 2021), project management,
11 procurement (Chen *et al.*, 2022), governance and performance management (Bourne *et al.*,
12 2018; Haq *et al.*, 2018; Kapsali *et al.*, 2019) that can only be understood through an analysis
13 of the entire procurement lifecycle. Focusing on only a subset of these factors omits the
14 emergent properties of the complex procurement system. In previous work, research has often
15 focused on one or a small number of dimensions of complex environments (see Caldwell and
16 Howard, 2014). This research attempts to perceive the process holistically.
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19 *2.3 Key areas of interest from the literature*

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21 While the mechanics of the literature review are not the key contributing element of this paper,
22 a review is a necessary first step required to identify a-priori areas of interest to focus the
23 empirical aspect (see section 3.2 – *Empirical research design*). An initial narrative review used
24 an iterative back and forth process of mind mapping and keyword searches to reveal a
25 comprehensive set of papers relevant to complex procurement lifecycles which consisted of 31
26 highly-relevant articles. These articles were categorised in accordance with their conceptual
27 coverage, and were used to derive a synthesis of key areas which were subsequently explored
28 during data collection and analysis. These areas were identified by applying an agency and
29 institutional-theoretic view to the emergent set of concepts featured in this body of literature.
30 The content of the articles was analysed using NVivo and the key concepts were identified,
31 separated and combined through thematic reduction (Miles *et al.*, 2019) into their different
32 lanes ascribed to agency theory and institutional theory until four areas emerged as a
33 consolidated representation of the relevant concepts. The third and final phase of this approach
34 utilised a snowball review to update the literature with the latest relevant research. The final
35 outputs are four superordinate themes that were used as the primary input to the empirical
36 enquiry. Two of the four themes – risk management and performance management - aligned
37 closely with the explanatory frame and properties attributed to agency theory such as the
38 presence of a natural principal (buyer) and natural agent (buyer); and two – organisational
39 alignment and technology management – aligned closely with institutional theory interpreted
40 by their more internal properties derived from a process of evolving professionalisation over
41 time.
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44 Each of these superordinate themes and their relationships to agency theory and institutional
45 theory are discussed with reference to previous applications.
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48 *2.4 Key Themes*

49 *Theme 1 - Organisational Alignment*

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51 Organisational alignment concerns the intra-organisational arrangement of governance
52 structures, individuals and teams that constitute the procurement function and its extra-
53 organisational relationships with partners, suppliers and governing bodies. It is an amalgam of
54 concepts broadly viewed as ‘how the system is set up’. Previous research has examined
55 organisational alignment for the enhancement of organisational capabilities to learn from
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3 experience and to accumulate knowledge over time (Bresnen and Marshall, 2000; Brady *et al.*,
4 2005), and for the development and exploitation of tangible and intangible relationship-specific
5 assets (Dyer and Singh, 1998). Intangible assets propagate a common normative context
6 through which organisations can enhance the efficiency of any collaborative undertaking (Seal
7 and Vincent-Jones, 1997) and organisational alignment and relationship structures are vital
8 intangible assets. Organisational alignment also acts as a proxy for infrastructural complexity
9 as discussed by Lewis and Roehrich (2009) and Hartmann *et al.* (2014), as it encapsulates the
10 processes that relate to how organisations and their supply chain partners are organised in terms
11 of their governance structures and coordination mechanisms. Numerous papers point to the
12 importance of coordination efforts through structural choice in hierarchical arrangements
13 (Johnsen, 2009; Tate and Ellram, 2012; Tanskanen, 2015). Roehrich *et al.* (2020) discuss the
14 need for research exploring the emergent asymmetries of combining organisations with
15 different organisational structures.
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20 *Theoretical View*

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22 The concurrent application of agency theory and institutional theory allows each key theme to
23 be interrogated in a bespoke fashion juxtaposing the insights from both theoretical viewpoints
24 within lifecycle phases. The lifecycle view allows us to consider the intra-organisational
25 governance practices that form as a result of specific institutional pressures that are at play
26 during intra-organisational negotiation, but to also differentiate these from the pressures at play
27 at points earlier in the lifecycle. Agency theory can and has been used to examine the inter-
28 organisational relationship used by the principal to control the agent (supplier) (Shevchenko *et*
29 *al.*, 2020) but can also be exercised in earlier phases to examine how internal actors structure
30 their relationships.
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33
34 It has already been noted from an institutional theory perspective that organisational practice
35 and, critically, 'organisational structure' become isomorphic over time (Eisenhardt, 1988).
36 Therefore, the normative pressure to support the acquisition process leads to practices that are
37 legitimate but not necessarily efficient (Meyer and Rowan, 1977; Tolbert and Zucker, 1983).
38 Equally, the organisational practices inherent in supply chain partners may cause a coercive
39 effect on the behaviour of the organisation. To meet these expectations, structural changes may
40 occur internally. Organisational structures necessary to support complex procurement
41 capabilities are regarded as largely non-transferable between contexts. Thus, from an
42 institutional theory perspective, there is no 'institutional blueprint' from which to extrapolate
43 an appropriate structure. Institutional theory reveals that isomorphisms form over time
44 (Eisenhardt, 1988), yet with each complex acquisition being partially unique such norms
45 continue to be established. An exploration of the variation of organisational alignment between
46 the case organisations is therefore critical in building a profile of organisational types, and in
47 suggesting effective pathways to improvement.
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51 *Theme 2 Contract and Performance Management*

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53 Contract and performance management concerns the set of activities used in identifying,
54 undertaking, assessing and monitoring the effectiveness of internal and external processes. It
55 is related to the previous theme, as performance management works most effectively when
56 embedded within an appropriate governance structure (Yong, 2010; Bourne *et al.*, 2018). The
57 role of governance mechanisms on performance is a persistent theme in the literature yet is still
58 considered underdeveloped: "Further studies should explore the possible influence of
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3 institutional legal and cultural contexts on the relationship between governance mechanisms
4 and performance” (Roehrich *et al.*, 2020, p. 459). Performance systems have attracted attention
5 from scholars interested in both public-private partnerships and the lifecycle of such
6 arrangements (Caldwell and Howard, 2010; Liu *et al.*, 2018). The literature also points to the
7 need to understand contract performance more generally and performance management has
8 been noted to be a fundamental component of contract management and the effective through-
9 life-management of an asset (Bititci *et al.*, 2012). There is no general consensus on how to best
10 manage performance in this field but researchers have noted the importance of developing
11 appropriate metrics and applying them to contracting frameworks within the context of the
12 unique and complex public-sector domain (Brown *et al.*, 2018).

16 *Theoretical view*

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18 The utility of each theory changes across a lifecycle as each phase consists of different
19 processes seeking different outcomes with different measures applied. From an institutional
20 theory perspective, the performance tools applied in the early phases of the procurement
21 lifecycle are informed more directly by mimetic isomorphism to mimic the metrics applied
22 elsewhere in the organisation or within the industry (Eisenhardt, 1988). While there is a range
23 of institutional pressures applied at the point of a formal outsourcing relationship, earlier phases
24 may have some institutional pressures (Silvestre, 2015; Wu and Jia, 2018) leading to a
25 significant difference in the approach to performance management.

26
27 The contract and the various mechanisms embedded within the contract are the central means
28 through which the buying organisation (principal) brings to bear control of the supplier (agent).
29 There is significant precedence in the application of agency theory to exploring this relationship
30 (Eisenhardt, 1988; Sumo *et al.*, 2016; Odongo *et al.*, 2019). The existence of performance
31 measures within earlier lifecycle phases can be interpreted through an agent model to
32 demonstrate how internal control is exerted. In each case, agency theory may be used to derive
33 a complementary explanation of the performance management system when juxtaposed with
34 institutional theory, providing a more robust rationalisation.

39 *Theme 3 - Technology Management*

40
41 This theme concerns the arrangement of information systems used to support complex
42 procurement processes. The literature highlights the unambiguous importance of technology
43 management in the execution of effective procurement practices with some researchers
44 highlighting the importance of particular sub-categories such as knowledge management
45 (Roehrich and Lewis, 2014; Gobbi and Hsuan, 2015; Schniederjans *et al.*, 2020), e-
46 procurement systems (Chen *et al.*, 2022) and extra-organisational collaborative systems (Liu
47 *et al.*, 2016; Aben *et al.*, 2021). Systems integration and the mechanisms for exchanging
48 information have long been recognised as core capabilities for the execution of successful,
49 complex projects (Davies and Hobday, 2005). This theme relates to theme 1 in that information
50 systems are a means of enabling collaboration through the coordination of information across
51 partnerships (Howard *et al.*, 2019; Roehrich *et al.*, 2019; Kalra *et al.*, 2021). Hagel and Brown
52 (2005) conceived the notion of process orchestrators within extended supply chains to describe
53 those organisations which account for the majority of the organisational effort. Given any
54 coordination effort will be technologically mediated, an exploration of the technology
55 functions is used as a proxy to understand the process of network orchestration.

The literature suggests that there are categories of ICT use that typify highly-capable procurement systems. An example is the 'learning from experience' system. This function is often cited within the literature as a key component of competitive advantage, leading to what Davies and Brady (2000) have called 'economies of repetition' in undertaking complex procurement capabilities. Juxtaposing the different technological capabilities and interpreting these capabilities through both theories offers a means of understanding the variation in the application of technology.

Theoretical View

Given the prevalence of ICT within organisational processes, the coercive, normative and mimetic pressures to adopt systems through 'legitimacy' and not 'efficiency-seeking' behaviours strongly impact technology adoption (Eisenhardt, 1988). Consequently, previous works often employ institutional theory in explaining the adoption of technologies relevant to the procurement lifecycle process e.g. SCM technologies (Liu *et al.*, 2010), e-commerce (Huang *et al.*, 2010), and auto-tagging technologies (Barratt and Choi, 2009). Agency theory also has an impact in the selection of technology management as a superordinate theme and positions information asymmetry between the principal and the agent as a core consideration in defining a contract (Eisenhardt, 1989).

Theme 4 - Risk Management

Risk management was prominent in the initial loading of superordinate themes. In this context it concerns the means by which buyers of complex goods and services identify, analyse and manage internal and external uncertainty. Risk management is of critical importance to the successful execution of large-scale projects and complex procurement projects (Johnsen, 2009; Caldwell and Howard, 2010; Roehrich and Lewis, 2014; Gobbi and Hsuan, 2015; Mahapatra *et al.*, 2017) and is prominent in the contracting relationships of complex procurement projects, with risk aversion often cited as the deciding variable in the selection of contract type (Kapsali *et al.*, 2019). Risk underpins the governance, performance and technology-related themes which may be regarded as the 'levers of control' that can be used to help manage risk (Simons, 1994). Understanding the interplay of these factors on risk has been called for in recent literature (Roehrich *et al.*, 2020).

Within COPS environments, the economic and organisational burden of sharing and managing risk requires alliance partners to garner trust, generate effective information sharing mechanisms and possess a mutual sense of accountability (Mayer and Argyres, 2004; Dyer and Singh, 1998). Uncertainty and risk are deemed critical in the examination of the process along the entirety of the procurement lifecycle (Caldwell and Howard, 2010).

Theoretical view

Agency theory has been used to examine risk in public-private partnerships, governance structures, performance management and contracting relationships (Zsidisin and Ellram, 2003; Haq *et al.*, 2018; Bloomfield *et al.*, 2019). Institutional theory is applied more generally to the risks faced in complex contexts (Park *et al.*, 2014) proving to be a valid lens in examining similar contexts such as megaprojects (Biesenthal *et al.*, 2018) and the effect of governance practices on change (Badewi, 2016). Institutional theory allows us to understand the motivations behind the emergence of risk management practices (Eisenhardt, 1988) within the context of a particular lifecycle phase. We are therefore able to interpret the emergent process

in accordance with the varying pressures innate to each phase, and derive a more insightful map of how these pressures manifest over time.

3. Research Design

3.1 Abductive data maps

The abductive data mapping technique, inspired by the Zachman framework (Lapalme *et al.*, 2018), organises qualitative data along a chronological map of processes, in this case using the procurement lifecycle of each case organisation. Data is recorded according to lifecycle sequence with a separate map constructed for each major phase of the lifecycle (Concept, Assessment, Procurement, In-Use). In order to scrutinise each phase, the researcher ensures a series of primary interrogatives are addressed (what, why, when, where, who, how) (see Figure 2).

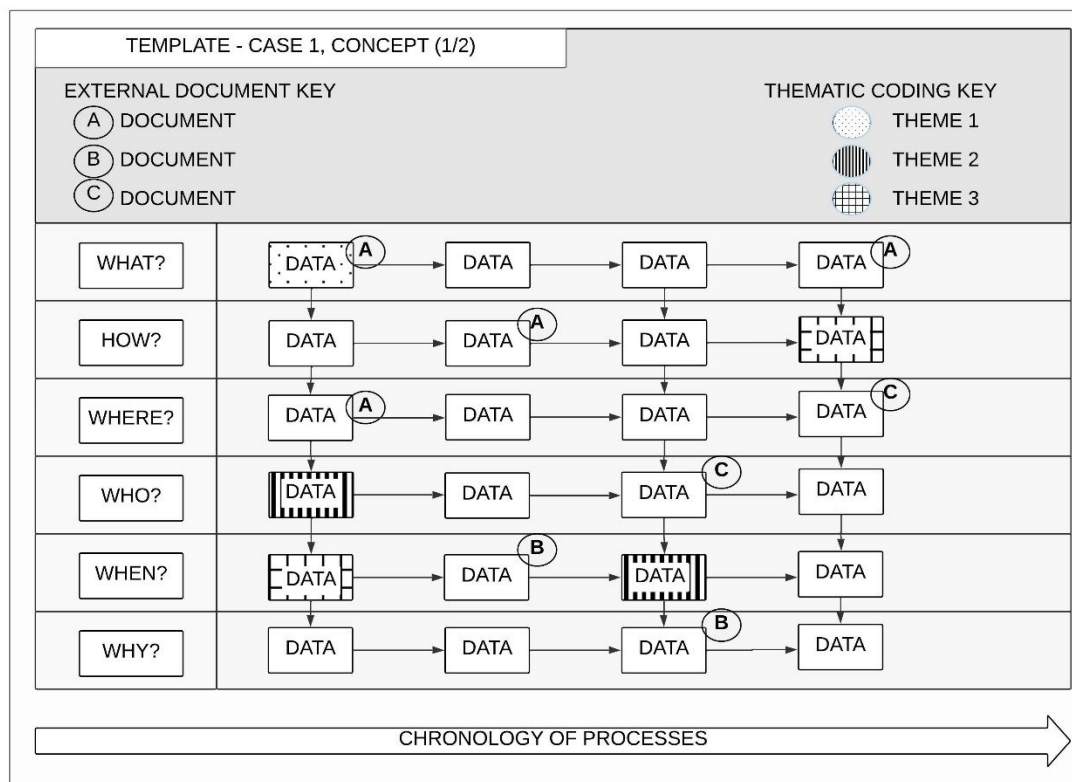


Figure 2. Abductive data map example

The original Zachman framework has traditionally been used within information systems' research but is often adapted to operate in a variety of contexts (Neaga and Harding, 2005; Hernandez *et al.*, 2014). The method relies on building up a picture of a system by taking multiple perspectives, making it particularly suitable for qualitative research utilising data triangulation. Data is summarised as responses to the primary six questions (vertical axis) and coded against any of the four themes to which a particular data point pertains. Furthermore, each data point is associated with relevant documents (shown as A, B, C). Nvivo was used in conjunction with the maps in order to organise the empirics. Each case study has four of these

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3 templates to organise the data, one each for the Concept, Assessment, Procurement and In-use
4 phases. This provides the cradle-to-grave view of the entire procurement lifecycle.

5
6 The “What” question is often the title or description of an internal process. This may, for
7 example, be the identification of a procurement request. The framework then encourages the
8 researcher to continue scrutinising this process until all six questions are answered. The
9 “When” question could concern procurement requirements being issued as and when a need
10 arises, or in accordance with an annual budget. After all queries are answered, the framework
11 prompts the researcher to query the next process in the lifecycle. After a first iteration, any
12 omissions in the data sheet become conspicuous and can be queried in subsequent interviews
13 or document analysis. Additionally, data points are coded in accordance with the a-priori
14 themes and the original data sources are referenced on the diagram (as shown in figure 2).

15
16 Organising qualitative research in this way is exceedingly time-consuming but provides three
17 key advantages that are particularly important in this context: (1) the researcher is prompted to
18 follow up if any of the six questions is left unanswered ensuring a breadth of knowledge is
19 captured (i.e. it is a dynamic data collection method as well as an analysis tool); (2) the
20 researcher can more easily compare the bigger picture of procurement lifecycle practice across
21 case organisations, as the whole picture is presented in a comparable fashion prompting further
22 enquiries if there are conspicuous divergences; (3) individual processes cannot be separated
23 from their surrounding context providing the researcher with the means to facilitate the
24 exploration of contextual depth.

25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60

3.2 Empirical research design

The empirical research design (see figure 3) comprises a number of different elements to explore the complex procurement lifecycles of the four selected UK cases: a major defence sector buyer (DSB), a major health sector buyer (HSB), a nuclear sector buyer (NSB) and a grouping of local government sector buyers (LGSB). The four key themes are used to inform the case study enquiry by broadly defining the interview topics, which in turn help identify relevant interview participants, organisational sub-units and relevant documentation. It is this iteration that defines the abductive design (Shani *et al.*, 2020) as insights are developed, revised and re-revised in continuous consultation with emergent data (Dubois and Gadde, 2002).

Cases were selected based on their adherence to Davies and Hobday’s (2005) definition of complex product systems. Their list of complex organisation characteristics was used to inform our case selection. Abductive data mapping was used to guide both interviews and document analysis (Eisenhardt and Graebner, 2007; Yin, 2014) and the application of the lifecycle approach revealed data omissions throughout the procurement process. These omissions are clarified in a secondary data collection stage. With each data collection, the theory and empirics are re-evaluated in the light of new evidence thus bringing the empirics and theory into closer alignment as more of the lifecycle maps are compiled. After completion of the cases, a cross-case analysis was undertaken, and the resulting thematic architecture was used to modify the case study protocol to include those emergent themes not included in the abductive iterations.

3.3 Data collection

The nature of abductive research is typified by engagement, analysis, and then re-engagement, repeated until saturation of a line of enquiry. This entailed forming enduring relationships with key interview participants with the data mapping reaching a state of increasing completeness

after each re-engagement. The data mapping, therefore, functions as the principal means of coding from which theoretical saturation is derived. As an example, in the DSB case, 12 staff were interviewed and, for most individuals re-interviewed, over a four-year period. While each case company's hierarchy of procurement personnel was different, interviews were primarily undertaken with the personnel occupying equivalent positions to those shown in Table 1

Equivalent Position	Description
Head of Procurement	Head of the organisation's procurement unit
Head of Commercial Department	Head of the organisation's contracting practice
Project Team Head	A participant with detailed knowledge of specific large-scale procurement projects
Project Team Group Head	A participant overseeing groups of large-scale procurement projects possessing an holistic, strategic perspective of practice
Special Project Heads	Participants involved with issues of critical importance to the organisation (for example, ICT capability provided to the procurement function)

Table 1. Procurement personnel interviewed

Figure 2 illustrates generically how quotes from interview transcripts and content from documents are coded for specific lifecycle positions and against specific themes in the data map. Worked examples can be seen in the Findings section of the paper. Each of the remaining cases were undertaken over a period of a single year with between 4 and 6 people interviewed.

3.4 Data analysis

The data analysis step concerns the thematic reduction of qualitative data (Voss *et al.*, 2002; Miles *et al.*, 2019). Whereas traditional thematic analysis involves the creation and re-creation of themes from case data, an abductive approach requires re-engagement with primary data sources during this analysis process (Dubois and Gadde, 2002). Therefore, the bulk of the data analysis is sub-divided into four components: (1) the first is referred to by Eisenhardt (1988), as the 'within-case' analysis and acquaints the researcher with the case organisation as a single and separate activity so as to allow the distinctive properties of that case to emerge (Barratt and Choi, 2009); (2) the second component is also 'within-case' and involves re-interviewing participants in order to fill any gaps identified by the abductive data mapping; (3) the third component is the cross-case analysis, the purpose of which is to compare and contrast the individual insights of cases across the body of cases to derive further insights applicable to the group (Ketokivi and Choi, 2014); (4) the final aspect of the analysis codifies each emergent thematic category according to 'prevalence' and 'perceived effectiveness', two cross-cutting themes derived by making comparative judgements across cases. Encoding is undertaken using a simple denotation of High, Medium (Med) or Low. These categories are comparative rather than absolute and, therefore, relevant only to this case set. The purpose is to provide relativistic statements to quickly unpick variances across the cases rather than to provide a universal typology of what is High, Medium or Low. The variances are the key phenomena of interest as these differences allow us to differentiate types without losing the nuance of the cases through the use of a rigid typology. In making a determination for each of the cross-cutting themes, we repeatedly triangulate several pieces of data. For 'prevalence', we consider the number of processes, the interconnectivity of the processes and the variety of actors and sub-units involved in the processes in order to make a relativistic judgement regarding the prevalence of that theme within that case in relation to other cases. For 'perceived effectiveness', we refer to two primary sources of information: the first is an analysis of the sentiment with which processes are described by participants in the primary data; secondly, senior personnel are asked to rate the overall effectiveness of a process grouping (for example,

contractual techniques) during a final round of interviews. Once we established a set of themes, cases are compared across each of the lifecycle phases and the results interpreted.

The iterations involved here were extensive and rigorous as each map contains six reference points (What, How, Where, Who, When, Why) each of which links to various primary data. In the focal DSB case, this required working closely with staff within the organisation for sustained periods of time with multiple additional supplementary interviews and document analyses required in order to amass the evidence pertaining to all procurement processes across all four phases.

4. Findings

We investigated the procurement practices of each of the case organisations across each entire procurement lifecycle. Whilst there are variances in the exact composition and length of the steps of these lifecycles, each case could be generalised into four distinct phases, namely: Concept, Assessment, Technical Procurement and In-Use. The approximate composition of these four phases across the case-set is illustrated in figure 3.

The research used lifecycle analysis and abductive data mapping to codify processes along a linear lifecycle. The four a-priori themes (organisational alignment, performance management, technology management and risk management) were used as inclusion criteria for identifying key processes and to guide the enquiry. Across these four superordinate themes, eighteen distinct, subordinate themes emerged. We first provide an overview of the DSB case and a summary of the remaining cases, and then use the thematic structure to interpret the implications of the whole case-set.

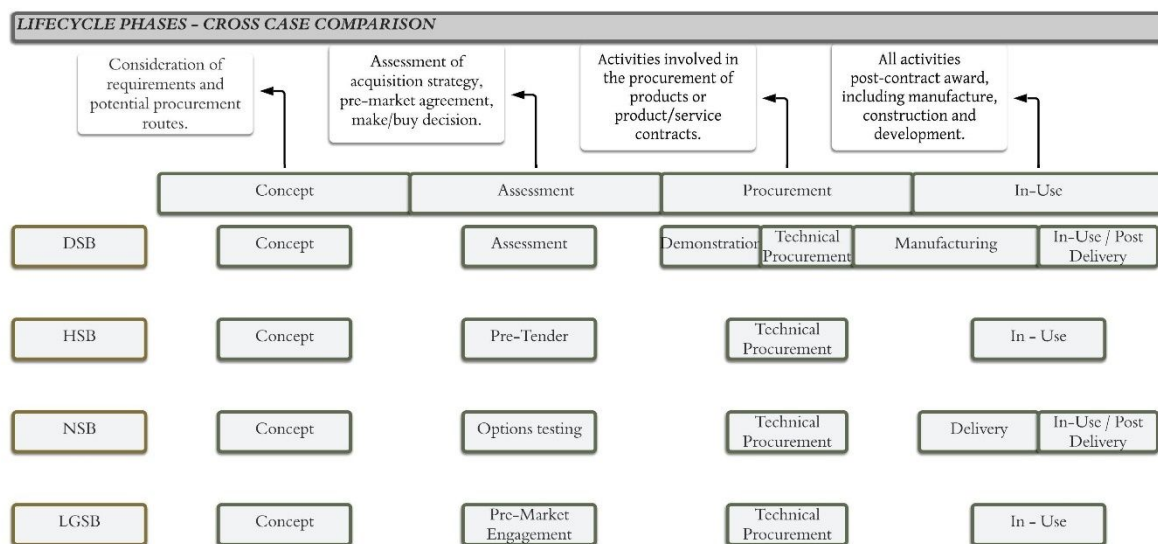


Figure 3. Procurement lifecycle phases

4.1 Case 1 – DSB

Figure 4 provides an excerpt of the DSB abductive data map in order to illustrate the details and practicalities of mapping a case. Generalisations and redactions have been applied to effectively showcase the approach in practice.

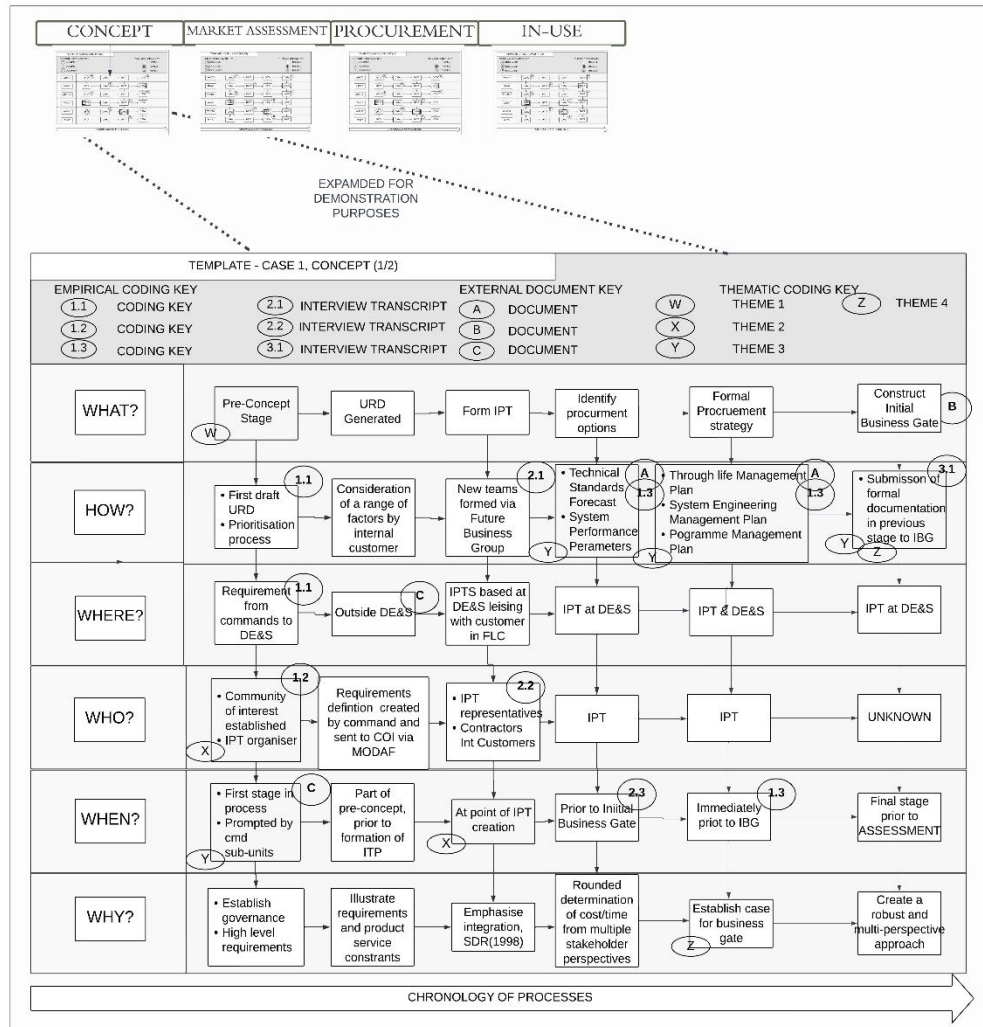


Figure 4. Concept example Defence Sector Buyer (DSB)

The abductive data map is an abridged version of one of six diagrams constructed for the DSB case. The map arranges the key processes chronologically along the lifecycle and in doing so links each process data point to empirical coding keys. The map is an interconnected web of logically-organised qualitative data that allows the case processes to be viewable as a snapshot and aids in theory building. This method of data collection and analysis has the advantages of:

- considering processes in relation to other contextually-relevant processes (i.e. within concept, assessment, procurement and in-use phases);
- prompting identification of missing information to fill gaps in the map;
- better utilisation of interview time and engagement with practitioners as the maps are partially compiled in real time.

Defence is a well-featured sector in the complex procurement literature (Kalra *et al.*, 2021; Bloomfield *et al.*, 2019) and studies of the Defence sector have helped to form the current conception of PCP (Caldwell and Howard, 2010). The prominence of lifecycles and through-life management in a military setting is significant, and so the context lends itself to the lifecycle view and the abductive data mapping technique. Our outputs from the lifecycle analysis are commensurate with this depiction of the DSB as a particularly relevant context for

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2
3 the study of complex procurement capabilities. The DSB case has the highest number and
4 variety of processes used along the procurement lifecycle as well as having the most-varied
5 organisation structure in comparison to the other cases. The complexity of the lifecycle maps
6 created to depict the overall procurement process was significantly denser than the other cases,
7 involving more organisational sub-units and interconnected processes. Its procurement is
8 largely handled through its project arm which is organised into project teams that pursue large
9 procurement contracts but with a number of central areas of expertise such as Commercial and
10 Contracting. The hierarchical arrangement is overly complex, leading to repeated guidelines,
11 policies and activities across sub-units rather than standardised across the whole or customised
12 in accordance with previous efforts. Performance management and metrics are utilised
13 inconsistently across these varied units, although there is some centralised expertise provided
14 by specific departments regarding specific functions. The oligopolistic nature of the
15 marketplace often causes a lack of performance management practices at the contracting stage,
16 with the DSB often favouring contracts that transfer most financial risk to the contractor (for
17 example, public finance initiatives). The ICT systems used vary in terms of function, ownership
18 and age with wide acknowledgement of the systems' siloed nature. Across each of the four
19 themes, the DSB's procurement practice tends to be decidedly uniform at the strategic levels,
20 but the processes were bespoke to projects at the operational level; this is barring a few notable
21 key exceptions such as the criteria for a project to pass 'main gate' stages which was broadly
22 consistent.

23
24 The lifecycle mapping approach provides a snapshot of the context within which a particular
25 process is being undertaken. This allows for secondary questions regarding the process to
26 emerge prior to additional rounds of data collection. This abductive approach allowed the
27 research team time to reflect and to probe further into any emergent considerations within the
28 next round of data collection. For example, if a key piece of performance data is captured
29 during one phase, we can project forward onto the lifecycle to see where this data is being used.

30
31 The DSB has a relatively high prevalence of processes encoded across the key themes
32 compared to other cases, indicating that process variety and complexity are significant but the
33 data often suggested a medium to low perception regarding their effectiveness. Holistic
34 knowledge management, standardisation of practice, a learning-from-experience capability and
35 the management of uncertainty are all features perceptible in the lifecycle and are particular
36 features of the case. However, despite the prevalence of these capabilities they were frequently
37 discussed as needing further development to be effective. A DSB project manager summed up
38 colleagues' feelings by commenting "The lack of learning from past projects and standardising
39 good practices are repeatedly highlighted as areas of weakness". Some elements of
40 standardisation existed in the form of contract templates and assurance processes prior to 'stage
41 gates' within the lifecycle. However, there is a conspicuous lack of standardisation outside of
42 these processes, which is a revealing finding given the military's association with standardised
43 processes. Knowledge management processes were also prominent across the lifecycle. Instead
44 of entrenched systems' knowledge, the acquisition process relied upon the expert knowledge
45 of the personnel - a particular problem within the military context as staff regularly rotate across
46 different roles. A procurement lead bemoaned "we start over with a new project lead every two
47 or three years losing vital knowledge and momentum as the former lead moves on". This was
48 in vivid contrast to the NSB case, for example, which embedded the accumulation and
49 dissemination of practice more explicitly in formalised processes.

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3 Case results were reported back to the case organisation. In the case of the DSB, this took the
4 form of a report and presentation to a Change Board headed by a Major General. The results
5 were congruent with the perspectives of the senior personnel on the Board.
6

7 *4.2 Key features of comparative cases*

8 The remaining three cases concerned the HSB, LGSB and the NSB. Each of these differed
9 from the DSB case in distinctive ways. They are briefly summarised and comparisons are made
10 to arrive at a typology of complex procurement lifecycles.
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13 The HSB has a complex procurement structure that involves budgetary control derived from
14 central government and enacted through over 200 Clinical Commissioning Groups (CCGs) that
15 act as devolved regional commissioning experts spread across the UK. These groups are
16 supported in the procurement process by Commissioning Support Units (CSUs) that are also
17 deployed on a devolved basis but do not align one-for-one with the CCGs. The CSUs act as the
18 centres for procurement expertise and thus a majority of the interviews and document requests
19 undertaken were with CSUs. The structure of the HSB is continuously evolving yet the
20 lifecycle approach bounds the organisation into segments based on function so these insights
21 are applicable beyond any future restructure. The organisational arrangement of units is novel
22 in that it is decentralised to local CCGs with procurement expertise partially centralised within
23 the CSUs associated with the CCGs in a non-uniform manner. A prominent factor that emerges
24 from this distribution is a tension between the various organisational sub-units. An internal
25 marketplace system allows the CSUs to 'sell' services to the CCGs which have a profound
26 impact on the relationship between internal organisational units. Specifically, the establishment
27 of a successful contract often relies strongly on interpersonal relationships between CCG and
28 CSU personnel, rather than being contingent on normative procedures alone. In addition, the
29 CCGs and CSUs have devolved powers to organise the practices as they see fit which is a cause
30 of inefficiency through a lack of overall control. There are a number of novel performance
31 management initiatives such as CQINs (Commissioning for Quality and Innovation) requiring
32 mandatory metrics in the HSB standard contract. However, the ICT infrastructure is
33 comparatively simplistic for sharing contract data. The lack of inter-unit coherence emerged
34 prominently as a result of adopting the lifecycle view.
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41 The LGSB case focused on the procurement activities of three local authorities (councils) in
42 the UK. The procurement departments procure on behalf of local front-line services such as
43 the fire service, refuse collection, local transport organisations, local infrastructure, social
44 facilities and some health provision. With some substantial variation year-on-year, the annual
45 budgets fall between £0.5 and £1.2 billion, with the majority being used on contracted services
46 and procured infrastructure. The local councils are treated as one single composite case owing
47 to similarities in their procurement practices and the comparatively consistent set of processes
48 observed. The characteristics codified under the organisational alignment theme diverge
49 significantly from the structures within the DSB and the HSB. Whereas these organisations
50 offer a hybrid structure consisting of centralised and decentralised elements, the local councils
51 are largely centralised both in terms of geography and organisational structure. Multiple
52 procurement functions are undertaken by significantly fewer staff. This is, in part, to be
53 expected owing to the relative differences in budget and organisational size. We observed
54 significantly higher dependence on extra-organisational communication, often in the form of
55 consultancy and collaboration. The communication between these parties is often ad-hoc and
56 contingent on the individual persons involved. Performance management practices are centred
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largely around the contract management aspects and aren't as prominent in other lifecycle areas as compared with the other cases. There are limited approaches to foster continuous improvement, and standard, off-the-shelf software packages are used. A number of contracting types are used aimed at sharing risk with collaborators. However, assessment tools are used without any formal risk profiling over time or policy guidance for risk management. In this case, the lifecycle approach showcases the disconnect across processes with few organising systems and procedures in comparison with the other cases.

The NSB operates across several geographically-dispersed sites. Its processes and procedures, encoded under the key themes, are unique amongst the body of cases in that they are connected and coherent across the varying sub-units of the organisation. From an organisational alignment perspective, the NSB operates a programme and project structure similar to the DSB, with each facility responsible for its own procurement. Its performance metrics are compiled across a centralised system that offers a consistent set of metrics and a bespoke interface to assess risk and evaluate supplier and project performance. The contracting processes use several novel approaches, notably cross-lot tendering and an innovative 'value transition point' for distributing contractor and organisational resources and responsibilities across different phases of a procurement lifecycle. Each of these approaches is directed and controlled by a uniform set of guidelines across the NSB's different projects. Cross-lot tendering allocates partial workloads to partner organisations and the value transition point provides a means of shifting primary ownership of a project to the contractor at the point when it is most capable of dealing with the risk. These processes were described as effective by practitioners. The 'learning from experience' system is also highly robust, enforcing documented explanations of variations from previous contracts, which then formed a body of well-organised knowledge that is used to guide all future projects. The lifecycle view is particularly effective at enabling comprehension of the NSB case as there is a high degree of formal procedural structure, and each process follows logically from the previous and onto the next.

4.3 Results of Cross-Case Analysis

A lifecycle map is constructed for each phase to assess the procedures and practices deemed relevant to the overall capability of the procurement process. The procedures and practices observed are thematically reduced into eighteen categories of procurement lifecycle capability (see table 2). The subordinate themes were derived from the abductive data maps. Each map highlights data points that aligns to one of the four key themes. The process involved coding each data point on a map as aligning with theme 1,2,3,4 or 0 (not relevant to key themes). These areas were then combined and discarded until a representative spread of key themes were apparent.

		DEFENCE (DSB)	HEALTH (HSB)	LOCAL GOVERNMENT (LGSB)	NUCLEAR (NSB)
Super-ordinate theme	Subordinate theme	Prevalence versus Perceived Effectiveness			
ORGANISATIONAL ALIGNMENT / GOVERNANCE FACTORS	Sub-contractor engagement	Low/High	Med/Med	Low/Not found	High/High
	Spread of organisational control	High/Low	High/Med	Med/Med	Med/Med
	Internal coherence / Communication	Low/Low	Med/Med	High/High	High/High
	Fit of normative and observed	High/Med	High/Med	High/High	Med/Med
	Geographical spread of stakeholders	High/Low	Med/Med	Med/Med	Low/High

PERFORMANCE MANAGEMENT	Quality filters and KPIs.	High/Low	High/Med	Low/Low	High/High
	Contractual techniques	High/Med	Med/Med	Low/Low	High/High
	Collaborative practice	Med/Low	Low/Med	Med/High	High/High
	Coherence of internal project control	Low/Low	Med/Med	High/Med	High/High
	Predictive analytics	Med/Med	Med/Med	Low/Low	High/Med
TECHNOLOGY MANAGEMENT	ICT system variety	High/Low	Med/Med	Low/Med	Med/High
	E-procurement systems	Med/Low	Low/Med	Low/Low	High/High
	Knowledge management systems	Low/Med	Med/Med	Low/Low	High/High
	Coherence created across organisations	Low/Low	Med/Med	Low/Not found	High/High
	Extra-organisational systems	Med/Med	Low/Med	Low/Low	Med/High
RISK MANAGEMENT	Use of avoidance/reduction transference strategies	High/High	Low/Not found	Low/Med	High/High
	Density of risk management practices throughout acquisition lifecycle	High/Med	Med/Med	Low/Low	High/High
	Risk reporting / Information gathering	High/Med	Med/Med	Low/Low	High/High

Table 2. Cross-case analysis

The assignment of the final determinations as to whether a process is High, Med or Low is principally a relativistic assessment within and across the cases and not an attempt to be an absolute typology. For example, the prevalence of sub-contractor engagement per procurement project in the NSB case is materially higher than it is in the HSB which in turn is materially higher than the DSB and LGSB (see table 1), whereas the effectiveness of sub-contractor engagement was regarded as being significantly better than the effectiveness of the spread of organisational control within the DSB based on the perceptions of relevant case interviewees (see table 1). Sub-contractor engagement was codified across 9 major processes along the procurement lifecycle within the DSB case, relatively few compared with the case set. These interactions were highly formal (ITTs etc) and based disproportionately in the latter stages of the lifecycle (8/9 instances during the In-Use, Contracting phases). This suggests a comparative opportunity to bring in engagement with sub-contractors earlier in the procurement process, and some opportunity for less formal interactions. This approach was deemed appropriate, however, and was not associated with any concerns at interview thus producing a relatively high perceived effectiveness. This seems to fit with the overall case trend of increased tendency to formalise procedures as complexity grows (normative isomorphism).

5. Discussion

Lifecycle mapping provides a practical approach to aid in the identification of categories of complex procurement situations. Processes are assessed against each of the four procurement lifecycle phases (Concept, Assessment, Procurement, In-use). This provides a solid basis for making relativistic statements about case divergences, and to better contrast the theoretical interpretations of the results. For example, Defence displayed a significantly higher prevalence for performance evaluation tools within the Procurement phase, whereas Health and Nuclear had significantly higher prevalence in the In-use phase.

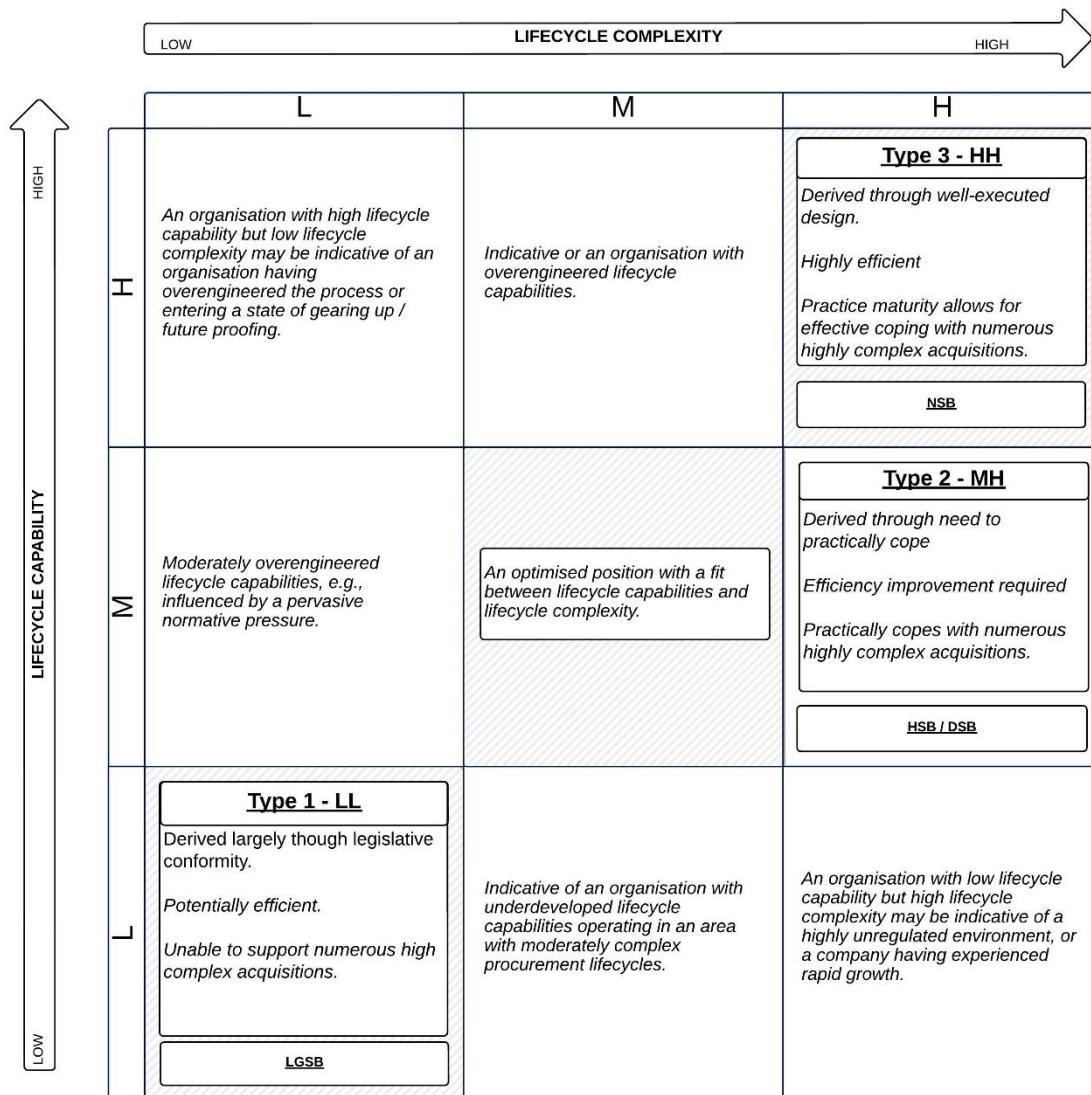
In making these determinations there is a necessary reliance on the judgement of both the research team in their view of the data and the senior personnel associated with the case. However, any absolutist determinations of the effectiveness of a given process would be near impossible in a complex system because a clear chain of cause and effect is extremely difficult to validate. For example, contract and performance management practices may appear to be effective viewed by their output, despite it being known that incorrect elements are being recorded and reported, masking an underlying flaw. The lifecycle approach and the use of the abductive data map is a critical tool in investigating this fuzzy, complex set of processes, particularly with regard to their interpretation. The total set of 16 qualitative data maps assist

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3 in guiding the empirical enquiry alerting the research team to knowledge gaps. The maps
4 present the whole lifecycle of processes in an accessible format and thus allow agency and
5 institutional theoretic interpretations of the data to easily reference the origins and
6 interrelationships between processes across a lifecycle. This mapping approach provides a
7 means by which the inherent complexity and systemicity (Williams, 2017) of the context can
8 be unpicked.
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11 We were able to identify process combinations distinct to each theme by using either agency
12 theory or institutional theory but the concurrent application of the two allowed for a clearer
13 delineation of the procurement practices. The detail of some of the agency and institutionally-
14 driven insights that help in understanding case differences would have been at a lower
15 resolution if they were not individually applied to each of the phases across the case set. While
16 the two theories produced different explanations for the characteristics of the buyers, these
17 explanations were entirely compatible, thus providing a richer picture of how complex
18 procurement practices vary across the lifecycles of different organisations.
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22 The mapping approach allowed us to propose a matrix of buyer types by relating procurement
23 lifecycle capability to procurement lifecycle complexity. Comparisons are made on the basis
24 of theoretically-driven reflections in order to define positions on the matrix (Figure 5). The
25 four cases occupy three of the matrix positions:
26
27

- 28 • Type 1 - LGSB. The LGSB operates in the least-complex context. Processes are often
29 created reactively (coercively) as a response to legislative pressure. There is a markedly
30 lower number of sophisticated procurement lifecycle capabilities (see table 1) yet the
31 introduction of more sophisticated capabilities would likely outweigh the benefits given the
32 comparative lack of lifecycle complexity. A type 1 organisation is likely to only be viable
33 if the complexity of its procurement demands do not increase. Its relatively limited
34 capabilities are appropriate to its context.
35
- 36 • Type 2 - DSB/HSB. Type 2 organisations are positioned off the lifecycle capability-
37 complexity diagonal and behave sub-optimally. They are typified as ‘practically coping’
38 with the highly-complex demands on their procurement systems. These organisations have
39 a high prevalence of sophisticated procurement lifecycle processes but their perceived
40 effectiveness is markedly less than other types. Processes are derived through a range of
41 mimetic, normative and coercive pressures to practically cope with the circumstances, and
42 are not necessarily the most effective to satisfy the underlying need. Explaining why one
43 process is in place as opposed to another is often difficult.
44
- 45 • Type 3 - NSB. The type 3 organisation’s lifecycle capabilities are derived from a purposeful
46 and deliberate design effort. The reasons for process and practice adoption are easily
47 explained and the logic is clear. These organisations have both a high level of process
48 capability and reported effectiveness. The system is able to cope with diverse and highly-
49 complex procurement requirements.
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KEY: Shaded = Optimum positioning

Figure 5. Types of complex procurement situations

The matrix is intended not as a single figure summary of the findings or theoretical contributions of this work, but rather as a visualisation to aid in understanding the implications of the work. The matrix offers an insight into future research by depicting the cases on a matrix of lifecycle capabilities versus lifecycle complexity, positing that there could be many additional organisational types incorporated into this model after undertaking further empirical work. The key contribution here is the conceptual framing rather than an exhaustive typology of organisational archetypes.

The cases were analysed by invoking the institutional and agency-theoretic views that accounted for the differences across the cases in conjunction with the thematic comparison. A key contribution of this paper is the use of a lifecycle framework as a methodological tool allowing for the concurrent application of theory to unique phases in a lifecycle across a range of themes. Considering the lifecycle in this way facilitates comparisons across the cases yet enables exploration of the processes that are unique to each phase. Whilst both theoretical viewpoints offered some explanatory power, institutional theory proved particularly effective in the exposition and assessment of the Concept, Assessment and In-use phases. In contrast,

agency theory was instructive in evaluating the Technical Procurement activity, given its naturally-defined principal and agent in the form of the case organisation and contractor.

The institutional lens revealed that the processes adopted across the case-set are distinctly different. In Type 1, the adoption of particular processes was driven explicitly by the coercive pressure to conform to legislation (for example, Official Journal of the European Union) and other government guidance. Whilst not the exclusive pressure, this is a clear driver of the majority of processes. In the case of the Type 3 organisations, processes across the lifecycle are driven by a range of normative and mimetic pressures. The NSB case exhibits strong, normative isomorphisms which are present across a majority of its processes. For example, the management of contractual risk is tightly controlled. Normative pressures for rigorous control filter through to commercial and procurement practices. Equally, there is a tendency for the mimetic pressure to lead to a diffusion of innovation, as practitioners are quick to adopt proven practices for providing positive outcomes. The Type 2 organisation is driven by a significant range of coercive pressures, understandable in the contexts of health and defence both being tightly-governed sectors. Informational asymmetry and sensitivity to isomorphisms in procurement system design were key factors in differentiating the systems of Type 2 and Type 3 organisations. While both possess significant lifecycle complexity, theory-driven insights demonstrated a clear distinction between the alignment of lifecycle capability and lifecycle complexity. The agency theory perspective also reveals conspicuous variances across the different categories. The Type 1 organisation is typified by a reluctance to manage and control contracts beyond the initial procurement. Consequently, the effect of information asymmetry is amplified, which causes these organisations to be susceptible to agents providing non-optimal outcomes. In contrast, the Type 3 organisation specifically attempts to address information asymmetry in contracting through a variety of initiatives. These two explanatory theories suggest that organisations that concentrate on outcomes, information sharing and coherence tend to be more effective buyers than those that focus on addressing the coercive pressures enforced by legislation.

While we propose a holistic framework for comprehending the whole complex procurement lifecycle in diverse industries based on a capability/complexity assessment, there are other industry specific frameworks using different criteria for assessment in sub-areas such as 'contracting'. A prominent example in the military context is Performance-Based Logistics (Glas *et al.*, 2013) but such a consideration is out of scope for this paper but may have synergies in industry-specific initiatives in the future. Equally, the focus of this research is to define the most 'complex' procurement projects within an organisation, accepting that there will be procurement projects within a complex organisation that are amenable to a simplified procurement process and so multiple strategies and process-sets may sit alongside the most complex (see Elstrom *et al.*, 2020). This matrix is for use in defining the upper bounds of the capability and complexity dimension.

6. Conclusion

This research provides new insights concerning the state of complex procurement capabilities in public-sector organisations. It demonstrates that organisational capabilities, practices, policies, tools and techniques are varied and have significant scope for improvement. Complex public-sector buyers have been shown to have common processes but highly-variable process capabilities. Certain processes and systems are profoundly more impactful than others, namely,

learning from experience, risk profiling and risk sharing, scenario planning, dynamic flexible contracting procedures and tightly controlled and standardised practices. A mastery of these capabilities leads to a marked increase in the ability to operate effectively. This finding provides a strong rationale for organising future strategic development focused towards these capabilities over others and is of interest to researchers looking to further discern the optimal process arrangement for complex public-sector buyers, and expand and critique the categorising of complex buyers provided here. It also has important implications for practice and will be of use to senior executives of public buyers in planning future capability investment. This matrix in conjunction with the set of 18 themes allows practitioners and managers to assess where their capabilities may be amenable to improvement by making more focused comparisons with other complex buyers. These insights can frame discussions around where potential value-adding capability may be derived and direct future efforts and further research to investigate the capabilities of complex buyers. Furthermore, managers can use the matrix (Figure 5) as an accessible heuristic to consider the suitability of their own procurement practices.

In summary, the contributions of this article are threefold: firstly, a method for making qualitative assessments of the procurement lifecycles of complex buyers; secondly, a thematic architecture to better understand complex procurement practice; finally, a matrix of public-sector buyer types where procurement effectiveness is shown to be contingent on the convergence of procurement lifecycle complexity with procurement lifecycle capability.

As is indicative of in-depth qualitative research, generalisability cannot be guaranteed beyond the case-set explored here, and therefore is a limitation of the study. Additionally, four cases do not provide sufficient breadth to identify all common characteristics of complex public procurement organisations. It is our hope that researchers examine complex procurement effectiveness and complex procurement arrangements in a wider variety of contexts, utilising research designs that address the limitation of this first but important step in reinvigorating complex public procurement research.

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A Lifecycle Analysis of Complex Public Procurement: An Agency-Institutional Theory Perspective

Abstract

Purpose: The study sets out to demonstrate how a lifecycle perspective on complex, public-sector procurement projects can be used for making qualitative assessments of procurement policy and practice and reveal those procurement capabilities that are most impactful for operating effectively.

Design/Methodology/Approach: Agency theory, institutional theory and the lifecycle analysis technique are combined to abductively develop a framework to identify, analyse and compare complex procurement policies and practices in public sector organisations. Defence is the focal case and is compared with cases in the Nuclear, Local Government and Health sectors.

Findings and practical implications: The study provides a framework for undertaking a lifecycle analysis to understand the challenges and capabilities of complex, public-sector buyers. Eighteen hierarchically-arranged themes are identified and used in conjunction with agency theory and institutional theory to explain complex procurement policy and practice variation in some of the UK's highest-profile public buyers. Our findings provide a classification of complex buyers and offer valuable guidance for practitioners and researchers navigating complex procurement contexts.

Originality/Value: The lifecycle approach proposed is a new research tool providing a bespoke application of theory by considering each lifecycle phase as an individual but related element that is governed by unique institutional pressures and principal-agent relationships.

Keywords: Procurement lifecycle analysis; Procuring complex performance; Complex procurement; Agency theory; Institutional theory

Paper type: Research paper

1. Introduction

This paper concerns public-sector procurement, an area where there are increasingly very large amounts of funds flowing through complex projects (Infrastructure and Projects Authority, 2023) yet systemic weaknesses in public procurement policies and practices persist (Barrett, 2016; Calvo *et al.*, 2019; Casady *et al.*, 2023). A plausible but under-studied explanation for this is the inherent difficulty in investigating such a complex area and the lack of an accessible toolkit for researching complex procurement domains. By their nature, complex procurement projects, like all complex systems, are difficult to investigate empirically. The purpose of this paper is to utilise a lifecycle approach to partition complex procurement systems into investigable phases in order to help overcome the difficulty of undertaking meaningful empirical work, and provide contextually-appropriate comparisons across different procurement systems, elucidating relative policy, practice and performance variances and revealing the most impactful capabilities for operating effectively.

The unique focus of this paper is the use of the concept of lifecycle to examine complex procurement processes. Our premise is that all processes associated with a complex procurement project are constrained or enabled in their effectiveness by the lifecycle within which they are embedded and the procurement processes' appropriateness are largely determined by their integration into the overall lifecycle rather than as functioning standalone elements. Therefore, we investigate the wide range of concepts captured by Procuring Complex Performance (PCP) (Caldwell *et al.*, 2009; Spring and Araujo 2014; Santos and Cabral, 2022) and Complex Product Systems (COPS) (Davies and Hobday, 2005; Raddats *et al.*, 2016) as a-priori areas of interest from a lifecycle perspective in order to provide an integrated understanding of the phenomena and inform Operations Management researchers and practitioners. We use the term 'complex procurement', defined by Lewis and Roerich (2009), as "*inter-organisational arrangements that are characterised by significant levels of performance complexity (i.e. must include numerous knowledge intensive activities) and infrastructural complexity (i.e. must include substantial bespoke or highly customised hardware and software elements)*" (Lewis and Roerich, 2009, p.2).

Theoretical lens

Our research findings are interpreted using a combination of agency theory and institutional theory. In this context, agency theory defines the explicit arrangements between two parties, for example, buyer (principal) and seller (agent); institutional theory defines the origins of emergent practices (isomorphisms) within institutions (Eisenhardt, 1988). The complementary nature of the theories is used to provide a robust examination of buyer-supplier relationships in complex procurement projects. The validity of this approach has been widely cited in a range of contexts (Kuhn, 1970; Clark, 1984; Stiles, 1993; Choi and Wacker, 2011), with some literature employing both agency theory and institutional theory concurrently (Eisenhardt, 1988) but, in a departure from Eisenhardt (1988), the purpose of our invoking the two theories is not to generate hypotheses from the two viewpoints but to use both viewpoints as a means to derive a comprehensive set of interrogatable constructs that codify meaningful strategic practice within buyer-supplier relationships and their associated governance processes. Each theoretical lens offers a different explanatory perspective over different phases of the procurement lifecycle. In order to understand lifecycle procurement, we leverage the concepts

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3 from both a-priori categories of interest (PCP, COPS) to inform our understanding of each
4 lifecycle phase.
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6 **Figure 1.** Theoretical positioning
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8 Figure 1 illustrates the relative positioning of applying each theory to different phases of the
9 overall procurement lifecycle. In the technical procurement (contracting) phase, there is a
10 distinct principal (contractor) and a distinct agent (supplier). Thus, the organisational processes
11 of the principal are naturally examined with reference to the agency-theoretic factors such as
12 information asymmetry, power dynamics, risk aversion and self-interested behaviour
13 (Eisenhardt, 1989), whereas within the concept and assessment phases, the stakeholders with
14 direct effect over process creation are largely internal ones, with some external influencers.
15 This does not suggest a principal-agent relationship, however, it may be interrogated through
16 an institutional-theoretic perspective, with a number of mimetic, normative and coercive
17 isomorphisms being readily apparent. Processes and capabilities developed within the front-
18 end phases are influenced by principal-agent phenomena but are more directly influenced by
19 institutional pressures such as organisational standards, government and legislative standards,
20 mimetic pressures from non-similar industries and the unique normative pressures of the
21 organisation.
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26 Williams (2017) introduced the term ‘systemicity’ within complex projects - a concept that
27 refers to the difficulty in establishing a clear line of causality within complex settings because
28 actions and results cannot be observed in isolation. This is addressed by the concurrent
29 application of agency theory and institutional theory, thus artificially bounding the limits of
30 what is to be considered to be within a single lifecycle phase, reducing the inherent complexity
31 that theory is attempting to explain. The combination of these theoretical perspectives rooted
32 in a lifecycle view offers a novel approach to address the inherent difficulty in researching
33 complex settings.
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36 Partitioning the overall procurement lifecycle into its conceptually and practically distinct
37 elements (Concept, Assessment, Procurement, In-Use) provides three advantages over
38 perceiving the process as a whole. Firstly, cross contamination of irrelevant data from one
39 phase with different objectives and skill-sets to other phases is avoided. For example, a tight
40 control of performance metrics might be prohibitive in the Concept phase but best practice in
41 the Procurement phase. This partitioning helps address the inherent systemicity problem in
42 complex procurement systems by reducing the ambient complexity at the point of initial
43 analysis (Williams, 2017). Secondly, research can derive more comparable data across cases,
44 allowing for the characteristics of one phase to be considered in opposition to the same phase
45 in a different case. This provides more actionable insights, reducing the risk of insights being
46 overly generic. Thirdly, the concurrently-applied theories can be better tailored, allowing the
47 capabilities of both to be applied to the unique phases thus offsetting the weaknesses of each.
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52 This work seeks to achieve the following objectives:
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- 54 • use the lifecycle concept to develop an approach capable of making qualitative comparisons
55 of organisations buying in complex contexts;
- 56 • contribute to knowledge in designing and managing procurement systems in complex
57 domains;
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- contribute to the empirical body of knowledge concerning complexity in public procurement by providing the ‘state of practice’ across some of the UK’s highest-profile public buyers.

The remainder of the paper is structured as follows: firstly, a review of relevant literature is undertaken, its results are then presented and organised around the key themes used to guide the lifecycle investigation as a list of a-priori constructs. Next, the methodology and results are presented. Lastly, we discuss the emergent categories of complex procurement situations and the implications for practice and future research.

2. Literature Review

The literature review comprises three components adapted from systematic approaches by Denyer and Tranfield (2009) and Colicchia and Strozzi (2012). First, there is a general narrative review in order to establish the relevant topics, second is a systematic component used to identify papers that acutely fit the areas of interest, the papers from which are used to inform the protocol and the concepts under investigation establishing a foundation of key authors and concepts that ‘snowball’ into an in-depth, third-stage, concept review.

2.1 The Lifecycle View

Variations on the lifecycle concept have been used in a number of related fields, for example, organisational change (Van de Ven and Poole, 1995), infrastructure procurement performance (Prasad, 1999), maintenance (Tsutsui and Takata, 2012) and supply chain agility (Roscoe *et al.*, 2020). The lifecycle concept is often used as an analogy to the biological context of a developing organism. It is this same analogy that applies within this paper:

“The typical progression of change events in a life-cycle model is a unitary sequence (it follows a single sequence of stages or phases), which is cumulative (characteristics acquired in earlier stages are retained in later stages) and conjunctive (the stages are related such that they derive from a common underlying process). Each of these events contributes a piece to the final product, and they must occur in a prescribed order, because each piece sets the stage for the next.” (Van de Ven and Poole, 1995:515).

The above quotation underpins the fundamental logic of investigating a complex operations management phenomenon through a lifecycle perspective, where each functional practice such as governance, contracting or procurement is interrelated along a linear timeline, initiated and refined at different stages and influenced by different pressures. Developing an in-depth understanding requires that these factors be observed in relation to each other. This concept has precedence: within the context of organisational change, lifecycles have been used to show how change is *“mediated by the immanent logic, rules, or programs that govern the entity’s development”* (Van de Ven and Poole, 1988, p. 37). This study considers that these rules change starkly depending on the procurement phase, and so each phase of a lifecycle with its unique set of pressures and objectives should be considered in sequence (Santos & Cabral, (2022). A similar point is made by Liu *et al.* (2018), within the context of infrastructure procurement, who recommend that it is necessary to understand an even wider lifecycle view that accommodates the antecedent processes prior to the formation of a business partnership and through to its subsequent servitised phases. This variation on the suitability of competencies and capabilities across lifecycle phases is also discussed by Aaltonen and

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3 Turkulainen (2018), but from a perspective of relational capital which in turn dictates
4 appropriate governance mechanisms. This breadth provides the capability to understand the
5 range of interdependent contextual elements at play.
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8 From a theoretical perspective, each phase of a complex procurement lifecycle has a different
9 set of institutional isomorphisms (Eisenhardt, 1988) that influence process formation. In early
10 phases, these may be largely internal pressures, in later phases they may be heavily influenced
11 by legislative compliance or external pressure. This provides an opportunity to cross examine
12 each phase using a combination of theoretical viewpoints demonstrated here through the
13 concurrent application of agency theory and institutional theory.
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15 16 2.2 COPS and PCP

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18 COPS pertain to large-scale, capital-intensive projects often based in highly-servitised,
19 manufacturing-intensive contexts such as Defence. PCP is concerned primarily with the
20 procurement activity of organisations operating within COPS environments. The PCP literature
21 acknowledges a number of interacting phenomena that define the problem landscape such as:
22 oligopolistic supplier environments (Caldwell and Howard, 2014), product and service
23 bundling (Stremersch *et al.* 2001), extended servitised product lifecycles (Wieland *et al.*, 2017)
24 and diverse performance-based contracting (Hypko *et al.*, 2010). PCP was described
25 extensively by Lewis and Roehrich (2009) who referred to it as “inter-organisational
26 arrangements that are characterised by significant levels of performance complexity and
27 infrastructural complexity”. The notion of performance complexity in this context can be
28 thought of as the interrelatedness of knowledge-intensive activities required to ensure an
29 effective outcome to relevant parties (Wieland *et al.*, 2017). This definition keeps PCP broadly
30 aligned to the classification of COPS proposed by Ren and Yeo (2006). Infrastructural
31 complexity refers to the systemic complexity in the tools, processes, infrastructure, and
32 technologies required to execute any particular action (Brady *et al.*, 2005). PCP in a servitised
33 environment is a concept that straddles the traditional view of both procurement and
34 outsourcing and can be described from either perspective. It is principally the procurement of
35 goods and services within the domain of COPS. COPS typically deal with highly-integrated
36 and complex asset and service acquisitions but does not cover procurement specifically, rather
37 focusing on innovation. Technical complexity necessitates that COPS and PCP require
38 competencies more closely aligned to strategic outsourcing than to high-throughput
39 purchasing. The lifecycle view of procurement is critical to PCP, as major procurement projects
40 in complex environments mimic the complexity and practices observed within megaprojects,
41 where it is understood that a whole lifecycle perspective is necessary (Gil and Fu, 2021).
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48 We propose that there is an interplay between contract management (Bloomfield *et al.*, 2019),
49 relationship management (Roehrich *et al.*, 2019, 2020; Kalra *et al.*, 2021), project management,
50 procurement (Chen *et al.*, 2022), governance and performance management (Bourne *et al.*,
51 2018; Haq *et al.*, 2018; Kapsali *et al.*, 2019) that can only be understood through an analysis
52 of the entire procurement lifecycle. Focusing on only a subset of these factors omits the
53 emergent properties of the complex procurement system. In previous work, research has often
54 focused on one or a small number of dimensions of complex environments (see Caldwell and
55 Howard, 2014). This research attempts to perceive the process holistically.
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2.3 Key areas of interest from the literature

While the mechanics of the literature review are not the key contributing element of this paper, a review is a necessary first step required to identify a-priori areas of interest to focus the empirical aspect (see section 3.2 – *Empirical research design*). An initial narrative review used an iterative back and forth process of mind mapping and keyword searches to reveal a comprehensive set of papers relevant to complex procurement lifecycles which consisted of 31 highly-relevant articles. These articles were categorised in accordance with their conceptual coverage, and were used to derive a synthesis of key areas which were subsequently explored during data collection and analysis. These areas were identified by applying an agency and institutional-theoretic view to the emergent set of concepts featured in this body of literature. The content of the articles was analysed using NVivo and the key concepts were identified, separated and combined through thematic reduction (Miles *et al.*, 2019) into their different lanes ascribed to agency theory and institutional theory until four areas emerged as a consolidated representation of the relevant concepts. The third and final phase of this approach utilised a snowball review to update the literature with the latest relevant research. The final outputs are four superordinate themes that were used as the primary input to the empirical enquiry. Two of the four themes – risk management and performance management - aligned closely with the explanatory frame and properties attributed to agency theory such as the presence of a natural principal (buyer) and natural agent (buyer); and two – organisational alignment and technology management – aligned closely with institutional theory interpreted by their more internal properties derived from a process of evolving professionalisation over time.

Each of these superordinate themes and their relationships to agency theory and institutional theory are discussed with reference to previous applications.

2.4 Key Themes

Theme 1 - Organisational Alignment

Organisational alignment concerns the intra-organisational arrangement of governance structures, individuals and teams that constitute the procurement function and its extra-organisational relationships with partners, suppliers and governing bodies. It is an amalgam of concepts broadly viewed as ‘how the system is set up’. Previous research has examined organisational alignment for the enhancement of organisational capabilities to learn from experience and to accumulate knowledge over time (Bresnen and Marshall, 2000; Brady *et al.*, 2005), and for the development and exploitation of tangible and intangible relationship-specific assets (Dyer and Singh, 1998). Intangible assets propagate a common normative context through which organisations can enhance the efficiency of any collaborative undertaking (Seal and Vincent-Jones, 1997) and organisational alignment and relationship structures are vital intangible assets. Organisational alignment also acts as a proxy for infrastructural complexity as discussed by Lewis and Roehrich (2009) and Hartmann *et al.* (2014), as it encapsulates the processes that relate to how organisations and their supply chain partners are organised in terms of their governance structures and coordination mechanisms. Numerous papers point to the importance of coordination efforts through structural choice in hierarchical arrangements (Johnsen, 2009; Tate and Ellram, 2012; Tanskanen, 2015). Roehrich *et al.* (2020) discuss the need for research exploring the emergent asymmetries of combining organisations with different organisational structures.

Theoretical View

The concurrent application of agency theory and institutional theory allows each key theme to be interrogated in a bespoke fashion juxtaposing the insights from both theoretical viewpoints within lifecycle phases. The lifecycle view allows us to consider the intra-organisational governance practices that form as a result of specific institutional pressures that are at play during intra-organisational negotiation, but to also differentiate these from the pressures at play at points earlier in the lifecycle. Agency theory can and has been used to examine the inter-organisational relationship used by the principal to control the agent (supplier) (Shevchenko *et al.*, 2020) but can also be exercised in earlier phases to examine how internal actors structure their relationships.

It has already been noted from an institutional theory perspective that organisational practice and, critically, 'organisational structure' become isomorphic over time (Eisenhardt, 1988). Therefore, the normative pressure to support the acquisition process leads to practices that are legitimate but not necessarily efficient (Meyer and Rowan, 1977; Tolbert and Zucker, 1983). Equally, the organisational practices inherent in supply chain partners may cause a coercive effect on the behaviour of the organisation. To meet these expectations, structural changes may occur internally. Organisational structures necessary to support complex procurement capabilities are regarded as largely non-transferable between contexts. Thus, from an institutional theory perspective, there is no 'institutional blueprint' from which to extrapolate an appropriate structure. Institutional theory reveals that isomorphisms form over time (Eisenhardt, 1988), yet with each complex acquisition being partially unique such norms continue to be established. An exploration of the variation of organisational alignment between the case organisations is therefore critical in building a profile of organisational types, and in suggesting effective pathways to improvement.

Theme 2 Contract and Performance Management

Contract and performance management concerns the set of activities used in identifying, undertaking, assessing and monitoring the effectiveness of internal and external processes. It is related to the previous theme, as performance management works most effectively when embedded within an appropriate governance structure (Yong, 2010; Bourne *et al.*, 2018). The role of governance mechanisms on performance is a persistent theme in the literature yet is still considered underdeveloped: "Further studies should explore the possible influence of institutional legal and cultural contexts on the relationship between governance mechanisms and performance" (Roehrich *et al.*, 2020, p. 459). Performance systems have attracted attention from scholars interested in both public-private partnerships and the lifecycle of such arrangements (Caldwell and Howard, 2010; Liu *et al.*, 2018). The literature also points to the need to understand contract performance more generally and performance management has been noted to be a fundamental component of contract management and the effective through-life-management of an asset (Bititci *et al.*, 2012). There is no general consensus on how to best manage performance in this field but researchers have noted the importance of developing appropriate metrics and applying them to contracting frameworks within the context of the unique and complex public-sector domain (Brown *et al.*, 2018).

Theoretical view

The utility of each theory changes across a lifecycle as each phase consists of different processes seeking different outcomes with different measures applied. From an institutional

theory perspective, the performance tools applied in the early phases of the procurement lifecycle are informed more directly by mimetic isomorphism to mimic the metrics applied elsewhere in the organisation or within the industry (Eisenhardt, 1988). While there is a range of institutional pressures applied at the point of a formal outsourcing relationship, earlier phases may have some institutional pressures (Silvestre, 2015; Wu and Jia, 2018) leading to a significant difference in the approach to performance management.

The contract and the various mechanisms embedded within the contract are the central means through which the buying organisation (principal) brings to bear control of the supplier (agent). There is significant precedence in the application of agency theory to exploring this relationship (Eisenhardt, 1988; Sumo *et al.*, 2016; Odongo *et al.*, 2019). The existence of performance measures within earlier lifecycle phases can be interpreted through an agent model to demonstrate how internal control is exerted. In each case, agency theory may be used to derive a complementary explanation of the performance management system when juxtaposed with institutional theory, providing a more robust rationalisation.

Theme 3 - Technology Management

This theme concerns the arrangement of information systems used to support complex procurement processes. The literature highlights the unambiguous importance of technology management in the execution of effective procurement practices with some researchers highlighting the importance of particular sub-categories such as knowledge management (Roehrich and Lewis, 2014; Gobbi and Hsuan, 2015; Schniederjans *et al.*, 2020), e-procurement systems (Chen *et al.*, 2022) and extra-organisational collaborative systems (Liu *et al.*, 2016; Aben *et al.*, 2021). Systems integration and the mechanisms for exchanging information have long been recognised as core capabilities for the execution of successful, complex projects (Davies and Hobday, 2005). This theme relates to theme 1 in that information systems are a means of enabling collaboration through the coordination of information across partnerships (Howard *et al.*, 2019; Roehrich *et al.*, 2019; Kalra *et al.*, 2021). Hagel and Brown (2005) conceived the notion of process orchestrators within extended supply chains to describe those organisations which account for the majority of the organisational effort. Given any coordination effort will be technologically mediated, an exploration of the technology functions is used as a proxy to understand the process of network orchestration.

The literature suggests that there are categories of ICT use that typify highly-capable procurement systems. An example is the 'learning from experience' system. This function is often cited within the literature as a key component of competitive advantage, leading to what Davies and Brady (2000) have called 'economies of repetition' in undertaking complex procurement capabilities. Juxtaposing the different technological capabilities and interpreting these capabilities through both theories offers a means of understanding the variation in the application of technology.

Theoretical View

Given the prevalence of ICT within organisational processes, the coercive, normative and mimetic pressures to adopt systems through 'legitimacy' and not 'efficiency-seeking' behaviours strongly impact technology adoption (Eisenhardt, 1988). Consequently, previous works often employ institutional theory in explaining the adoption of technologies relevant to the procurement lifecycle process e.g. SCM technologies (Liu *et al.*, 2010), e-commerce

(Huang *et al.*, 2010), and auto-tagging technologies (Barratt and Choi, 2009). Agency theory also has an impact in the selection of technology management as a superordinate theme and positions information asymmetry between the principal and the agent as a core consideration in defining a contract (Eisenhardt, 1989).

Theme 4 - Risk Management

Risk management was prominent in the initial loading of superordinate themes. In this context it concerns the means by which buyers of complex goods and services identify, analyse and manage internal and external uncertainty. Risk management is of critical importance to the successful execution of large-scale projects and complex procurement projects (Johnsen, 2009; Caldwell and Howard, 2010; Roehrich and Lewis, 2014; Gobbi and Hsuan, 2015; Mahapatra *et al.*, 2017) and is prominent in the contracting relationships of complex procurement projects, with risk aversion often cited as the deciding variable in the selection of contract type (Kapsali *et al.*, 2019). Risk underpins the governance, performance and technology-related themes which may be regarded as the 'levers of control' that can be used to help manage risk (Simons, 1994). Understanding the interplay of these factors on risk has been called for in recent literature (Roehrich *et al.*, 2020).

Within COPS environments, the economic and organisational burden of sharing and managing risk requires alliance partners to garner trust, generate effective information sharing mechanisms and possess a mutual sense of accountability (Mayer and Argyres, 2004; Dyer and Singh, 1998). Uncertainty and risk are deemed critical in the examination of the process along the entirety of the procurement lifecycle (Caldwell and Howard, 2010).

Theoretical view

Agency theory has been used to examine risk in public-private partnerships, governance structures, performance management and contracting relationships (Zsidisin and Ellram, 2003; Haq *et al.*, 2018; Bloomfield *et al.*, 2019). Institutional theory is applied more generally to the risks faced in complex contexts (Park *et al.*, 2014) proving to be a valid lens in examining similar contexts such as megaprojects (Biesenthal *et al.*, 2018) and the effect of governance practices on change (Badewi, 2016). Institutional theory allows us to understand the motivations behind the emergence of risk management practices (Eisenhardt, 1988) within the context of a particular lifecycle phase. We are therefore able to interpret the emergent process in accordance with the varying pressures innate to each phase, and derive a more insightful map of how these pressures manifest over time.

3. Research Design

3.1 Abductive data maps

The abductive data mapping technique, inspired by the Zachman framework (Lapalme *et al.*, 2018), organises qualitative data along a chronological map of processes, in this case using the procurement lifecycle of each case organisation. Data is recorded according to lifecycle sequence with a separate map constructed for each major phase of the lifecycle (Concept, Assessment, Procurement, In-Use). In order to scrutinise each phase, the researcher ensures a series of primary interrogatives are addressed (what, why, when, where, who, how) (see Figure 2).

Figure 2. Abductive data map example

The original Zachman framework has traditionally been used within information systems' research but is often adapted to operate in a variety of contexts (Neaga and Harding, 2005; Hernandez *et al.*, 2014). The method relies on building up a picture of a system by taking multiple perspectives, making it particularly suitable for qualitative research utilising data triangulation. Data is summarised as responses to the primary six questions (vertical axis) and coded against any of the four themes to which a particular data point pertains. Furthermore, each data point is associated with relevant documents (shown as A, B, C). Nvivo was used in conjunction with the maps in order to organise the empirics. Each case study has four of these templates to organise the data, one each for the Concept, Assessment, Procurement and In-use phases. This provides the cradle-to-grave view of the entire procurement lifecycle.

The "What" question is often the title or description of an internal process. This may, for example, be the identification of a procurement request. The framework then encourages the researcher to continue scrutinising this process until all six questions are answered. The "When" question could concern procurement requirements being issued as and when a need arises, or in accordance with an annual budget. After all queries are answered, the framework prompts the researcher to query the next process in the lifecycle. After a first iteration, any omissions in the data sheet become conspicuous and can be queried in subsequent interviews or document analysis. Additionally, data points are coded in accordance with the a-priori themes and the original data sources are referenced on the diagram (as shown in figure 2).

Organising qualitative research in this way is exceedingly time-consuming but provides three key advantages that are particularly important in this context: (1) the researcher is prompted to follow up if any of the six questions is left unanswered ensuring a breadth of knowledge is captured (i.e. it is a dynamic data collection method as well as an analysis tool); (2) the researcher can more easily compare the bigger picture of procurement lifecycle practice across case organisations, as the whole picture is presented in a comparable fashion prompting further enquiries if there are conspicuous divergences; (3) individual processes cannot be separated from their surrounding context providing the researcher with the means to facilitate the exploration of contextual depth.

3.2 Empirical research design

The empirical research design (see figure 3) comprises a number of different elements to explore the complex procurement lifecycles of the four selected UK cases: a major defence sector buyer (DSB), a major health sector buyer (HSB), a nuclear sector buyer (NSB) and a grouping of local government sector buyers (LGSB). The four key themes are used to inform the case study enquiry by broadly defining the interview topics, which in turn help identify relevant interview participants, organisational sub-units and relevant documentation. It is this iteration that defines the abductive design (Shani *et al.*, 2020) as insights are developed, revised and re-revised in continuous consultation with emergent data (Dubois and Gadde, 2002).

Cases were selected based on their adherence to Davies and Hobday's (2005) definition of complex product systems. Their list of complex organisation characteristics was used to inform our case selection. Abductive data mapping was used to guide both interviews and document analysis (Eisenhardt and Graebner, 2007; Yin, 2014) and the application of the lifecycle approach revealed data omissions throughout the procurement process. These omissions are clarified in a secondary data collection stage. With each data collection, the theory and empirics

are re-evaluated in the light of new evidence thus bringing the empirics and theory into closer alignment as more of the lifecycle maps are compiled. After completion of the cases, a cross-case analysis was undertaken, and the resulting thematic architecture was used to modify the case study protocol to include those emergent themes not included in the abductive iterations.

3.3 Data collection

The nature of abductive research is typified by engagement, analysis, and then re-engagement, repeated until saturation of a line of enquiry. This entailed forming enduring relationships with key interview participants with the data mapping reaching a state of increasing completeness after each re-engagement. The data mapping, therefore, functions as the principal means of coding from which theoretical saturation is derived. As an example, in the DSB case, 12 staff were interviewed and, for most individuals re-interviewed, over a four-year period. While each case company's hierarchy of procurement personnel was different, interviews were primarily undertaken with the personnel occupying equivalent positions to those shown in Table 1

Table 1. Procurement personnel interviewed

Figure 2 illustrates generically how quotes from interview transcripts and content from documents are coded for specific lifecycle positions and against specific themes in the data map. Worked examples can be seen in the Findings section of the paper. Each of the remaining cases were undertaken over a period of a single year with between 4 and 6 people interviewed.

3.4 Data analysis

The data analysis step concerns the thematic reduction of qualitative data (Voss *et al.*, 2002; Miles *et al.*, 2019). Whereas traditional thematic analysis involves the creation and re-creation of themes from case data, an abductive approach requires re-engagement with primary data sources during this analysis process (Dubois and Gadde, 2002). Therefore, the bulk of the data analysis is sub-divided into four components: (1) the first is referred to by Eisenhardt (1988), as the 'within-case' analysis and acquaints the researcher with the case organisation as a single and separate activity so as to allow the distinctive properties of that case to emerge (Barratt and Choi, 2009); (2) the second component is also 'within-case' and involves re-interviewing participants in order to fill any gaps identified by the abductive data mapping; (3) the third component is the cross-case analysis, the purpose of which is to compare and contrast the individual insights of cases across the body of cases to derive further insights applicable to the group (Ketokivi and Choi, 2014); (4) the final aspect of the analysis codifies each emergent thematic category according to 'prevalence' and 'perceived effectiveness', two cross-cutting themes derived by making comparative judgements across cases. Encoding is undertaken using a simple denotation of High, Medium (Med) or Low. These categories are comparative rather than absolute and, therefore, relevant only to this case set. The purpose is to provide relativistic statements to quickly unpick variances across the cases rather than to provide a universal typology of what is High, Medium or Low. The variances are the key phenomena of interest as these differences allow us to differentiate types without losing the nuance of the cases through the use of a rigid typology. In making a determination for each of the cross-cutting themes, we repeatedly triangulate several pieces of data. For 'prevalence', we consider the number of processes, the interconnectivity of the processes and the variety of actors and sub-units involved in the processes in order to make a relativistic judgement regarding the prevalence of that theme within that case in relation to other cases. For 'perceived effectiveness', we refer to two primary sources of information: the first is an analysis of the

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3 sentiment with which processes are described by participants in the primary data; secondly,
4 senior personnel are asked to rate the overall effectiveness of a process grouping (for example,
5 contractual techniques) during a final round of interviews. Once we established a set of themes,
6 cases are compared across each of the lifecycle phases and the results interpreted.
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9 The iterations involved here were extensive and rigorous as each map contains six reference
10 points (What, How, Where, Who, When, Why) each of which links to various primary data. In
11 the focal DSB case, this required working closely with staff within the organisation for
12 sustained periods of time with multiple additional supplementary interviews and document
13 analyses required in order to amass the evidence pertaining to all procurement processes across
14 all four phases.
15

16 17 **4. Findings**

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19 We investigated the procurement practices of each of the case organisations across each entire
20 procurement lifecycle. Whilst there are variances in the exact composition and length of the
21 steps of these lifecycles, each case could be generalised into four distinct phases, namely:
22 Concept, Assessment, Technical Procurement and In-Use. The approximate composition of
23 these four phases across the case-set is illustrated in figure 3.
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27 The research used lifecycle analysis and abductive data mapping to codify processes along a
28 linear lifecycle. The four a-priori themes (organisational alignment, performance management,
29 technology management and risk management) were used as inclusion criteria for identifying
30 key processes and to guide the enquiry. Across these four superordinate themes, eighteen
31 distinct, subordinate themes emerged. We first provide an overview of the DSB case and a
32 summary of the remaining cases, and then use the thematic structure to interpret the
33 implications of the whole case-set.
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36 **Figure 3.** Procurement lifecycle phases

37 *4.1 Case 1 – DSB*

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39 Figure 4 provides an excerpt of the DSB abductive data map in order to illustrate the details
40 and practicalities of mapping a case. Generalisations and redactions have been applied to
41 effectively showcase the approach in practice.
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44 **Figure 4.** Concept example Defence Sector Buyer (DSB)

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46 The abductive data map is an abridged version of one of six diagrams constructed for the DSB
47 case. The map arranges the key processes chronologically along the lifecycle and in doing so
48 links each process data point to empirical coding keys. The map is an interconnected web of
49 logically-organised qualitative data that allows the case processes to be viewable as a snapshot
50 and aids in theory building. This method of data collection and analysis has the advantages of:
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- 52 • considering processes in relation to other contextually-relevant processes (i.e. within.
53 concept, assessment, procurement and in-use phases);
- 54 • prompting identification of missing information to fill gaps in the map;
- 55 • better utilisation of interview time and engagement with practitioners as the maps are
56 partially compiled in real time.
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3 Defence is a well-featured sector in the complex procurement literature (Kalra *et al.*, 2021;
4 Bloomfield *et al.*, 2019) and studies of the Defence sector have helped to form the current
5 conception of PCP (Caldwell and Howard, 2010). The prominence of lifecycles and through-
6 life management in a military setting is significant, and so the context lends itself to the
7 lifecycle view and the abductive data mapping technique. Our outputs from the lifecycle
8 analysis are commensurate with this depiction of the DSB as a particularly relevant context for
9 the study of complex procurement capabilities. The DSB case has the highest number and
10 variety of processes used along the procurement lifecycle as well as having the most-varied
11 organisation structure in comparison to the other cases. The complexity of the lifecycle maps
12 created to depict the overall procurement process was significantly denser than the other cases,
13 involving more organisational sub-units and interconnected processes. Its procurement is
14 largely handled through its project arm which is organised into project teams that pursue large
15 procurement contracts but with a number of central areas of expertise such as Commercial and
16 Contracting. The hierarchical arrangement is overly complex, leading to repeated guidelines,
17 policies and activities across sub-units rather than standardised across the whole or customised
18 in accordance with previous efforts. Performance management and metrics are utilised
19 inconsistently across these varied units, although there is some centralised expertise provided
20 by specific departments regarding specific functions. The oligopolistic nature of the
21 marketplace often causes a lack of performance management practices at the contracting stage,
22 with the DSB often favouring contracts that transfer most financial risk to the contractor (for
23 example, public finance initiatives). The ICT systems used vary in terms of function, ownership
24 and age with wide acknowledgement of the systems' siloed nature. Across each of the four
25 themes, the DSB's procurement practice tends to be decidedly uniform at the strategic levels,
26 but the processes were bespoke to projects at the operational level; this is barring a few notable
27 key exceptions such as the criteria for a project to pass 'main gate' stages which was broadly
28 consistent.

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The lifecycle mapping approach provides a snapshot of the context within which a particular
process is being undertaken. This allows for secondary questions regarding the process to
emerge prior to additional rounds of data collection. This abductive approach allowed the
research team time to reflect and to probe further into any emergent considerations within the
next round of data collection. For example, if a key piece of performance data is captured
during one phase, we can project forward onto the lifecycle to see where this data is being used.

The DSB has a relatively high prevalence of processes encoded across the key themes
compared to other cases, indicating that process variety and complexity are significant but the
data often suggested a medium to low perception regarding their effectiveness. Holistic
knowledge management, standardisation of practice, a learning-from-experience capability and
the management of uncertainty are all features perceptible in the lifecycle and are particular
features of the case. However, despite the prevalence of these capabilities they were frequently
discussed as needing further development to be effective. A DSB project manager summed up
colleagues' feelings by commenting "The lack of learning from past projects and standardising
good practices are repeatedly highlighted as areas of weakness". Some elements of
standardisation existed in the form of contract templates and assurance processes prior to 'stage
gates' within the lifecycle. However, there is a conspicuous lack of standardisation outside of
these processes, which is a revealing finding given the military's association with standardised
processes. Knowledge management processes were also prominent across the lifecycle. Instead

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3 of entrenched systems' knowledge, the acquisition process relied upon the expert knowledge
4 of the personnel - a particular problem within the military context as staff regularly rotate across
5 different roles. A procurement lead bemoaned "we start over with a new project lead every two
6 or three years losing vital knowledge and momentum as the former lead moves on". This was
7 in vivid contrast to the NSB case, for example, which embedded the accumulation and
8 dissemination of practice more explicitly in formalised processes.
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11 Case results were reported back to the case organisation. In the case of the DSB, this took the
12 form of a report and presentation to a Change Board headed by a Major General. The results
13 were congruent with the perspectives of the senior personnel on the Board.
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15 16 *4.2 Key features of comparative cases*

17 The remaining three cases concerned the HSB, LGSB and the NSB. Each of these differed
18 from the DSB case in distinctive ways. They are briefly summarised and comparisons are made
19 to arrive at a typology of complex procurement lifecycles.
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21 The HSB has a complex procurement structure that involves budgetary control derived from
22 central government and enacted through over 200 Clinical Commissioning Groups (CCGs) that
23 act as devolved regional commissioning experts spread across the UK. These groups are
24 supported in the procurement process by Commissioning Support Units (CSUs) that are also
25 deployed on a devolved basis but do not align one-for-one with the CCGs. The CSUs act as the
26 centres for procurement expertise and thus a majority of the interviews and document requests
27 undertaken were with CSUs. The structure of the HSB is continuously evolving yet the
28 lifecycle approach bounds the organisation into segments based on function so these insights
29 are applicable beyond any future restructure. The organisational arrangement of units is novel
30 in that it is decentralised to local CCGs with procurement expertise partially centralised within
31 the CSUs associated with the CCGs in a non-uniform manner. A prominent factor that emerges
32 from this distribution is a tension between the various organisational sub-units. An internal
33 marketplace system allows the CSUs to 'sell' services to the CCGs which have a profound
34 impact on the relationship between internal organisational units. Specifically, the establishment
35 of a successful contract often relies strongly on interpersonal relationships between CCG and
36 CSU personnel, rather than being contingent on normative procedures alone. In addition, the
37 CCGs and CSUs have devolved powers to organise the practices as they see fit which is a cause
38 of inefficiency through a lack of overall control. There are a number of novel performance
39 management initiatives such as CQINs (Commissioning for Quality and Innovation) requiring
40 mandatory metrics in the HSB standard contract. However, the ICT infrastructure is
41 comparatively simplistic for sharing contract data. The lack of inter-unit coherence emerged
42 prominently as a result of adopting the lifecycle view.
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49 The LGSB case focused on the procurement activities of three local authorities (councils) in
50 the UK. The procurement departments procure on behalf of local front-line services such as
51 the fire service, refuse collection, local transport organisations, local infrastructure, social
52 facilities and some health provision. With some substantial variation year-on-year, the annual
53 budgets fall between £0.5 and £1.2 billion, with the majority being used on contracted services
54 and procured infrastructure. The local councils are treated as one single composite case owing
55 to similarities in their procurement practices and the comparatively consistent set of processes
56 observed. The characteristics codified under the organisational alignment theme diverge
57 significantly from the structures within the DSB and the HSB. Whereas these organisations
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offer a hybrid structure consisting of centralised and decentralised elements, the local councils are largely centralised both in terms of geography and organisational structure. Multiple procurement functions are undertaken by significantly fewer staff. This is, in part, to be expected owing to the relative differences in budget and organisational size. We observed significantly higher dependence on extra-organisational communication, often in the form of consultancy and collaboration. The communication between these parties is often ad-hoc and contingent on the individual persons involved. Performance management practices are centred largely around the contract management aspects and aren't as prominent in other lifecycle areas as compared with the other cases. There are limited approaches to foster continuous improvement, and standard, off-the-shelf software packages are used. A number of contracting types are used aimed at sharing risk with collaborators. However, assessment tools are used without any formal risk profiling over time or policy guidance for risk management. In this case, the lifecycle approach showcases the disconnect across processes with few organising systems and procedures in comparison with the other cases.

The NSB operates across several geographically-dispersed sites. Its processes and procedures, encoded under the key themes, are unique amongst the body of cases in that they are connected and coherent across the varying sub-units of the organisation. From an organisational alignment perspective, the NSB operates a programme and project structure similar to the DSB, with each facility responsible for its own procurement. Its performance metrics are compiled across a centralised system that offers a consistent set of metrics and a bespoke interface to assess risk and evaluate supplier and project performance. The contracting processes use several novel approaches, notably cross-lot tendering and an innovative 'value transition point' for distributing contractor and organisational resources and responsibilities across different phases of a procurement lifecycle. Each of these approaches is directed and controlled by a uniform set of guidelines across the NSB's different projects. Cross-lot tendering allocates partial workloads to partner organisations and the value transition point provides a means of shifting primary ownership of a project to the contractor at the point when it is most capable of dealing with the risk. These processes were described as effective by practitioners. The 'learning from experience' system is also highly robust, enforcing documented explanations of variations from previous contracts, which then formed a body of well-organised knowledge that is used to guide all future projects. The lifecycle view is particularly effective at enabling comprehension of the NSB case as there is a high degree of formal procedural structure, and each process follows logically from the previous and onto the next.

4.3 Results of Cross-Case Analysis

A lifecycle map is constructed for each phase to assess the procedures and practices deemed relevant to the overall capability of the procurement process. The procedures and practices observed are thematically reduced into eighteen categories of procurement lifecycle capability (see table 2). The subordinate themes were derived from the abductive data maps. Each map highlights data points that aligns to one of the four key themes. The process involved coding each data point on a map as aligning with theme 1,2,3,4 or 0 (not relevant to key themes). These areas were then combined and discarded until a representative spread of key themes were apparent.

Table 2. Cross-case analysis

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3 The assignment of the final determinations as to whether a process is High, Med or Low is
4 principally a relativistic assessment within and across the cases and not an attempt to be an
5 absolute typology. For example, the prevalence of sub-contractor engagement per procurement
6 project in the NSB case is materially higher than it is in the HSB which in turn is materially
7 higher than the DSB and LGSB (see table 1), whereas the effectiveness of sub-contractor
8 engagement was regarded as being significantly better than the effectiveness of the spread of
9 organisational control within the DSB based on the perceptions of relevant case interviewees
10 (see table 1). Sub-contractor engagement was codified across 9 major processes along the
11 procurement lifecycle within the DSB case, relatively few compared with the case set. These
12 interactions were highly formal (ITTs etc) and based disproportionately in the latter stages of
13 the lifecycle (8/9 instances during the In-Use, Contracting phases). This suggests a comparative
14 opportunity to bring in engagement with sub-contractors earlier in the procurement process,
15 and some opportunity for less formal interactions. This approach was deemed appropriate,
16 however, and was not associated with any concerns at interview thus producing a relatively
17 high perceived effectiveness. This seems to fit with the overall case trend of increased tendency
18 to formalise procedures as complexity grows (normative isomorphism).

23 24 **5. Discussion**

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26 Lifecycle mapping provides a practical approach to aid in the identification of categories of
27 complex procurement situations. Processes are assessed against each of the four procurement
28 lifecycle phases (Concept, Assessment, Procurement, In-use). This provides a solid basis for
29 making relativistic statements about case divergences, and to better contrast the theoretical
30 interpretations of the results. For example, Defence displayed a significantly higher prevalence
31 for performance evaluation tools within the Procurement phase, whereas Health and Nuclear
32 had significantly higher prevalence in the In-use phase.

33
34 In making these determinations there is a necessary reliance on the judgement of both the
35 research team in their view of the data and the senior personnel associated with the case.
36 However, any absolutist determinations of the effectiveness of a given process would be near
37 impossible in a complex system because a clear chain of cause and effect is extremely difficult
38 to validate. For example, contract and performance management practices may appear to be
39 effective viewed by their output, despite it being known that incorrect elements are being
40 recorded and reported, masking an underlying flaw. The lifecycle approach and the use of the
41 abductive data map is a critical tool in investigating this fuzzy, complex set of processes,
42 particularly with regard to their interpretation. The total set of 16 qualitative data maps assist
43 in guiding the empirical enquiry alerting the research team to knowledge gaps. The maps
44 present the whole lifecycle of processes in an accessible format and thus allow agency and
45 institutional theoretic interpretations of the data to easily reference the origins and
46 interrelationships between processes across a lifecycle. This mapping approach provides a
47 means by which the inherent complexity and systemicity (Williams, 2017) of the context can
48 be unpicked.

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50 We were able to identify process combinations distinct to each theme by using either agency
51 theory or institutional theory but the concurrent application of the two allowed for a clearer
52 delineation of the procurement practices. The detail of some of the agency and institutionally-
53 driven insights that help in understanding case differences would have been at a lower
54 resolution if they were not individually applied to each of the phases across the case set. While

the two theories produced different explanations for the characteristics of the buyers, these explanations were entirely compatible, thus providing a richer picture of how complex procurement practices vary across the lifecycles of different organisations.

The mapping approach allowed us to propose a matrix of buyer types by relating procurement lifecycle capability to procurement lifecycle complexity. Comparisons are made on the basis of theoretically-driven reflections in order to define positions on the matrix (Figure 5). The four cases occupy three of the matrix positions:

- Type 1 - LGSB. The LGSB operates in the least-complex context. Processes are often created reactively (coercively) as a response to legislative pressure. There is a markedly lower number of sophisticated procurement lifecycle capabilities (see table 1) yet the introduction of more sophisticated capabilities would likely outweigh the benefits given the comparative lack of lifecycle complexity. A type 1 organisation is likely to only be viable if the complexity of its procurement demands do not increase. Its relatively limited capabilities are appropriate to its context.
- Type 2 - DSB/HSB. Type 2 organisations are positioned off the lifecycle capability-complexity diagonal and behave sub-optimally. They are typified as ‘practically coping’ with the highly-complex demands on their procurement systems. These organisations have a high prevalence of sophisticated procurement lifecycle processes but their perceived effectiveness is markedly less than other types. Processes are derived through a range of mimetic, normative and coercive pressures to practically cope with the circumstances, and are not necessarily the most effective to satisfy the underlying need. Explaining why one process is in place as opposed to another is often difficult.
- Type 3 - NSB. The type 3 organisation’s lifecycle capabilities are derived from a purposeful and deliberate design effort. The reasons for process and practice adoption are easily explained and the logic is clear. These organisations have both a high level of process capability and reported effectiveness. The system is able to cope with diverse and highly-complex procurement requirements.

Figure 5. Types of complex procurement situations

The matrix is intended not as a single figure summary of the findings or theoretical contributions of this work, but rather as a visualisation to aid in understanding the implications of the work. The matrix offers an insight into future research by depicting the cases on a matrix of lifecycle capabilities versus lifecycle complexity, positing that there could be many additional organisational types incorporated into this model after undertaking further empirical work. The key contribution here is the conceptual framing rather than an exhaustive typology of organisational archetypes.

The cases were analysed by invoking the institutional and agency-theoretic views that accounted for the differences across the cases in conjunction with the thematic comparison. A key contribution of this paper is the use of a lifecycle framework as a methodological tool allowing for the concurrent application of theory to unique phases in a lifecycle across a range of themes. Considering the lifecycle in this way facilitates comparisons across the cases yet enables exploration of the processes that are unique to each phase. Whilst both theoretical viewpoints offered some explanatory power, institutional theory proved particularly effective in the exposition and assessment of the Concept, Assessment and In-use phases. In contrast,

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3 agency theory was instructive in evaluating the Technical Procurement activity, given its
4 naturally-defined principal and agent in the form of the case organisation and contractor.
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7 The institutional lens revealed that the processes adopted across the case-set are distinctly
8 different. In Type 1, the adoption of particular processes was driven explicitly by the coercive
9 pressure to conform to legislation (for example, Official Journal of the European Union) and
10 other government guidance. Whilst not the exclusive pressure, this is a clear driver of the
11 majority of processes. In the case of the Type 3 organisations, processes across the lifecycle
12 are driven by a range of normative and mimetic pressures. The NSB case exhibits strong,
13 normative isomorphisms which are present across a majority of its processes. For example, the
14 management of contractual risk is tightly controlled. Normative pressures for rigorous control
15 filter through to commercial and procurement practices. Equally, there is a tendency for the
16 mimetic pressure to lead to a diffusion of innovation, as practitioners are quick to adopt proven
17 practices for providing positive outcomes. The Type 2 organisation is driven by a significant
18 range of coercive pressures, understandable in the contexts of health and defence both being
19 tightly-governed sectors. Informational asymmetry and sensitivity to isomorphisms in
20 procurement system design were key factors in differentiating the systems of Type 2 and Type
21 3 organisations. While both possess significant lifecycle complexity, theory-driven insights
22 demonstrated a clear distinction between the alignment of lifecycle capability and lifecycle
23 complexity. The agency theory perspective also reveals conspicuous variances across the
24 different categories. The Type 1 organisation is typified by a reluctance to manage and control
25 contracts beyond the initial procurement. Consequently, the effect of information asymmetry
26 is amplified, which causes these organisations to be susceptible to agents providing non-
27 optimal outcomes. In contrast, the Type 3 organisation specifically attempts to address
28 information asymmetry in contracting through a variety of initiatives. These two explanatory
29 theories suggest that organisations that concentrate on outcomes, information sharing and
30 coherence tend to be more effective buyers than those that focus on addressing the coercive
31 pressures enforced by legislation.
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38 While we propose a holistic framework for comprehending the whole complex procurement
39 lifecycle in diverse industries based on a capability/complexity assessment, there are other
40 industry specific frameworks using different criteria for assessment in sub-areas such as
41 'contracting'. A prominent example in the military context is Performance-Based Logistics
42 (Glas *et al.*, 2013) but such a consideration is out of scope for this paper but may have synergies
43 in industry-specific initiatives in the future. Equally, the focus of this research is to define the
44 most 'complex' procurement projects within an organisation, accepting that there will be
45 procurement projects within a complex organisation that are amenable to a simplified
46 procurement process and so multiple strategies and process-sets may sit alongside the most
47 complex (see Elstrom *et al.*, 2020). This matrix is for use in defining the upper bounds of the
48 capability and complexity dimension.
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52 **6. Conclusion**

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55 This research provides new insights concerning the state of complex procurement capabilities
56 in public-sector organisations. It demonstrates that organisational capabilities, practices,
57 policies, tools and techniques are varied and have significant scope for improvement. Complex
58 public-sector buyers have been shown to have common processes but highly-variable process
59 capabilities. Certain processes and systems are profoundly more impactful than others, namely,
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learning from experience, risk profiling and risk sharing, scenario planning, dynamic flexible contracting procedures and tightly controlled and standardised practices. A mastery of these capabilities leads to a marked increase in the ability to operate effectively. This finding provides a strong rationale for organising future strategic development focused towards these capabilities over others and is of interest to researchers looking to further discern the optimal process arrangement for complex public-sector buyers, and expand and critique the categorising of complex buyers provided here. It also has important implications for practice and will be of use to senior executives of public buyers in planning future capability investment. This matrix in conjunction with the set of 18 themes allows practitioners and managers to assess where their capabilities may be amenable to improvement by making more focused comparisons with other complex buyers. These insights can frame discussions around where potential value-adding capability may be derived and direct future efforts and further research to investigate the capabilities of complex buyers. Furthermore, managers can use the matrix (Figure 5) as an accessible heuristic to consider the suitability of their own procurement practices.

In summary, the contributions of this article are threefold: firstly, a method for making qualitative assessments of the procurement lifecycles of complex buyers; secondly, a thematic architecture to better understand complex procurement practice; finally, a matrix of public-sector buyer types where procurement effectiveness is shown to be contingent on the convergence of procurement lifecycle complexity with procurement lifecycle capability.

As is indicative of in-depth qualitative research, generalisability cannot be guaranteed beyond the case-set explored here, and therefore is a limitation of the study. Additionally, four cases do not provide sufficient breadth to identify all common characteristics of complex public procurement organisations. It is our hope that researchers examine complex procurement effectiveness and complex procurement arrangements in a wider variety of contexts, utilising research designs that address the limitation of this first but important step in reinvigorating complex public procurement research.

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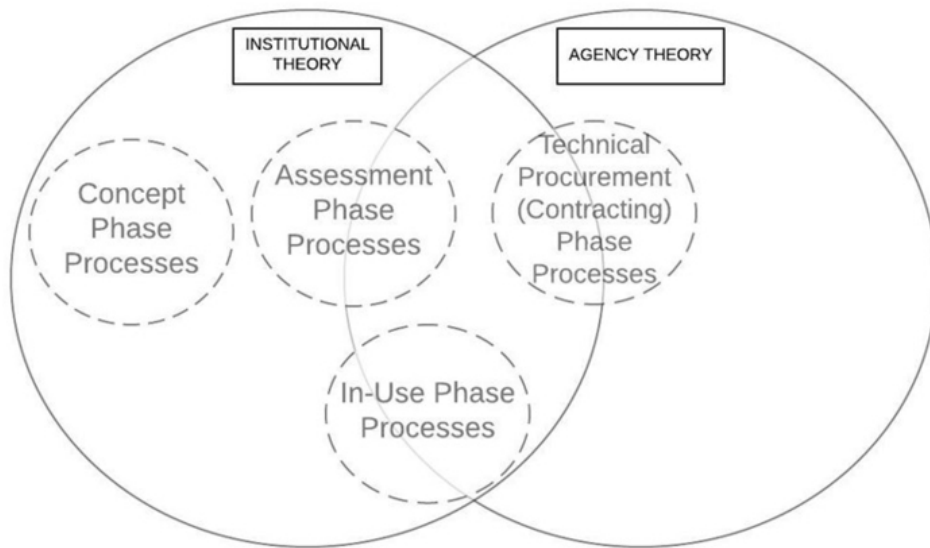


Figure 1. Theoretical positioning

125x76mm (150 x 150 DPI)

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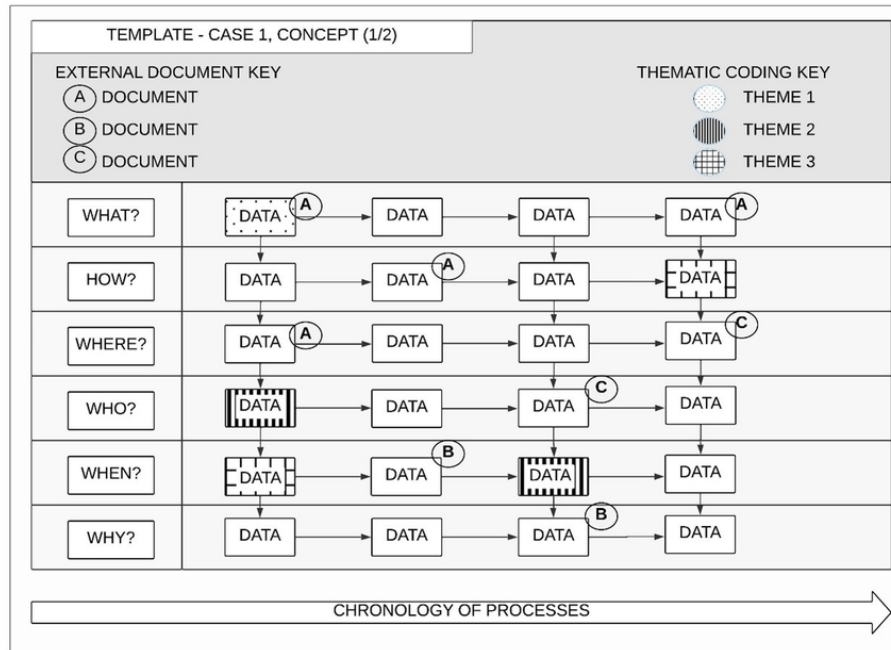


Figure 2. Abductive data map example

159x112mm (150 x 150 DPI)

Table 1. Procurement personnel interviewed

Equivalent Position	Description
Head of Procurement	Head of the organisation's procurement unit
Head of Commercial Department	Head of the organisation's contracting practice
Project Team Head	A participant with detailed knowledge of specific large-scale procurement projects
Project Team Group Head	A participant overseeing groups of large-scale procurement projects possessing an holistic, strategic perspective of practice
Special Project Heads	Participants involved with issues of critical importance to the organisation (for example, ICT capability provided to the procurement function)

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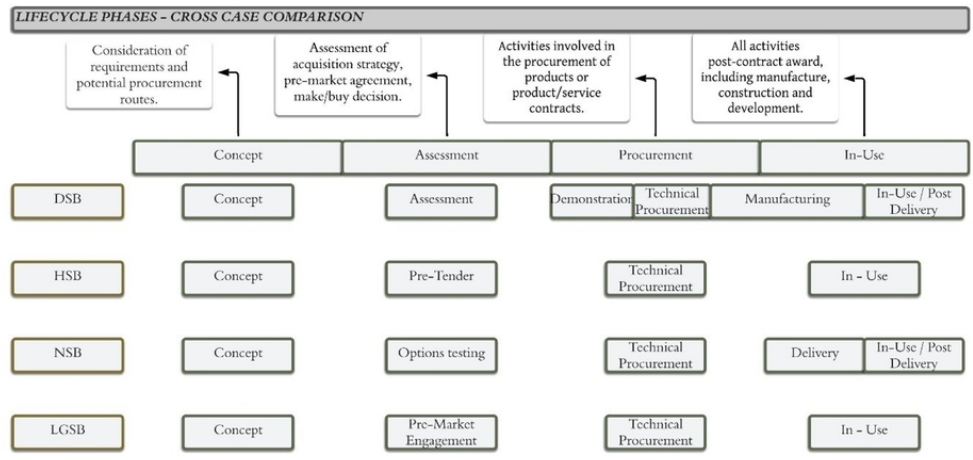


Figure 3. Procurement lifecycle phases

159x77mm (150 x 150 DPI)

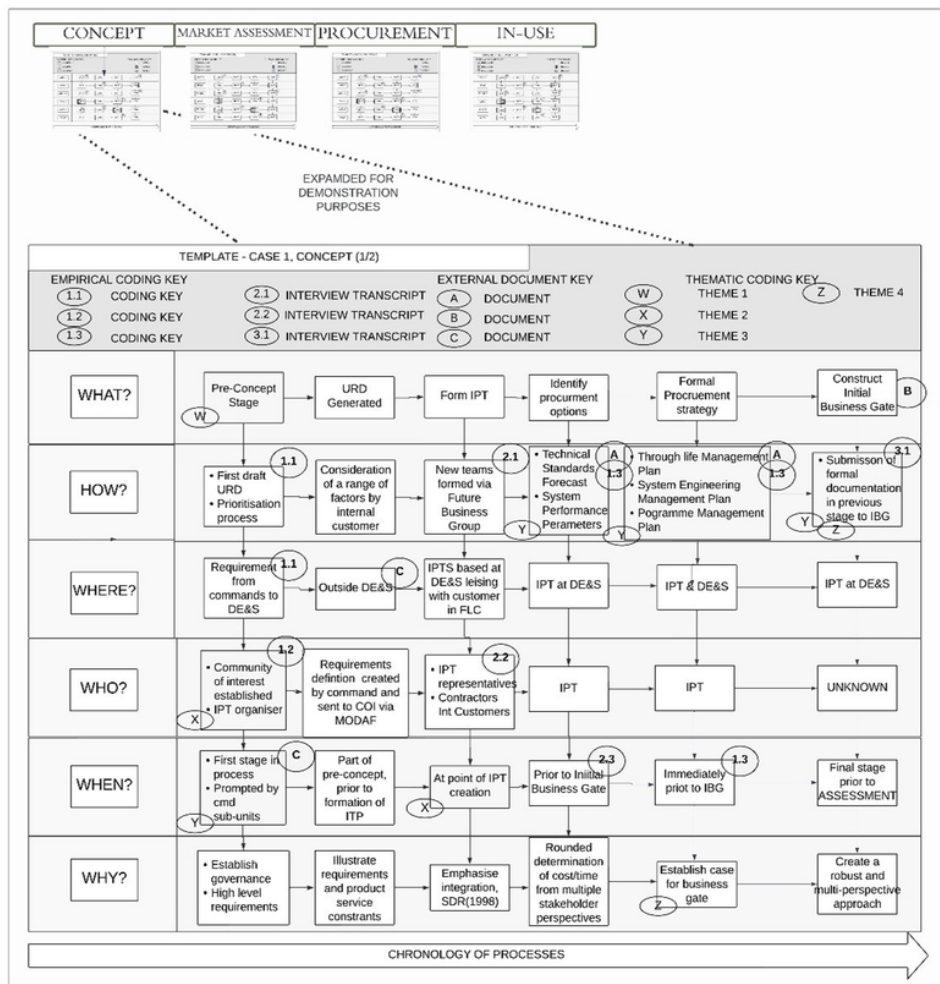


Figure 4. Concept example Defence Sector Buyer (DSB)

138x142mm (150 x 150 DPI)

Table 2. Cross-case analysis

		DEFENCE (DSB)	HEALTH (HSB)	LOCAL GOVERNMENT (LGSB)	NUCLEAR (NSB)
Super-ordinate theme	Subordinate theme	Prevalence versus Perceived Effectiveness			
ORGANISATIONAL ALIGNMENT / GOVERNANCE FACTORS	Sub-contractor engagement	Low/High	Med/Med	Low/Not found	High/High
	Spread of organisational control	High/Low	High/Med	Med/Med	Med/Med
	Internal coherence / Communication	Low/Low	Med/Med	High/High	High/High
	Fit of normative and observed	High/Med	High/Med	High/High	Med/Med
	Geographical spread of stakeholders	High/Low	Med/Med	Med/Med	Low/High
PERFORMANCE MANAGEMENT	Quality filters and KPIs.	High/Low	High/Med	Low/Low	High/High
	Contractual techniques	High/Med	Med/Med	Low/Low	High/High
	Collaborative practice	Med/Low	Low/Med	Med/High	High/High
	Coherence of internal project control	Low/Low	Med/Med	High/Med	High/High
	Predictive analytics	Med/Med	Med/Med	Low/Low	High/Med
TECHNOLOGY MANAGEMENT	ICT system variety	High/Low	Med/Med	Low/Med	Med/High
	E-procurement systems	Med/Low	Low/Med	Low/Low	High/High
	Knowledge management systems	Low/Med	Med/Med	Low/Low	High/High
	Coherence created across organisations	Low/Low	Med/Med	Low/Not found	High/High
	Extra-organisational systems	Med/Med	Low/Med	Low/Low	Med/High
RISK MANAGEMENT	Use of avoidance/reduction transference strategies	High/High	Low/Not found	Low/Med	High/High
	Density of risk management practices throughout acquisition lifecycle	High/Med	Med/Med	Low/Low	High/High
	Risk reporting / Information gathering	High/Med	Med/Med	Low/Low	High/High

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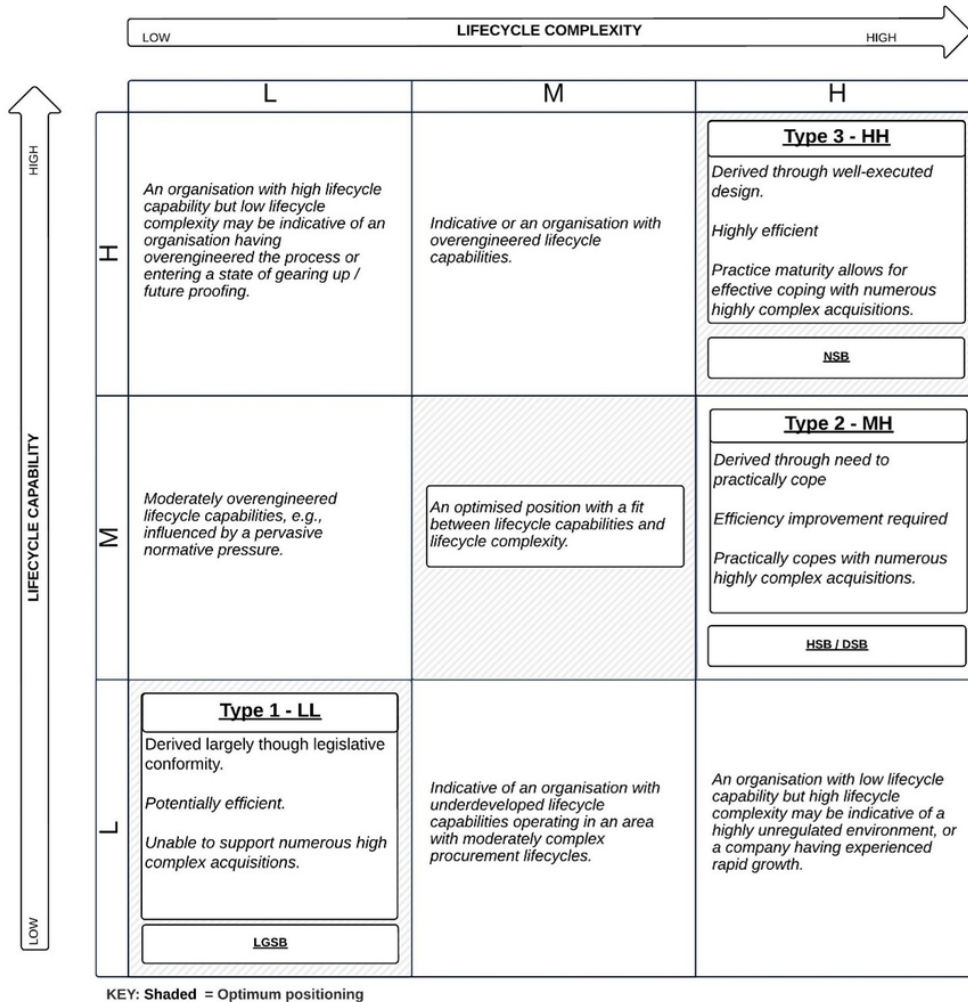


Figure 5. Types of complex procurement situations

148x151mm (150 x 150 DPI)