Lorentz, H., Aminoff, A., Kaipia, R. and Srai, J.S. (2021), "Structuring the phenomenon of procurement digitalisation: contexts, interventions and mechanisms", International Journal of Operations & Production Management, Vol. 41 No. 2, pp. 157-192. https://doi.org/10.1108/IJOPM-03-2020-0150,

Structuring the phenomenon of procurement digitalisation: contexts, interventions and mechanisms

Abstract

Purpose – The study develops a structure for procurement digitalisation by identifying its context drivers, technology interventions and performance-inducing mechanisms and exploring the linkages between these variables.

Methodology – The study draws on rich interview and workshop data on 48 digital intervention projects, as reflected by mental models of managers from 12 case organisations in manufacturing, retail and service sectors. Supported by an a priori structure, the study employs an abductive cross-case analysis approach.

Findings – Results suggest several categories within the elements of context, intervention and mechanism to structure procurement digitalisation and the linkages between them. Seven propositions that reflect digitalisation strategy options in procurement are developed regarding the linkages. Internal complexity dominantly drives procurement digitalisation, motivating communication support and process structuring interventions, which in turn aim at procurement coordination and control as well as process improvement. External coercive pressure and external dynamism also drive interventions for information processing and decision aiding, which appear to be linked with supply market knowledge, strategic alignment and supplier capability assessment. Therefore, an internal–external dichotomy is observed as the main thrust of procurement digitalisation.

Practical implications – The study supports decision makers in developing digitalisation strategy options for different procurement contexts. The results also raise awareness of a possible bias in existing strategies for procurement digitalisation.

Originality – A novel forward-looking approach is employed to enable the design and construction of systems that do not yet exist by focusing on the mental models of managers in a systematic way.

Keywords: Digitalisation, procurement, purchasing and supply management, case study

Article classification: Research Paper

1. Introduction

The adoption of technologies pertaining to Industry 4.0 or digitalisation in procurement has been touted as the catalyst for revolutionising the way vital upstream supply networks are managed. This has led procurement functions to seek, discover and experiment with new technology solutions (Gualandris et al., 2018). Although digitalisation of the procurement function may be regarded as desirable, and thus imperative for forward-looking organisations (Sanders, 2016), a more critical view should consider various factors influencing the adoption of new technologies for managing supply.

The contextual variables influencing procurement digitalisation may be divided into those of efficiency and non-efficiency orientation in nature (Sousa and Voss, 2008). Such a theoretical perspective enables a critical evaluation of the boundaries for propositions regarding universalistic adoption of various digital technology applications within procurement (cf. Busse et al., 2017), and allows for more informed practical interventions. Moreover, these factors should be linked with dependent or response variables, namely those reflecting organisational or managerial action and practice effectiveness (Sousa and Voss, 2008). While notable advances in this respect have been made, for example by Søgaard et al. (2019) and Handfield et al. (2019), the present study employs an integrated view of digital technologies and applications within a set of emergent context and response variables.

This study addresses this research gap by aiming to structure the phenomenon of procurement digitalisation in two key aspects. Firstly, it identifies driver-oriented *context* variables and response variables in terms of digital technology *interventions* and performance-inducing *mechanisms* (cf. Denyer et al., 2008). Secondly, by exploring the linkages between these variables, this study seeks to develop propositions for inducing further research on procurement digitalisation and providing strategy options for practical purposes. The key construct of the study—procurement digitalisation—is defined simply as the use of digital technologies, such as the Internet of Things, mobile applications, cloud computing, big data, 3D printing, social networks, human–computer interaction, artificial intelligence, autonomous robots and blockchain technology, to support or enhance procurement processes (cf. Srai and Lorentz, 2019).

In addressing the research aims, this study draws on interview and workshop data from 12 case companies. The nature of the phenomenon of interest presents an interesting challenge for this research. Much of procurement digitalisation has not yet been realised at scale, at least in its advanced forms, including predictive analytics, artificial intelligence and blockchains (Handfield et al., 2019; Gray and Prud'homme, 2019). Therefore, observing the actual states of the response variables is challenging. It follows that this study employs a forward-looking approach and seeks to enable the design and construction of the artificial, that is, systems that do not yet exist (Simon, 2019), by focusing on the mental models of managers regarding the linked context and response variables within the domain of procurement digitalisation. Defined by Gary and Wood (2011, 569) in the management domain as 'simplified knowledge structures or cognitive representations about how the business environment works', mental models may be regarded as predictors of future states (Morecroft, 1992) because decision makers act on the subjective cognitive structures or mental models of the environment (Daft and Weick, 1984; Porac and Thomas, 1990). Importantly, the variation in mental models explains the variation in adopted strategies and competitive success (Gary and Wood, 2011). Therefore, mental models contain information about causality and, as proxies of realised events, can be used to study the key variables of the procurement digitalisation phenomenon.

2. Theoretical foundations for structuring procurement digitalisation

In the quest for structuring the procurement digitalisation phenomenon, a theoretically sound *a priori* structure is considered an imperative. Such a theoretical foundation for this study is provided by the so-called CIMO logic (Denyer et al., 2008), which has been proposed to serve as a template for structuring problem-solving propositions in any management context. In this logic, C stands for a problematic context, defined as the factors pertaining to the external and internal environment, such as organisational politics and power, organisational stability, uncertainty and system interdependencies (Denyer et al., 2008). The relevant context here is understood to drive procurement digitalisation. Furthermore, regarding the response variables, I stands for a key component of the logic, specifically, the intervention through which the problematic context or driver should be addressed or the means 'managers have at their disposal to influence behavior' (Denyer et al., 2008, 397). M is 'the mechanism that in a certain context is triggered by the intervention', perhaps essentially representing the new state or capability that results from managerial intervention and through which the final element, namely the outcome (O), takes place or is brought about. As the current study relies on the mental models of managers about a phenomenon in an emerging state, the performance effects of which are thus difficult to estimate, the final outcome response variable is considered to be out of the scope of the study. Next, the remaining elements of the *a priori* foundational logic (CIM) are discussed in the context of procurement technology adoption.

2.1 Contextual variables driving procurement technology adoption

Several theoretical lenses may be considered to fully understand the variety of context variables for procurement digitalisation, or more broadly, procurement technology adoption. We select theories which (1) specifically address the interaction of the firm with its context and (2) are discussed in supply chain and procurement or e-procurement literature (Spina et al., 2016). We end up selecting theories that allow the context to vary and are useful in explaining intervention adoption in different contexts, including contingency theory (Sousa and Voss, 2008; as applied to procurement: Bals et al., 2018), strategic choice theory (Child, 1972; as applied to procurement: Shook et al., 2009) and institutional theory (DiMaggio and Powell, 1983; as applied to procurement: Zsidisin et al., 2005). With focus on theories related to the interaction of context and firm, such theoretical frameworks as the resource-based view (e.g. Barney 1991), transaction cost economics (e.g. Williamson 1981), and the knowledge-based view (Kogut and Zander, 1992 Nonaka, 1994), are not selected as theoretical lenses.

Management practices and technologies, or more generally, interventions, may be undertaken or adopted due to the influence of efficiency factors (i.e. based on a rational analysis of the interventions' optimal fit with the problematic context) even in a rather deterministic manner. This efficiency perspective is deeply rooted in the *contingency theory* of organisations (Donaldson, 2001; Donaldson, 1987). Therefore, the approach may also be demarcated as defining associations between the context and response variables (cf. Luthans and Stewart, 1977). Context may be divided into internal and external environment (Duncan, 1972), as is often the case in contingency-theory-oriented studies (Luthans and Stewart, 1977). In the procurement context, Ellram et al. (2002) point out early on the contingent nature of purchasing best practices; for example, the efficacy of purchasing organisation structure (Bals

et al., 2018), lean purchasing (Azadegan et al., 2013) and management of buyer–supplier relationships (Saccani and Perona, 2007) was subsequently shown to depend on external and internal contingencies, such as environmental complexity and dynamism (Duncan, 1972).

However, the assumptions underlying the design for efficiency-oriented mental models may be relaxed, as interventions in procurement may also be driven by a variety of non-efficiency variables, possibly giving rise to panaceas (Sousa and Voss, 2008). Such cases may be appropriately covered by using *institutional theory* (DiMaggio and Powell, 1983). In contrast to the contingency theoretical approach for context-determined practices, institutional theory focuses on understanding the production of external legitimacy and support through three isomorphic mechanisms: (1) coercive pressure, which stems from political influence and the need for legitimacy; (2) mimetic pressure, which results from standard responses to uncertainty; and (3) normative pressure, which is associated with professionalisation (DiMaggio and Powell, 1983, 150). In the general supply management context, Zsidisin et al. (2005) propose that isomorphic pressures result in similar supply risk management practices, and Zhu et al. (2013) show similar tendencies in terms of green supply practice adoption.

With this recognition of the role of both efficiency and non-efficiency contextual variables in driving the uptake of procurement practices, the contexts and drivers of e-procurement adoption are next observed. This is done to establish a foundation for making educated empirical observations regarding the phenomenon of procurement digitalisation and evaluating the adequacy of the selected theoretical perspectives. Relying on the e-procurement literature is necessary due to the paucity of relevant procurement digitalisation literature, as only Søgaard et al. (2019) imply the contingent nature of adoption of digital technologies in procurement. By contrast, Sanders (2016) adopts a rather universalistic perspective regarding procurement analytics. Kosmol et al. (2019) emphasise the role of co-evolution of digital procurement readiness by the buyer and supplier in the adoption of digital procurement practices. This interdependency could result in coercive pressures for adoption in certain types of relational contexts.

Defined as the technology solution that facilitates corporate buying through the Internet (Presutti, 2003), e-procurement has been widely considered in the literature. However, with a few exceptions (e.g. Wu et al., 2007), the discussion of contextual variables that drive adoption has been somewhat atheoretical. In the literature, several contingency factors may be observed and categorised as external or internal to the firm and internal to the procurement function according to the authors' interpretations. Although the rather scarce evidence regarding external environment hints at the role of dynamism in determining e-procurement adoption (Walker and Harland, 2008), the internal firm factors are more diverse, emphasising, for example, the role of top management support (Teo et al., 2009), culture (Tatsis et al., 2006) and absorptive capacity for learning (Wu et al., 2007). Internal procurement factors seem to emphasise task–technology fit (Goodhue and Thompson, 1995), with manual and large volume tasks calling for efficiency-oriented e-procurement solutions. Large numbers of ad hoc solutions (e.g. spreadsheets; Doherty et al., 2013), suggesting complexity (Duncan, 1972), and supplier participation (Purchase and Dooley, 2010) have the same effect.

Somewhat balanced in terms of the extent of coverage in the literature with contingency factors are the institutional factors. Public policy or regulation and business partner influence may be interpreted as coercive pressure (Doherty et al., 2013; Teo et al., 2009), and the perception of competitors' success and adoption may result in mimetic pressure (Soares-Aguiar and Palma-dos-Reis, 2008), whereas public procurement functions may feel normative pressure from the more dynamic private sector (Doherty et al., 2013). Thus, e-procurement adoption takes place for external legitimacy.

Interestingly, the literature quite saliently suggests perceived benefits as a key driver for e-procurement adoption (e.g. Ronchi et al., 2010; Smart, 2010; Purchase and Dooley, 2010; Doherty et al., 2013; Toktaş-Palut et al., 2014). While this may indeed reflect expressed managerial mental models, true to the *a priori* structure (CIM), it is important to understand the underlying contextual variables or root causes that lead managers to perceive such benefits as lucrative.

This somewhat problematic saliency of perceived benefits as drivers for e-procurement adoption triggers a consideration of yet another relevant theoretical lens. *Strategic choice theory* builds on contingency theory but argues that decision makers essentially decide upon courses of strategic action and set performance standards while taking the environment into consideration (Child, 1972). As Shook et al. (2009) point out, the strategic choices of the firm, for example regarding prioritisation of savings, innovation or sustainability, potentially influence and determine sourcing decisions, as the procurement function may or may not fully align its strategic priorities with the competitive priorities and strategic initiatives of the firm (Baier et al., 2008). Thus, contingencies such as corporate or functional strategic initiatives break free from the deterministic nature of contingency theory (cf. Bals et al., 2018), and strategic choice theory provides a suitable explanation for example for a situation where the quest for efficiency and savings drives digitalisation.

Finally, intervention adoption rate driving factors, such as the availability of proven solutions (Doherty et al. 2013) and the uncertainty regarding technology and its benefits, as well as level of technology development (Tatsis et al., 2006) are noted. These aspects fall into the domain of *innovation diffusion theory* (e.g. Rogers, 2010), which proposes that technology adoption takes place in contexts where information about the returns from the utilisation of a specific technology becomes more widely available. As more organisations adopt the technology, the knowledge about the true returns is disseminated, resulting in an increased number of adopters due to, for instance, bandwagon pressure (Abrahamsson and Rosenkopf, 1993).

2.2 Response variables of procurement technology adoption

Firstly, in this research, *interventions* are defined as digital applications or the use of technologies of digitalisation to address problematic contexts and enable procurement value drivers (Srai and Lorentz, 2019; Hartmann et al., 2012). Comprehensive taxonomies of digitalisation applications in procurement do not yet exist, though some examples of digital applications have been described in the literature (Sanders, 2016; Handfield et al., 2019).

Therefore, observation of the procurement digitalisation phenomenon may benefit from understanding the more abstract and high-level categories of e-procurement applications. Several forms are suggested by de Boer et al. (2002), including a categorisation that includes web-based ERP, e-sourcing, e-tendering, e-reverse auctioning and e-informing. At a more abstract level, Johnson et al. (2007) reveal a two-dimensional framework for e-procurement, namely transactional technologies for improving existing business processes and relational technologies for supporting the strategic integration of partners. Interventions in the domain of procurement digitalisation may be expected to relate to similar broader dimensions; however, a more general technology categorisation may also inform empirical analysis.

In this vein, despite tremendous advances in information and digital technologies, the literature from 20–30 years ago remains potentially informative. For example, Huber (1990) suggests basic information technology characteristics to pertain to data storage, transmission and processing capacities, with properties related to the facilitation of communication and decision aiding. Furthermore, within the theoretical domain of task–technology fit, Zigurs and Buckland (1998) define a typology of group support systems technologies. Firstly, communication support tools are defined as 'any aspects of the technology that supports, enhances, or defines the capability of group members to communicate with each other'. Secondly, process structuring technology 'supports, enhances, or defines the process by which groups interact' and corresponds closely with the concept of process workflows in operations management. Thirdly, information processing technology provides the capability to 'gather, share, aggregate, structure, or evaluate information' (Zigurs and Buckland, 1998, 320–321). In the context of inter-organisational systems, Kumar and van Dissel (1996) propose a typology along the dimension of interdependency, classifying such systems as pooled information resources, value/supply chain and networked systems. The respective technologies that power these systems are defined as mediating (e.g. shared databases), long-linked (e.g. EDI) and intensive (e.g. CAD data interchange; see also Thompson, 1967).

Secondly, *mechanisms* may be defined as new states or capabilities triggered by the intervention (Denyer et al., 2008), that is, something that can now be done differently in order to achieve the final performance outcomes. As the literature on procurement digitalisation is in a nascent state—and thus the response variables related to this phenomenon are largely uncharted—there is room for exploration. Nevertheless, the emerging mechanisms as a result of this research may, to some degree, be expected to relate to capability improvement in the areas of procurement value drivers, such as those identified by Srai and Lorentz (2019) for the digitalisation context: transaction management, coordination and control, process improvement and innovation, alignment, supplier capability assessment, relationship management and supply market knowledge management. Alternative perspectives on such drivers are offered by Hartmann et al. (2012), including supplier management, cross-functional integration, strategy development, human resource management and controlling.

Empirical studies focusing on the perceived benefits from e-procurement indicate that the mechanisms may relate to, firstly, *efficiency* inducing practices and capabilities, such as reduction of maverick buying (Ronchi et al., 2010), introduction of common processes through harmonisation (Smart, 2010), task improvement (Purchase and Dooley, 2010) and

simplification of processes (Toktaş-Palut et al., 2014). Many of these aspects seem to be supported by reported benefits by Croom and Brandon-Jones (2007), who also emphasise the improved internal service quality by procurement as a driver for greater internal compliance, resulting in lower total costs of acquisition.

Secondly, greater visibility and transparency (Ronchi et al., 2010; Toktaş-Palut et al., 2014) and improved and even real-time monitoring and reporting (Smart, 2010) relate to the enhancement of *control*-related capabilities, again supported by the findings of Croom and Brandon-Jones (2007). Thirdly, e-procurement may also provide a basis for capabilities for *broader value contribution*, based on knowledge and market intelligence sharing, as well as collaboration and integration (Smart, 2010; Toktaş-Palut et al., 2014; see also Croom and Brandon-Jones, 2007). Finally, literature suggests the enhanced capability for *supply base management* in the form of rationalisation and supplier selection (Ronchi et al., 2010; Smart, 2010).

In conclusion, the CIM logic is proposed as an *a priori* structure for our attempt to provide a broader and structured view on the procurement digitalisation by establishing linkages between specific contexts and response variables (Figure 1). The linkages between the elements can be illustrated as follows: external dynamism in the form of a large and variable supply base (C) drives the adoption of technologies to implement a more structured process for supplier selection (I), which improves the capability of the company to assess suppliers' capability (M).

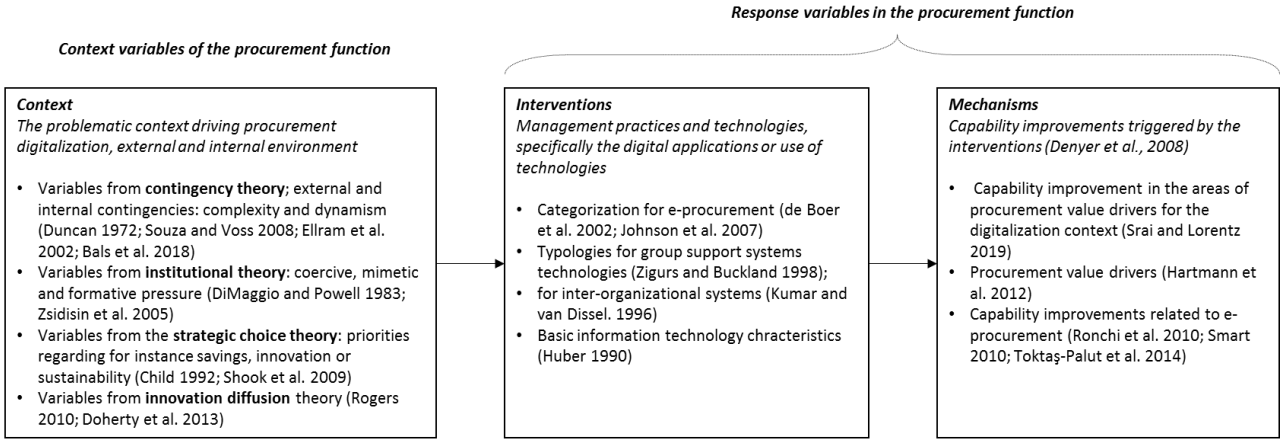

Figure 1 CIM-logic as an *a priori* structure: theoretical foundations for contexts and response variables

The above literature review, firstly, selectively covered prominent theoretical perspectives and, secondly, drew useful points of departure from the e-procurement literature for understanding the context and response variables. With an appropriate level of pre-understanding regarding the 'potentially important constructs' thus developed (Eisenhardt, 1989), theoretical foundations have been set for the exploratory case study, the process of which is elaborated in the following.

3. Methods

3.1 Research design and case selection

A case study design is suitable for the forward-looking approach because it enables identifying emerging themes and patterns and acquiring rich and detailed data of the mental models (Eisenhardt and Graebner, 2007). In the case study approach, data collection allows for the use of multiple informants and clarification questions, which enable triangulation and facilitate a strong substantiation of constructs (Eisenhardt and Graebner, 2007). This study design enables managerially relevant knowledge to be generated due to the involvement of managers operating in real digitalisation projects (Gibbert et al., 2008).

The empirical study drew on data from 12 organisations. These case organisations were selected using theoretically motivated (Dubois and Araujo, 2007) intensity sampling (Patton, 2002) to include rich and sophisticated examples of the phenomenon of interest. Adhering to this principle, organisations where procurement is of high priority and have high learning potential for the researchers were searched (i.e. leading companies and public organisations). These case organisations apply advanced supply management methods and have demonstrated interest in the digitalisation of procurement. The organisations were selected from Finland, the leading EU country in digital performance in 2019 (European Commission, 2019). The unit of analysis (UoA) in this research is a digital application project, which is considered important for the organisation to advance procurement digitalisation. Altogether, 48 application projects were identified (see details in Appendix B) and comprised the case study data set.

To find and select case organisations according to the principles of intensity sampling, seven leading organisations known from previous research collaborations were invited to participate in the study, based on the maturity and resourcing of their procurement organisation (large firm, observed category management practices), as well as having procurement digitalisation on their strategic agenda. Secondly, the participants of two industry seminars on procurement digitalisation were approached. Amongst the participants (30 and 15 per seminar), three organisations were selected to act as cases, again based on the maturity and resourcing of their procurement organisation, their interest towards procurement digitalisation, as well as their willingness to commit to the study. Thirdly, based on an academic survey amongst Finnish companies on the status of procurement (see Lorentz et al., 2019), two more organisations were invited for the study, based on their response indicating completed or planned procurement digitalisation initiatives, and willingness to commit to the study. For these selected 12 organisations, their willingness to participate in the study and access to key informants were ensured to secure commitment and a high quality process for data collection. The overview of the case companies is presented in the Table I.

Table I Overview of the cases and data collection

----------Insert Table I approximately here ----------

3.2 Data collection

The main data collection method was semi-structured interviews with knowledgeable managers in the organisations. The interviewed individuals were selected on the basis of their position; all were in managerial positions in procurement and involved hands-on in the digitalisation of this function. The interviews were conducted by two or three researchers (researcher triangulation) who met the interviewees individually or in pairs/groups. All participating organisations were covered with more than one interview or a second engagement in the form of a workshop, thus enabling source triangulation and strengthening overall research quality. The interviews were recorded and transcribed, and interviewers took notes. A semi-structured interview protocol guided the discussion towards the objectives of the interview, including (1) mapping the adopted or planned digital applications (e.g. spend analytics) and (2) disclosing the nature (e.g. cloud-based), aims (e.g. improved control), implications and fundamental reasons (e.g. complex multi-unit organisation) for the implementation of such applications, thus covering the entire CIM spectrum. The adopted interview format also gave the researchers the flexibility to focus on unique features in each case (see Appendix A). Assisted by a digitalisation grid (Srai and Lorentz, 2019) defined by technologies and value drivers, the interviewees were asked to point out the most important digital applications. The grid was used to identify and explain applications along the a priori CIM dimensions. This phase was interactive in nature; the researchers explained the terms when needed to ensure a univocal understanding of each construct, gave instructions and asked detailed questions when necessary.

In addition to interviews, a workshop was arranged with the interviewed procurement managers to validate and complement the preliminary findings. The three-hour workshop was attended by nine managers from several case organisations and three researchers. The participants were asked to enrich the understanding on the links between contexts, interventions (specific digital technologies) and mechanisms.

3.3 Data coding and analysis

The data, including the interview transcripts, the filled-in digitalisation grids and the workshop transcripts, were analysed within cases and across cases (Miles and Huberman, 1994; Yin, 2009). The a priori defined CIM elements formed the basic structure while the interview data were utilised to add rich content to the framework. Data coding and analysis was an iterative process in which the phases alternated, including systematic coding, frequent face-to-face discussions amongst the three involved researchers, generation of different data displays, visual projections of coding results and summary of results.

The transcribed data were coded with NVivo software. The first phase started with a test round, in which two researchers coded one interview transcription, and comparisons were made to ensure similar interpretations of the key constructs. After adjustments, each interview was coded by at least two researchers to identify the UoA for each case organisation from the data and create a description of the units along the elements of the CIM a priori structure. A total of 48 units were identified, with reduced form data describing the analysis unit in appropriate level of detail arranged into a data display (Appendix B). This phase essentially constitutes the within-case analysis of the research.

In the second phase, a cross-case analysis was conducted by observing the UoA across each element of the CIM a priori structure. Emergent themes in each were abductively compared and matched with the earlier covered theories (Dubois and Gadde, 2014) and thus create higher-order themes and theoretical constructs. Having advanced from case specific details to a more abstract and theoretical level within each of the CIM element, patterns were then observed in terms of how these elements were connected by sorting the data display. This exploratory sorting broke down the abductively matched constructs and brought further clarity into linkages, allowing the development of propositions as procurement digitalisation strategy options.

4. Results

4.1 Identification of categories within CIM elements

In the following, the results of analysis across the entire data set are presented, starting with the analyses of each of the CIM elements. This was based on abductive matching of the observations from the data with the theoretical perspectives presented previously. The results regarding contexts are presented in Table II, interventions in Table III and mechanisms in Table IV.

In this research, context is considered as a driver or a cause for procurement digitalisation, with external and internal environment-related contingencies appearing as strong drivers of digitalisation interventions. Major identified context subcategories are external dynamism, external complexity and internal complexity (Duncan, 1972), with Table II presenting representative examples from the empirical data. Furthermore, the strategic choices made by the organisation's decision makers (cf. Child, 1972) seem to drive some of the digitalisation interventions. Here, the organisation's strategic choice for savings and efficiency was identified as a strong driver for digitalisation. Other decision makers' strategic choices that seemed to influence the digitalisation interventions are presented in Table II. As a third context category, reflecting institutional isomorphism (DiMaggio and Powell, 1983), coercive and normative pressure seems to drive digital interventions in the case organisations (Table II). By contrast, innovation diffusion theory did not seem to explain the drivers for procurement digitalisation in the data set.

Moving on to digital interventions, we observed that the typology for group support technologies by Zigurs and Buckland (1998) fits the structure perceived in the data set. Therefore, the interventions were categorised as communication support, process structuring and information processing interventions. These categories were further classified to subcategories (Table III) to better match the observations from the data. The data set also included interventions that fit the concept of decision aiding (Huber, 1990).

The observed structure related to mechanism seemed to fit well with the value driver framework suggested by Srai and Lorentz (2019), including transaction management, coordination and control, process improvement and innovation, strategic alignment, supplier capability assessment, relationship management and supply market knowledge management. Table IV presents representative examples of the data related to the mechanisms.

Table II Contexts with representative examples from the data

----------Insert Table II approximately here ----------

Table III Interventions with representative examples from the data

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Table IV Mechanism categories and examples from the data

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4.2 Propositions on linkages between CIM elements

In this section, a set of propositions were developed reflecting the abductively perceived constructs and their linkages in the data set either across all the CIM elements or only between two elements (e.g. IM). To support the development and discussion of propositions, Figure 2 was used to focus attention on the relatively salient linkages based on the frequencies between the CI and IM elements, as observed in the data display in Appendix B. Those linkages with a frequency equal to or above a threshold of three (directs attention to max. 50% of all the linkages), were selected for further consideration for proposition development; nevertheless, a closer examination in some cases caused relaxation of this rule. After the salient linkages for potential proposition development were identified, these were examined in more detail for actual associations (see data display in Appendix B). For example, after closer examination, two different institutional pressures (external coercive and normative pressures), driving data storage and management (Figure 2: L5 and M5, panel A) were treated together in a proposition despite their low frequencies individually, as they both serve as drivers for producing external legitimacy. Furthermore, although data storage and management are linked with a frequency of three with coordination and control (Figure 2: E2, panel B), the evidence on related linkage with the context is mixed, and thus proposition development was not pursued further. Essentially, some judgement was used to decide on the potential for proposition development. In the following, the resulting propositions are developed and discussed (highlighted with colour codes in Figure 2) with references to the appropriate units of analysis (see Appendix B).

From context (as in Table II) ... \ ... to intervention (as in Table III)	Comm. support		Proc. structuring		Info. processing				Decision aiding
	1. Internal	2. External	3. Automation	4. Formalisation	5. Data storage & mgmt	6. Int. data integration	7. Ext. data integration	8. Ext. data sharing	9.
A. Internal complexity	3		3	8	2	1	1		1
B. External complexity		1		2			2		1
C. External dynamism		1		1		1	4		1
D. Choice for savings for efficiency			6	1		1			1
E. Choice for sustainability		1					1		
F. Choice for agility and speed		1	1	2					
G. Choice for differentiation									1
H. Choice for transparency					1				
I. Choice for value						1			
J. Choice for innovation								1	
K. Choice for reliability							1		
L. External coercive pressure					2		3		
M. Normative pressure				2	1	1	1		1
N. Obsolesence of old system	1		1	1	1				1

PANEL A

From intervention (as in Table III) ... \ ... to mechanism (as in Table IV)		1. Transaction mgmt	2. Coordination & control	3. Process improvement	4. Strategic alignment	5. Supplier capability ass.	6. Relationship mgmt	7. Supply market knowl.
Comm. support	A. Internal		3					
	B. External			2	1		3	
Proc. structuring	C. Automation	1	2	10	1			
	D. Formalisation	1	5	8	3	1	1	
Info. processing	E. Data storage & mgmt		3	4	2	1	1	
	F. Int. data integration		4		2	1		
	G. Ext. data integration			1	4	3		4
	H. Ext. data sharing			1			1	
Decision aiding	I.		1		3	4		

PANEL B

Propositions: P1, P2a, P2b, P3a, P3b, P3c, P4

Figure 2 Data display of the frequencies of CI linkages (panel A) and IM linkages (panel B)

Interventions for *internally oriented communication support*, for example social media platforms used for communicating and informing about system updates and procurement policies across the organisation and stakeholders, are predominantly observed. Internal complexity stemming from (1) a large number of stakeholders, especially in the case of indirect procurement, (2) multiple organisational units and (3) many different legacy information systems (Appendix B: 3, 27, 33), seem to drive uncertainty across the organisation (Duncan, 1972) and affect procurement tasks (cf. Foerstl et al., 2018). Therefore organisations are expected to match such uncertainty-driven requirement with more information sharing, produced with increased capacity for communication within the organisation (Galbraith, 1977; Tushman and Nadler, 1978). Communication support interventions in the form of social media platforms may be ideal at reducing internal complexity-driven uncertainty owing to their capacity to communicate large quantities of data (Figure 2: A1, panel A).

It is likewise observed that internally oriented communication support interventions are linked with the coordination and control mechanism for policy compliance and greater visibility into contracts provided by strategic sourcing (Appendix B: 3, 27, 33) with a remedial effect on maverick buying (Figure 2: A2, panel B). The interpretation of this linkage is supported by Kauppi and van Raaij (2015, 953), who suggest that 'guidance and training help to reduce governmental employees' noncompliance' regarding centrally negotiated frame agreements because internal social media may support such efforts for guidance. Therefore, the following proposition is suggested.

P1: Internal complexity contexts (C) regarding multiple stakeholders and multi-unit organisations, drive internal communication support interventions (I) with social media platforms supporting coordination and control mechanisms (M) for policy compliance.

Moving on to *process structuring* interventions, initially on those with *automation* orientation, it is observed that these primarily draw on robotic process automation technology for data transfer between systems, invoice handling, contract implementation and supplier validation (Appendix B: e.g. 3, 14, 22, 28). Further observations on the reduced form of data in Appendix B suggest that such interventions are typically driven by the context variable of strategic choice for savings and efficiency along with internal complexity (Figure 2: D3 and A3, panel A). Regarding the latter, the complexity due to many internal stakeholders, several separate systems and multi-unit organisation creates a ripe context for applying robotic process automation to large volumes of repetitive, error-prone and rule-based tasks, including those with a swivel-chair nature for integrating separate systems (Fung, 2014). Coupled with a strategic choice for savings and efficiency at the firm level, automation likely becomes part of the procurement strategy (cf. Säfsten et al., 2007).

The link from automation-oriented interventions to the mechanism side is quite straightforward, as it is observed that process structuring via automation most prominently results and is aimed at process improvement (Figure 2: C3, panel B), which takes place through process renewal, release of resources for more strategic tasks, reduced amount of mistakes, faster contract formulation and easing the burden of sourcing managers (Appendix B: e.g. 1, 3, 23, 39). The observations based on data set therefore suggest the following proposition.

P2a: Strategic choice for savings and efficiency and internal complexity contexts (C) drive automation-oriented process structuring interventions (I), which typically support process improvement mechanisms (M) leading to shortened cycle times, efficient use of procurement resources and error reduction.

Similarly to automation, *formalisation-oriented process structuring* interventions also appear to be driven by internal complexity, but even more saliently (Figure 2: A4, panel A). Multi-unit organisations, multiple stakeholders and heterogeneous spend, particularly in the domain of indirect procurement, drive the need for clear operating procedures harmonised across units and sites (Appendix B: e.g. 6, 13, 16, 20, 29), thus enabling the achievement of synergies (cf. Rozemeijer, 2000). Such formalisation has been suggested to contribute to the level of procurement maturity (Bals et al., 2018) and that formalisation-oriented process structuring interventions respond to internal complexity. In the data set, interventions typically come in the form of software-as-a-service (SaaS)-based platforms for broadly supporting sourcing processes and projects (e.g. supplier onboarding and management, tendering, RFx, e-auctions, savings registering), supplier collaboration and stakeholder buying through, for example, e-catalogues (Appendix B: e.g. 5, 12, 18, 20).

These interventions (Appendix B) typically aim at the mechanisms of coordination and control and process improvement (Figure 2: D2 and D3, panel B). In the data set,

coordination and control as a result of process formalisation come in the form of harmonisation, better use of contract terms, buying based on accepted requisitions, improved linking of contractor work reports with contracts and reduction of maverick buying (Appendix B: e.g. 1, 16, 20). Indeed, limiting task autonomy has been shown to reduce maverick buying (Karjalainen and van Raaij, 2011). Moreover, process improvement as a result of formalisation shows in the data as an accessible single site for sourcing tasks, process throughput time reduction, redirection of resources to more strategic tasks and improved category management (Appendix B: 5, 6, 30). These observations are aligned with research that suggests formalisation, by means of rules, procedures and protocols, improves the effectiveness of, for example, global teams (Gibson et al., 2019). Source-to-contract platforms may essentially be perceived as providing such in the procurement context. The following proposition is thus suggested.

P2b: Internal complexity contexts (C), such as in the form of multi-unit organisations, multiple stakeholders and heterogeneous spend, drive process structuring interventions (I) for formalisation, typically supporting coordination and control (for improved contract utilisation and harmonisation) and process improvement mechanisms (M) (for efficiency and speed).

The third identified intervention category is related to information processing and covers three subcategories as discussed earlier. All the intervention categories focus on data, with the first on the aspect of *data storage and management*. These types of interventions range from simple network drives to more advanced data warehouse infrastructures, as well as from automatic collection and deletion of data points by means of robotic process automation to artificial intelligence-based contract content categorisation and labelling (Appendix B: 7, 8, 19, 30). RPA applications include automatically including suppliers' product information in an e-commerce system for the benefit of consumers or deleting unused suppliers' data from databases in compliance with GDPR regulation (Appendix B: 11, 8). Other contextual variables that serve as drivers for adoption include regulation regarding product information availability, such as coercive pressures, as well as a perceived 'quest for sourcing excellence' (Appendix B: 8, 11, 30), which may be understood as pertaining to normative pressures (Figure 2: L5 and M5, panel A). Similarly, the role of such institutional pressures in the adoption of Internet-enabled systems for supply chain management (e.g. Liu et al., 2010) and the nature of GDPR regulation as coercive pressure in data collaboration (van den Broek and van Veenstra, 2018) have been recognised in extant research.

Information processing interventions for data storage and management aim for process improvement and strategic alignment (Figure 2: E3 and E4, panel B), with error free, up-to-date and compliant databases supporting category management and consumer-facing strategies for transparency in e-commerce (Appendix B: e.g. 7, 8, 11). Therefore the following proposition is stated.

P3a: Institutional pressures contexts (C) in the form of coercive data regulation or normative pressure for excellence , drive information processing interventions (I) for automatic data storage and management, which supports process improvement mechanisms (M) for increased compliance and transparency.

As discussed earlier, the interventions for *internal data integration* seek to combine high volume, variety and velocity of data from heterogeneous internal sources to enable improved decision making in the organisation (e.g. Nadal et al., 2019; Waller and Fawcett, 2013). In the procurement context, the data set in Appendix B prominently describes advanced spend data applications and suggests relevance for evaluating supplier performance on cloud-based analytics platforms (Appendix B: 2, 26, 32, 35). The advanced forms of spend analytics draw on algorithms for data improvement, provide real-time monitoring capabilities and combine spend data internally with contract and order data to enable forward-looking spend planning in contrast to the typical rearview mirror perspective. The context variable drivers for these interventions seem to vary somewhat, preventing conclusions regarding prominent drivers (Figure 2: column 6, panel A). Drivers such as effort to secure savings, complex multi-unit organisation and aim for fact-based procurement are observed (Appendix B: e.g. 2, 32).

However, at the mechanism side, the picture is clearer, suggesting, quite logically, coordination and control as the prominent output (Figure 2: F2, panel B). This is achieved by the means of better capability for steering and achievement of a global or 'helicopter' view on spend (Appendix B: 35), allowing the detection of synergy opportunities across business units and supply markets (Faes et al., 2000). Thus, interventions that support the spend analysis process and related decision making result in coordination for global synergies in procurement (Smart and Dudas, 2007). The following proposition is therefore stated.

P3b: Information processing interventions (I) for internal data integration, such as for spend management, typically enhance coordination and control mechanisms (M) in support of steering and global synergy (M).

Interventions for *external data integration* seek to combine high volume, variety and velocity of data from heterogeneous internal and external sources. Such big data ecosystems may enable organisations to leverage situational data analysis, with data obtained, for example, from third-party data providers (Nadal et al., 2019) or, in the procurement case, from suppliers. Appendix B describes such interventions as cloud-based systems and tools for collecting, combining and analysing internal spend data, supplier performance data and external supplier financial status data, commodity prices, country risk indicators, news feeds and even possible court records for suppliers' key personnel background checks (Appendix B: e.g. 9, 15, 45, 46). Interventions may also be geared towards enabling an examination of suppliers' compliance with, for example, the REACH regulation regarding their products and components (Appendix B: 42). The data set also shows that the contextual variables as drivers pertain predominantly to external dynamism (Figure 2: C7, panel A), for example in terms of changing supply markets (e.g. consolidation, volatile market prices) and dynamic supply bases (mergers, production transfers, PLC ramp-downs; Appendix B: e.g. 36, 45). Such characteristics drive uncertainty and, therefore, according to the information processing theory, suggest a greater amount of information processing that must be matched with an appropriate capacity for processing (Galbraith, 1977; Tushman and Nadler, 1978). Information systems as interventions provide such a capacity by being able to process large quantities of data (Daft and Lengel, 1986). Additionally, external coercive pressure in the form of REACH, traceability and security regulation (Appendix B: 15, 17, 42) drive the

uptake of interventions for integrating external data (Figure 2: L7, panel A). This phenomenon may be linked to the more general adoption of responsible and ethical practices, which are often driven by institutional pressures (Waddock et al., 2002).

Aligned with information processing theory (Galbraith, 1977; Tushman and Nadler, 1978), the mechanisms enabled by this type of information processing capacity that increases interventions relate to an improvement in supply market knowledge (Figure 2: G7, panel B) in the form of an efficient access to enhanced intelligence and supply market visibility. It is also linked to a strategic alignment for compliance in the form of traceability and meeting public expectations for ethical practices (Figure 2: G4, panel B). Other business benefits appear to include, for instance optimisation of food supply chain for less waste and recalls, enabled by a blockchain application for transparency in terms of food sources (Appendix B: 4). The following proposition is therefore suggested.

P3c: External dynamism (e.g. regarding supply markets) and coercive pressure contexts (C) (e.g. in the form of regulation), drive information processing interventions (I) for external market data integration, which typically support supply market knowledge and strategic alignment mechanisms (M) for enhanced compliance.

Interventions for decision aiding is the final category discussed in this section. As was observed earlier, no subcategories are detected in the data because the number of analysis units is relatively low (6). It seems that the contextual variables as drivers (Appendix B) are quite heterogeneous without a common denominator (Figure 2: column 9, panel A). For example, the following is observed: (1) internal complexity is mentioned as a driver for workplace–social media application for rating suppliers, (2) external complexity due to heterogeneous spend and suppliers appears as a driver of artificial-intelligence-based prescriptive analysis for supporting sourcing decisions and (3) normative pressure in the form of aim for fact-based decision making functions as a driver of intelligent anomaly alerts regarding supplier performance (Appendix B: 3, 9, 31). Prescriptive analytics or artificial intelligence applications form the technological basis for such interventions. Therefore, in the early maturity phase of the technology, the drivers are more or less firm specific because of the lack of use cases, low availability of off-the-shelf applications and low degree of innovation diffusion (Rogers, 2010). Such conditions discourage firms to broadly board the bandwagon of intervention adoption for decision aiding (Abrahamsson and Rosenkopf, 1993).

By contrast, the linkage to the mechanism side is somewhat clearer, as supplier capability assessment and strategic alignment seem to be dominant aims of decision-aiding interventions (Figure 2: I4 and I5, panel B). Regarding the former, the interventions enable supplier performance ranking, risk profiling and predicting on-time-delivery performance (Appendix B: 3, 9, 41), whereas in terms of the latter, the data set suggests improved capability for evidence-based category management and cost reduction (Appendix B: 2, 31). The following proposition is therefore suggested.

P4: Firm-specific contexts (C) drive decision-aiding interventions (I) with artificial intelligence and predictive analytics, supporting, for example, supplier capability assessment mechanisms (M) for improved on-time delivery and risk mitigation, and strategic alignment mechanisms (M) for enhanced category management.

Figure 3 depicts the developed propositions across the CIM elements.

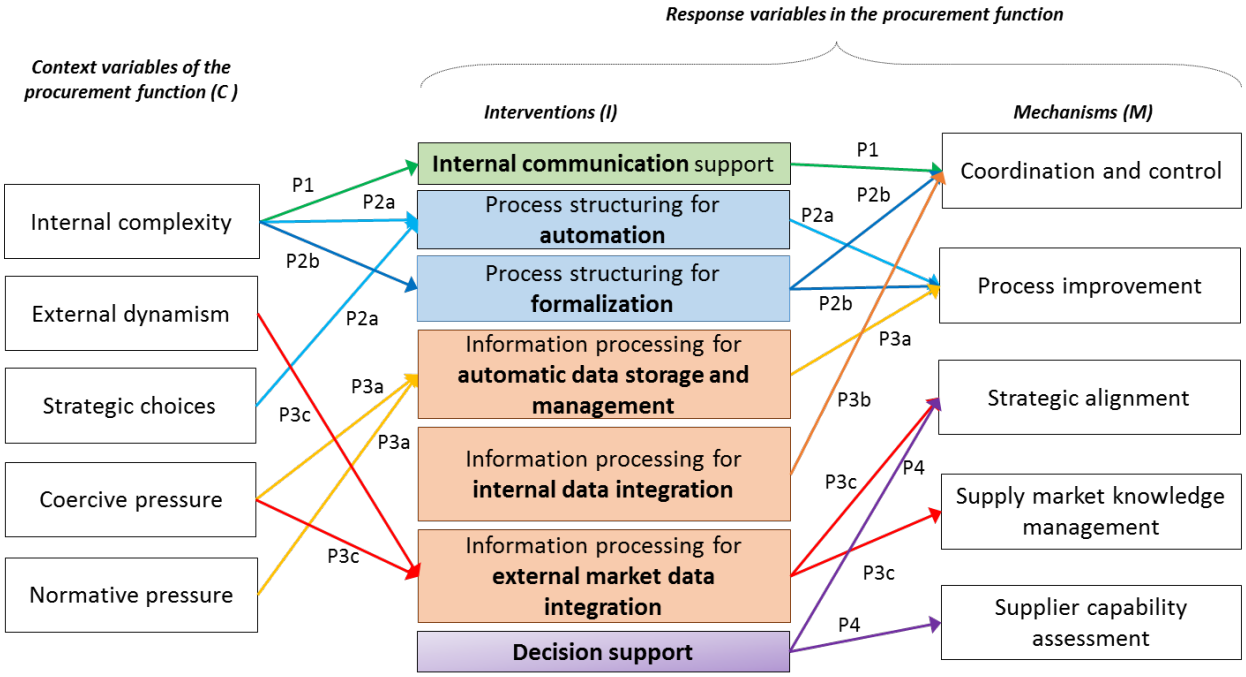

Figure 3 Linkages between context variables and response variables as stated in propositions

5. Discussion and conclusions

5.1 Theoretical implications

In pursuing to structure the phenomenon of procurement digitalisation, this research presented a rich picture of the dominant managerial mental models or cognitive representations regarding the business environment where decision makers act to manage systems and organisations (Daft and Weick, 1984; Porac and Thomas, 1990). The theoretical implications of this research may be roughly divided into two categories.

Firstly, the results provide structure to each of the elements of the CIM a priori structure, broken down into categories, with empirical observations abductively matched with extant theoretical constructs in the literature. The data show that *context* as the driver of digital interventions in procurement may be explained with (1) contingency-theory-related constructs of complexity and dynamism as characteristics of procurement and supply markets (Duncan, 1972); (2) various strategic choices aligned with corporate strategic imperatives such as savings and sustainability (Child, 1972); and (3) institutional pressures instigated by,

for example, coercive regulation and normative perceptions about procurement excellence (DiMaggio and Powell, 1983). These results are not unexpected, as some of these theories have been used to examine contextual variables in the procurement context before (Zsidisin et al., 2005; Bals et al., 2018). However, the results suggest the dominance of certain categories of drivers, such as internal complexity and choice for savings and efficiency, in the pursuance of procurement digitalisation.

At the *intervention* side, the abductive analysis matched empirical observations with extant technology categories in the literature (Zigurs and Buckland, 1998; Huber, 1990), allowing the advance from referring to particular technologies, such as robotic process automation or artificial intelligence, to a more abstract and theoretically interesting level of examining the procurement digitalisation phenomenon. The data reveal that procurement digitalisation interventions are first and foremost about process structuring in the form of automation and formalisation as well as information processing in the form of integrating external and internal data for leveraging analytics in decision making. With such interventions, procurement decision making becomes more situational (Nadal et al., 2019), timely and confident, with potentially beneficial effects on involvement in cross-functional and strategic deliberations (e.g. Zsidisin et al., 2005).

For structuring the *mechanism* side, the data appeared to match appropriately with the procurement value drivers identified by Srai and Lorentz (2019). Interestingly, the most prominent mechanisms in the data appear to be (1) process improvement, (2) coordination and control and (3) strategic alignment. According to Srai and Lorentz (2019), these drivers may be considered predominantly internal in nature, suggesting bias in the mental models towards internal development, rather than aiming at more externally oriented supplier capability assessment, relationship management and supply market knowledge. While the subsequent proposition development in the domain of CIM linkages covers almost the entire range of element categories, both internally and externally oriented, we note that the main thrust of procurement digitalisation, as reflected in our data set, appears to have a predominantly internal flavour. Specifically, it represents internal complexity and choice for efficiency at the context side; automation and formalisation of processes at the intervention side; and coordination and control, process improvement and strategic alignment at the mechanism side. Integration of data sources for information processing, including those external in nature, seems to be an exception to this pattern of internal bias in procurement digitalisation mental models. Given the proposed dyadic nature of procurement digitalisation (Kosmol et al., 2019), that is, adoption in sync with suppliers, the dominant results presented here provide an interesting contrast to the more externally oriented mental models that may appear in specific contexts.

Secondly, the theoretical contributions come in the form of seven propositions regarding the linkages between element categories within the CIM a priori structure. The seven propositions may be conceptualised as managerial mental models. From the observations across these propositions, it seems that *internal complexity*, as previously suggested, appears to be a salient driver for procurement digitalisation, motivating (1) internal communication support, (2) automation-oriented process structuring and (3) formalisation-oriented process

structuring interventions, which in turn aim at procurement coordination and control as well as process improvement. This is a prominent mental model (P1, P2a, P2b; see also P3b) an with internal orientation (cf. Søgaard et al., 2019), which, if realised with digitalisation, enables procurement to reduce operating cost, serve stakeholders faster and more reliably and achieve higher spend-under-management ratios across categories. These basic but rather important internal aims thus remain on the procurement development agenda (cf. Cox et al., 2005) and may be potentially addressed with digitalisation.

In contrast to the internal mental model, another cross-proposition observation is that external forces such *coercive regulatory pressures* and *external dynamism* drive interventions for information-processing-related (1) automatic data storage and management, (2) external market data integration and interventions related to (3) decision aiding. These interventions seem to be linked with mechanisms such as process improvement (P3a), supply market knowledge and strategic alignment for external compliance (P3a, P3c) and supplier capability assessment (P4). This prominent mental model therefore demonstrates a more external orientation and will potentially enable procurement to leverage intelligence on suppliers and supply markets. Consequently, it will increase its involvement in cross-functional decision making (Zsidisin et al., 2015) and the strategic relevance of the function (van Weele and van Raaij, 2014). Improved capability to tap into the supply base and market knowledge may enable the procurement function to draw on both exploitation- and exploration-oriented development efforts and simultaneously improve the existing as well as adopt novel sourcing arrangements and supply solutions in a balanced way (Kilpi et al., 2018). Furthermore, efficiently meeting the requirements imposed on the organisation by external parties, for example in terms of sustainability, enables the procurement function to support broader corporate objectives.

5.2. Managerial implications

The structured picture of the phenomenon of digitalisation in procurement gives guidelines for managers when considering procurement digitalisation in their specific contexts. The study identifies categories of contexts in which specific choices of digital technologies are common and links to specific mechanism categories. For example, a desire to achieve savings in company operations was identified as a strong driver for digitalisation, which may be realised in terms of adopting robotic process automation-based solutions for bringing about process improvement for efficiency outcomes. On the other hand, innovations may be a strategic choice for another company, and the achievement of such a goal may be supported by digital solutions related to enhanced external data sharing, with improved relationship management leading to innovation outcomes.

With critical assessment, the identified sets of variables, presented in the form of propositions, may be considered as digital strategies for procurement. Decision makers may then develop and refine such strategies further into case-specific root cause analyses, user journeys, technical specifications for vendors, roadmaps and expected outcomes with plans for measurement. Essentially, the results provide strategy options for decision makers to consider both in the contexts of procurement digital strategy development and evaluation.

Here the results also allow for checking of a possible strategy bias towards, for example, the internally oriented digitalisation, which would leave the externally oriented unaddressed. Reflection on the organisation's context allows appropriate prioritisation and focus in the light of the results of this research.

5.3 Limitations and future work

In terms of limitations, this research focuses on mental models of procurement managers in 12 organisations in one country. Although case selection sought to employ purposeful sampling for a diverse set of organisations across manufacturing, retail, utilities and public domains, the eventual sample unavoidably suffers from a small size and some level of bias. In this vein, it is noted that our data did not provide salient enough evidence for linking all of the observed context variables and mechanisms with interventions (e.g. external complexity), thus suggesting the need for further research. Furthermore, this research suggests a structure for procurement digitalisation, which, as a mental model, can largely be considered a prediction because the phenomenon that is the focus of this research has not yet been realised at scale.

Despite these shortcomings, when addressed with careful research design, diversity in sampling and triangulation of researchers and sources during data collection and analysis, this research structures the field in a nuanced manner and offers a foundation for further exploration of the phenomenon in different environments. Replication studies may refine and enrich the results of this study, and longitudinal studies may capture change in this rapidly evolving domain for example in terms of shift from internal to external orientation. In further research, as digital applications in procurement become more common, and as the study and observation of realised contexts, interventions and mechanisms become possible, the knowledge base on procurement digitalisation can be validated and refined by testing the suggested propositions and expanding the scope to the achieved outcomes and their measurement.

Indeed, this novel forward-looking approach for structuring the phenomenon of procurement digitalisation may support procurement functions to seek, discover and experiment with new technology solutions. Only with such efforts can procurement possibly experience a transformation that will meet the expectations characterising the much discussed 'revolution scenario' for the procurement future.

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APPENDIX A: Interview guide

1. What are your key priorities and challenges for procurement at the moment?

2. What kind status does procurement have? Does it have representation in the top management team? How does collaboration with other functions work?

3. Why is procurement digitalization a relevant topic for you? What are your aims regarding procurement digitalization? Do you have a digital/digitalization strategy?

4. What kind of digital applications do you a) have in use, b) have decided to implement, c) plan to implement in the next 2-10 years? Please position the application in the grid [see Srai and Lorentz, 2019].

5. For each application:

    a. What kind of application is this? Powering technologies? Functionalities? [intervention]

    b. What do you aim for with the application? Observed or assumed capability and performance implications? [mechanism]

    c. Why was/will the application be implemented? Which phenomenon, problem, challenge, requirement or pressure led to planning or implementation? [context]

Appendix B Reduced form data of the case study

UoA	Case	*Context*	*Intervention*	*Mechanism*
1	Chemicals	**Internal complexity:** global business and the need to harmonize procurement, integrated system for replacing separate legacy systems, prohibiting information flow	**Process structuring:** cloud-based integrated system for managing sourcing, buying, invoicing, contracts and suppliers through a portal;	**Coordination and control:** better use of contract terms, leveraging sourcing achievements, control of buying through accepted requisitions, ease-of-use as priority improving acceptance
2	Chemicals	**External dynamism / internal complexity:** multiple dynamic supply markets for indirect procurement to manage; **Normative pressure:** data as a key asset in procurement, drive for digitalisation and using supply market intelligence; **Coercive pressure:** regulatory requirements for data	**Information processing:** Power BI reports with data from different sources, self-service portal for accessing market data, raw material prices, country risk indicators, supplier financials etc.	**Supply market knowledge:** aim for efficiency in accessing supply market intelligence, ability to deal with and respond to new compliance requirements
3	Chemicals	**External complexity:** dozens of contractors involved in regular operations and large scale facility maintenance projects, legacy process highly manual with large volume of tasks	**Process structuring:** cloud-based system for external contractors to report their work on facility maintenance, integrated with ERP and acceptance systems;	**Coordination and control:** more efficient linking of work reports with contracts and the associated terms, provides transparency into the process
4	Energy	**Choice for savings and efficiency:** savings, task simplification and support	**Process structuring:** RPA applied to purchase-to-pay process and supplier management	**Process improvement:** automation
5	Energy	**Internal complexity:** global multiunit organisation	**Information processing:** spend analytics solutions	**Coordination and control:** global view to spend, harmonization and consolidation
6	Energy	**Internal complexity:** diverse practices due to M&A	**Communication support:** internal social media	**Coordination and control:** informing about category management and policies
7	Food	**Internal complexity:** Drive to centralise and harmonise/standardise the geographically dispersed procurement organisation	**Information processing:** Network drives and Sharepoint	**Coordination and control:** Sharing of procurement related information
8	Food	**Internal complexity:** Need to control and coordinate multiunit and dispersed procurement organisation	**Process structuring:** (improved, more flexible and easier for suppliers) e-catalogues	**Coordination and control:** Reduction of maverick buying
9	Food	**Choice for sustainability:** Organic and local supply key priorities for the firm	**Communication support:** Social media and other mobile apps	**Strategic alignment for sustainability:** Visibility into the source for the company and consumers
10	HeavyMach	**Choice for savings and efficiency:** cost competitiveness as a priority, suppliers communicate with emails, need to input delivery data into ERP systems	**Process structuring:** system integration and automation of small and repetitive tasks, RFQ automation	**Transaction management; process improvement:** automation
11	HeavyMach	**Choice for reliability:** supply chain transparency as a driver	**Information processing:** IoT and mobile technologies connected to Supplier web	**Supplier capability assessment:** inbound order tracking
12	HeavyMach	**External dynamism:** volatile commodity prices and recent investments in reporting and analytics capabilities	**Information processing:** RPA for commodity price collection	**Supply market knowledge:** enhanced supply market intelligence

13	HeavyMach	**External complexity:** high number of suppliers, availability challenge, transparency as a driver	**Information processing:** risk analysis application (cloud based, follows news feed)	**Supply market knowledge**
14	HeavyMach	**External complexity:** global business and supply base	**Communication support:** virtual supplier development engineer -app for supporting suppliers in problem solving	**Relationship management; Process improvement** due to less travel
15	HeavyMach	**Choice for agility and speed:** aim for transparency and speed in the supply chain	**Communication support:** supplier portal for communicating transport (with IoT & mobile tech.), drawings, quality notifications and performance	**Relationship management:** collaboration and transparency
16	Instruments	**External dynamism:** visibility cross-functionally and in supplier relationships as a priority due to demand fluctuation	**Communication support:** supplier web, also with mobile access	**Process improvement; Relationship management:** sharing of forecast with suppliers, visibility into inventories (inventory reduction)
17	Instruments	**Choice for savings and efficiency:** efficiency and automation as drivers in procurement excellence development	**Process structuring:** application of RPA to manual buying and sourcing work. Automation of component data input (integration of systems with RPA)	**Process improvement:** make the work of sourcing managers easier (less burden)
18	Instruments	**Choice for innovation:** innovation focused company. Procurement seeks to bring in technologies and innovation from supply base, ESI	**Information processing:** cloud-based Supplier Collaboration -platform for sharing of product data and product change data with suppliers. Receiving engineering change proposals from suppliers.	**Relationship management:** supplier involvement in product development**;** **Process improvement:** contributes to productivity
19	Instruments	**External dynamism:** Long component lead times, availability and supply risk management challenge	**Decision aiding:** AI and algorithms applied on historical on-time-delivery data	**Supplier capability assessment:** predicting supplier on-time-delivery and inbound delivery risk management
20	Instruments	**Coercive pressure:** REACH regulation	**Information processing:** cloud-based system for examination of suppliers' compliance with the REACH regulation regarding their products and components.	**Strategic alignment:** regulatory compliance; **Supplier capability assessment**
21	Logistics	**Choice for savings and efficiency:** rationalisation of work; **Choice for agility and speed:** faster service of suppliers and stakeholders; **Internal complexity:** challenge of serving the large multi-unit organisation	**Process structuring:** SaaS-based platform [Jaggaer] for managing sourcing projects, incl. supplier onboarding and management, tendering, RfX, e-auctions, savings registering (S2C)	**Process improvement:** accessible single site for all sourcing related information and tasks (reduction of multiple data input requirements), simpler process indepedent of individuals; **Strategic alignment:** facilitates project collaboration with stakeholders
22	Logistics	**Internal complexity:** several signatures needed in sourcing projects	**Process structuring:** electronic signature application by Adobe	**Process improvement:** cuts lead time significantly
23	Logistics	**Obsolescence of old system**, with poor user acceptance	**Information processing:** external service provider's AI application processes contract documents by collecting and categorising content in order to support search and queries	**Process improvement:** less mistakes, faster, not dependent on individuals completing tasks; **Coordination & control:** contracts more broadly accessible and better managed; **Supplier capability assessment:** facilitates supplier assessment and KPIs
24	Logistics	**External coercive pressure:** supplier data bases must meet GDPR regulations	**Information processing:** RPA solution for deleting data of unused suppliers from the sourcing portal	**Process improvement / relationships management:** more appropriate, up-to-date and compliant supply base management

25	Logistics	**External complexity:** many supply markets for heterogeneous spend, many suppliers and of different types	**Information processing:** data warehouse and Power BI application with spend data, internal supplier status data, external supplier financial data; **Decision aiding:** plans for AI based prescriptive analytics for aiding sourcing managers	**Supplier capability assessment:** supplier risk profiles and selection
26	MovingMach	**Choice for savings and efficiency:** drive for efficient procurement operations	**Process structuring:** RPA for invoice handling	**Process improvement:** less resources used for invoide handling (automation), more time for strategic sourcing
27	MovingMach	**Choice for agility and speed:** faster time-to-market	**Process structuring:** AI-based contract benchmarking	**Process improvement:** better & faster contract formulation and negotiatio; **Strategic alignment:** shorter contract cycles and velocity
28	MovingMach	**Internal complexity:** multiunit organisation, aim for excellence	**Process structuring:** RPA for contract utilization	**Coordination and control:** reduction of maverick buying
29	Pharma	**Internal complexity:** Aiming for a common way of working in all categories--> Today many different channels and systems	**Communication support:** Yammer for informing e.g. about systems updates etc.; Information processing: Sharepoint, Pallas document management system (incl. contracts and important data)	**Coordination and control:** Transparency and visibility into procurement documents and contracts
30	Pharma	**Choice for savings and efficiency:** seeking to decrease manual work, towards automation	**Process structuring:** automation of tasks in SAP	**Process improvement:** efficiency, automation
31	Pharma	**External dynamism:** Supplier management development as a priority, changing supply base (mergers, production transfers, PLC ramp-downs)	**Process structuring:** SRM, tendering; Information processing: cloud-based Polaris-system for supplier performance measurement (SAS for performance analytics), contract archive	**Coordination and control:** achieving a helicopter-view; **Supplier capability assessment:** more time for supplier development
32	Pharma	**External dynamism:** supply risk management as a priority, developing a second source, dynamic supply base	**Information processing:** market intelligence tool	**Supply market knowledge:** visibility into supply markets
33	Pharma	**Coercive pressure:** regulation for traceability and security in pharma supply chain	**Information processing:** Big Data and analytics for tracing raw material origin	**Strategic alignment:** traceability of pharma products
34	Public	**Internal complexity:** customer centric centralised public procurement unit dealing with complex organisation, heterogenous spend and supply base; **Choice for agility and speed:** with internal customer service as a priority	**Process structuring:** Cloud-based platform for supporting sourcing, contracting, supplier management and category management processes, as well as stakeholder delegated buying.	**Process improvement:** reduction of procurement process lead time from 11 months to 6 months; **Strategic alignment for internal customer service:** reduction of dependency on individuals leading to reliable and consistent service
35	Public	**Internal complexity:** several separate systems and many workflows	**Process structuring:** RPA for automating manual tasks and processes which require data transfer between different information systems and platforms (systems integration)	**Process improvement:** better use of procurement personnel resources with focus on "the beef"
36	Public	**External dynamism:** strategy promotes using functioning markets while market consolidation and change makes this difficult; **Coercive pressure:** public organisations need to source responsibly, requiring background checks of supplier key personnel	**Information processing:** collection and integration of data from various sources, incl. external service provider data bases and dispersed district courts around the country	**Strategic alignment for compliance:** ability to better meet strategic imperatives and compliance with regulation and public expectations

37	Retail 1	**Strategic choice for differentiation:** supply in retail stores needs to fit with local demands	**Decision aiding:** AI-based forecasting of product demand in retail stores	**Strategic alignment:** supporting strategy through matching local demands with supply
38	Retail 1	**External coercive pressure:** regulation on making product information available to consumers in e-commerce; **Strategic choice for transparency:** desire to support to consumers varying dietary requirements	**Information processing:** collection and input of suppliers' product information automatically by deploying RPA	**Process improvement; strategic alignment:** supporting strategy for transparency in e-commerce
39	Retail 1	**External complexity:** need to collaborate with a large supply base; **Coersive pressure:** suppliers expect advanced systems in order to consider buyer as preferred customer	**Process structuring:** SaaS platform for collaboration with suppliers e.g. in terms of forecasts, information exchange, bidding, sourcing and contracting, logistics management	**Process improvement:** more efficient way of working (automation, less emails), redirecting resources for more productive tasks; **Relationship management:** two-way collaboration
40	Retail 2	**Internal complexity:** Many near-obsolete and siloed ERP systems in multi-unit organisation	**Process structuring:** adoption of single ERP across business units	**Process improvement:** automation, less mistakes, efficiency; **Coordination and control:** harmonisation;
41	Retail 2	**Choice for savings and efficiency:** effort to secure and retain savings	**Information processing:** new spend management application with use of contract and order data for forward looking planning in indirect categories; **Decision aiding**: predictive analytics	**Coordination and control:** better steering and transparency; **Strategic alignment for savings:** aim for cost savings
42	Retail 2	**Internal complexity:** many stakeholders and buyers in indirect; **Obsolesence of old system**	**Process structuring:** Coupa -integrated platform for supporting new easy-to-use O2P and S2C processes; RPA for automating e.g. supplier validation and requisitions; **Communication support:** Workplace application for communicating about the system, chatbot for guiding users chatbot for guiding users **Decision aiding:** Workplace application for facilitating supplier evaluations	**Process improvement:** renewed S2C process, goal to achieve 80% automation level for savings; **Coordination and control:** steering stakeholders to behave in a desired way (compliance) **Supplier capability assessment**: based on rankings by other users
43	Retail 2	**Choice for sustainability:** consumer preference for understanding source of food by tracing	**Information processing:** blockchain solution for making the source or domestic fish transparent for the consumer, based on the IBM Food Trust platform (easy to use interface for supplier data input).	**Strategic alignment for tracing**; **Process improvement:** optimisation of food supply chain for less waste and recalls
44	Tele	**Choice for savings and efficiency**	**Process structuring:** RPA in contract implementation	**Process improvement:** automation
45	Tele	**Internal complexity:** aim to make-buying-easy -aim leads to automatisation and tools	**Process structuring:** buying tools for b2b transactions	**Transaction management; Process improvement:** more time for other more important (strategic) tasks
46	Tele	**Normative pressure:** quest for sourcing excellence	**Process structuring:** Ivalua platform, with Clickview; Information processing: SAP Business Warehouse, Azure data lake	**Strategic alignment; Process improvement:** category management, incl. project pipeline management, team management
47	Tele	**Normative pressure:** aim for fact-based procurement	**Decision aiding:** supplier performance dashboard drawing on Big Data analytics, and intelligent anomaly alerts	**Supplier capability assessment; Strategic alignment:** data and evidence-based category management, development and impact assessment

48	Tele	**Strategic choice for value:** towards broader value delivery, cashflow management as a priority **Normative pressure:** aim for fact-based-procurement	**Information processing:** Big data -analytics for enabling focus on key aspects, algorithms for spend data improvement, Clickview with realtime impact monitoring	**Coordination and control:** better steering **Strategic alignment:** data and evidence-based category management, development and impact assessment