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Dynamic capabilities for digital procurement transformation: a systematic literature review

Silke Herold, Jonas Heller and Frank Rozemeijer
Department of Marketing and Supply Chain Management, School of Business and Economics, Maastricht University, Maastricht, The Netherlands, and
Dominik Mahr
Department of Marketing and Supply Chain Management, School of Business and Economics, Maastricht University, Maastricht, The Netherlands and
Centre for Relationship Marketing and Service Management, Hanken School of Economics, Helsinki, Finland

Abstract

Purpose – The purpose of this paper is to achieve a collective understanding of the capabilities required for digital procurement transformation (DPT).

Design/methodology/approach – The authors contextualize theory about dynamic capabilities (DCs) to integrate the fragmented body of literature on procurement digitalization by means of a systematic literature review (SLR). By extracting and clustering capabilities, as well as proven performance outcomes from existing literature in the field, the authors develop a conceptual model of the DCs required for DPT.

Findings – The authors first introduce and define DPT and the corresponding motivations that trigger firms to invest in advanced digital technologies. Second, by adopting the DC lens, the authors provide an overview of nine microfoundations required for DPT and highlight the strategic options procurement leaders can use when strategizing about adopting combinations of digital technologies. Third, the authors present a future research agenda on DCs for DPT.

Research limitations/implications – The developed conceptual model must be verified and enhanced through further empirical research.

Practical implications – The conceptual model can be used by procurement leaders as a starting point and framework when strategizing about digitally transforming the procurement organization.

Originality/value – The study is the first to synthesize previous research findings on procurement digitalization through an SLR in order to develop a fine-grained conceptual model that supports practitioners and researchers alike in better understanding the capabilities required for and potential performance outcomes of DPT.

Keywords Digital procurement transformation, Procurement 4.0, Purchasing, Digitalization, Literature review, Dynamic capabilities

Paper type Research paper

1. Introduction

Over the past decades, procurement has further professionalized by shifting away from the transactional and administrative role toward a more strategic role that involves strategic sourcing, supplier relationship management and supply networks (Tassabehji and

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Moorhouse, 2008). The advancement of procurement technologies from *basic e-procurement solutions* (developed in the 90s) to the more *advanced digital technologies* available today, such as artificial intelligence (AI) or blockchain, has been instrumental to this development. The use of advanced digital technologies in procurement, referred to as *procurement digitalization* in the academic literature, has the potential to transform the procurement organization (Srai and Lorentz, 2019).

Practitioners hail the digitalization of procurement as an innovation catalyst (ADL, 2016), strategic enabler (BCG, 2018), and technological tipping point (Kearney, 2019). The list of outcome expectations includes efficiency and effectiveness gains for procurement, for example, *cost* savings, improved process *speed*, and enhanced product *quality* and *innovation*, as well as improved supply *risk* monitoring, as highlighted by industry reports (BCG, 2018) and academic research (Glas and Kleemann, 2016). Substantial funding (approximately 30 billion Euro) has been devoted to venturing new procurement technology start-ups since 2010, resulting in a growing number of new startups (Maersk Growth, 2020). Today, it is estimated that there are more than 4,000 digital procurement solutions available on the market (ProcureTech, 2021), with over 6 billion US dollars in revenues for 2021 (Statista, 2020) and an expected annual growth rate of 10.2% until 2026 (Mordor Intelligence, 2020). This double-digit growth rate explains some of the attention paid to procurement digitalization in recent years – both by academics and practitioners alike.

However, growing skepticism with respect to the maturity and adoption of digital technologies exists. The Fraunhofer Institute found that only 28% of participating companies are using advanced digital technologies in procurement. *A lack of knowledge of technologies and a lack of clarity regarding the scope of the transformation required* are mentioned as reasons for this prolonged adoption. Industry experts share various opinions on the transformational impact (functional versus overall company), as well as the different levels of machine involvement (automation versus autonomization) (Pellengahr *et al.*, 2016). Similarly, empirical research by Kosmol *et al.* (2019) found that their case companies, in addition to being industry leaders, had only implemented mature e-procurement technologies, as opposed to advanced digital technologies. Several scholars have outlined the barriers to the adoption of advanced digital technologies in procurement (e.g. Srai and Lorentz, 2019; Bienhaus and Haddud, 2018). However, it is still unclear which capabilities Chief Procurement Officers (CPOs) and other procurement leaders must promote when strategizing about whether to invest in advanced digital procurement technologies. Moreover, a more holistic perspective on the adoption of advanced digital technologies in procurement – which we term *digital procurement transformation (DPT)* – is missing. Such a perspective would highlight the fact that the impact of these technologies goes beyond the boundaries of procurement.

While the purchasing and supply management (PSM) field lacks a body of knowledge on this matter, borrowing knowledge from the broader field of supply chain management (SCM) is not recommended. In the SCM field, digitalization within the context of procurement has been discussed (Schmidt and Wagner, 2019); it is, however, difficult to deploy these general insights on digitalization, due to the specific nature of procurement processes, interfaces, and technologies (e.g. Bienhaus and Haddud, 2018; Kosmol *et al.*, 2019). Therefore, we want to focus our analysis and implications on procurement. Further study of the phenomenon at hand will lead to more detailed insights (that are not generalizable to the broader field of SCM) and enhance the PSM field as a result.

Consequently, more research is required to strengthen a collective understanding of procurement digitalization as a process, its transformative impact, as well as the capabilities CPOs must promote. Because we study a phenomenon that is currently evolving and dynamic of nature and requires strategic change, we use dynamic capability theory (DCT) to guide our study. Specifically, DCT has been chosen because it allows us to systematically study the specific activities and mechanisms of the underlying microfoundations required for

DPT, thereby guiding us to bring greater coherence to the existing body of knowledge. Moreover, because the positive impact of a firm's dynamic capabilities (DCs) on a firm's competitive advantage and performance is empirically validated (see Brekalo *et al.*, 2013), we include the performance outcomes of DPT in our literature study.

This paper aims to synthesize previous research findings on procurement digitalization through a systematic literature review (SLR) in order to develop a fine-grained conceptual model that supports practitioners and researchers alike in better understanding the transformative impact of procurement digitalization, the potential gains firms can expect from DPT, as well as the capabilities required to strategize about procurement digitalization. We aim to contextualize DCT to integrate the fragmented body of literature on procurement digitalization (Durach *et al.*, 2021), thereby enhancing knowledge on this specific and emerging domain (Wong, 2021), and provide a structured approach to future research. The following research questions were formulated:

RQ1. How can we define DPT, and what is driving it?

RQ2. What DCs and underlying microfoundations are required for DPT, and how do they relate to performance outcomes for DPT?

RQ3. How does DCT inform future research questions for DPT?

We contribute to both academia and practice by addressing an emerging topic. We first introduce and define DPT and the corresponding motivations that trigger firms to invest in advanced digital technologies. Second, by adopting the DC lens, we provide an overview of nine microfoundations required for DPT and specifically highlight the strategic options procurement leaders can use when strategizing about adopting combinations of digital technologies. Third, we present a future research agenda on DCs for DPT. Practitioners can use the developed conceptual model as a starting point and framework when strategizing about digitally transforming the procurement organization.

The remainder of the paper is structured as follows. Section Two introduces DPT and the factors that drive firms to digitally transform their procurement organization. Thereafter, DCT, as a lens to study DPT, is introduced, followed by Section Four, which elaborates on the research methodology used for our SLR. Subsequently, the conceptual model of DPT based on DCT is proposed and discussed based on the reviewed literature in Section Five. Finally, the theoretical, managerial, and practical contributions are discussed, and further research directions and limitations are provided in Section Six.

2. Digital procurement transformation (DPT)

Ambiguity and a mixed understanding with respect to definitions and terms that are frequently used in the context of digital procurement were observed by the authors when reviewing some of the existing literature, as well as by conducting an initial scoping workshop with 17 digital procurement experts. Various terms, such as "advanced procurement digitalization", "procurement 4.0", "purchasing 4.0", or "digital procurement", are used interchangeably to broadly describe the "use" of advanced digital technologies in the procurement context. While all these terms refer to newer digital technologies (such as AI or blockchain) that go beyond the use of the internet (which is e-procurement), the contingencies for employing these are largely missing from existing definitions. Implicitly, scholars share their thoughts on these contingencies by mentioning "digital transformation" in procurement more broadly (see, for instance, Srai and Lorentz, 2019; Kosmol *et al.*, 2019).

By borrowing from the information management (IM) literature (Vial, 2019), we go beyond the static definitions of procurement digitalization available today and adopt the DC perspective to introduce *digital transformation* in the procurement context. Digital transformation (DT) can be defined as "a process that aims to improve an *entity* by triggering significant changes to its

properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 118). The term *entity* refers, in this context, to an (procurement) organization, society, or industry. In this research, the term *DPT* is introduced to emphasize a more holistic perspective on the adoption of advanced digital technologies in procurement and the impact it may have not only on the procurement organization but also on the entire organization, as well as how it interacts with the supply chain.

The PSM literature states that internal, as well as external, triggers exist that motivate firms to digitally transform their procurement organization (e.g. Srai and Lorentz, 2019; Lorentz *et al.*, 2021). Srai and Lorentz (2019) define seven procurement drivers that motivate companies to adopt digital technologies: transaction management, coordination and control, process improvement and innovation, aligned category management, supplier capability assessment, relationship management, and supply market knowledge management (see p. 85). In subsequent work, Lorentz *et al.* (2021) identify three context categories that trigger DPT: external and internal contingencies (such as supply base complexity, having several separate systems, and workflows), organizations' strategic choices (such as savings and efficiency), and institutional pressure (such as regulations).

3. Theoretical lens: DCT

Triggered by internal or external factors, many companies strategically decide to adopt advanced digital technologies in procurement to better cope with the increasingly complex and dynamic business environment. Past research suggests that DCs are most valuable when deployed in dynamic business environments (i.e. high uncertainty, frequent change, and high complexity) and less valuable in stable and predictable environments (Brandon-Jones and Knoppen, 2018). Recent market and supply chain disruptions caused by the COVID-19 pandemic and today's rapid advancements in digital technology represent such a rapidly changing business environment for procurement leaders. This makes studying DC's underlying successful DPT relevant.

Broadly, DCs are defined as "the ability to sense and then seize new opportunities, and to reconfigure and protect knowledge assets, competencies, and complementary assets with the aim of achieving a sustained competitive advantage" (Augier and Teece, 2009, p. 412). It is further suggested that "microfoundations" are distinct activities that further undergird the sensing, seizing, and reconfiguring capabilities (Ellström *et al.*, 2022). Moreover, DCs are grounded in the performance of individuals such as managers because DCs ultimately view repeated patterns of independent actions (Vial, 2019). When applying DCT, academics are generally interested in how organizations generate and/or acquire new information, make investment decisions, and then achieve the necessary business model and organizational transformation. Thus, DCT necessitates an understanding of technology and organizational change (Augier and Teece, 2009).

In the PSM field, several scholars have studied DCs in the context of e-procurement adoption. Ramkumar *et al.* (2019), for instance, investigated technology-acceptance models through the DC lens. More recent work on procurement digitalization by Hallikas *et al.* (2021) finds positive and significant relationships between digital procurement capabilities, data analytics capabilities (conceptualized through DCT), and supply chain performance. While existing research provides interesting insights, there is a gap on DCs regarding DPT, which we aim to fill with our study.

Several scholars in the field of IM have suggested studying DCs in the context of DT (e.g. Bharadwaj *et al.*, 2013; Vial, 2019). Vial (2019), for instance, argues that there is a "good fit between DC as a conceptual foundation and DT as a phenomenon of interest" (p. 133). Especially at the micro-level, interest in further researching the micro-processes that support building and maintaining DCs exists. In their recent study of DCs for DT, Warner and Wäger (2019) develop a process model comprising "nine microfoundations to reveal the generic contingency factors that

trigger, enable, and hinder the building of DCs for digital transformation" (p. 326). We follow this logic because we are interested in the connections, relationships, and mechanism of the underlying microfoundations that comprise the sensing, seizing, and reconfiguring capabilities of DPT, a topic that has not received attention in the PSM field.

4. Research method

To address the second and third research questions, an SLR was carried out because it is a robust and auditable method with which to map and assess the existing intellectual territory and develop the existing body of knowledge (Tranfield *et al.*, 2003). It was structured and conducted in three phases, following the process developed by Tranfield *et al.* (2003).

4.1 Phase 1: planning the SLR

The first phase determines the keywords for the search. We used previous International Purchasing and Supply Education and Research Association (IPSERA) conference papers on procurement digitalization to not only build knowledge about what recent trending research topics are but also to establish suitable keywords for the search string. Procurement-related terms such as "procurement," "purchasing," and "supply management" were combined with technology and digitalization-related terms such as "digit*," "industry 4.0," and "artificial intelligence." In addition to the IPSERA conference proceedings, a keyword search was conducted on Scopus and Web of Science covering the 2011–May 2022 time period because procurement digitalization has its roots in the fourth industrial revolution (in short, "Industry 4.0") and the year 2011 marks the birth of this concept (Kipper *et al.*, 2020). Moreover, further restrictions were placed on the search query due to the spread of keywords in a substantial number of contributions; thus, only contributions (1) in the English language (2) that are marked as being "final" and (3) are published in the "Business and Management" area are included. The search queries follow different logics depending on the search base and were therefore slightly adapted for the two chosen search bases (see Figure 1).

Finally, inclusion and exclusion criteria were defined. We decided to include contributions that very specifically focus on procurement and excluded SCM, given that the broader scope

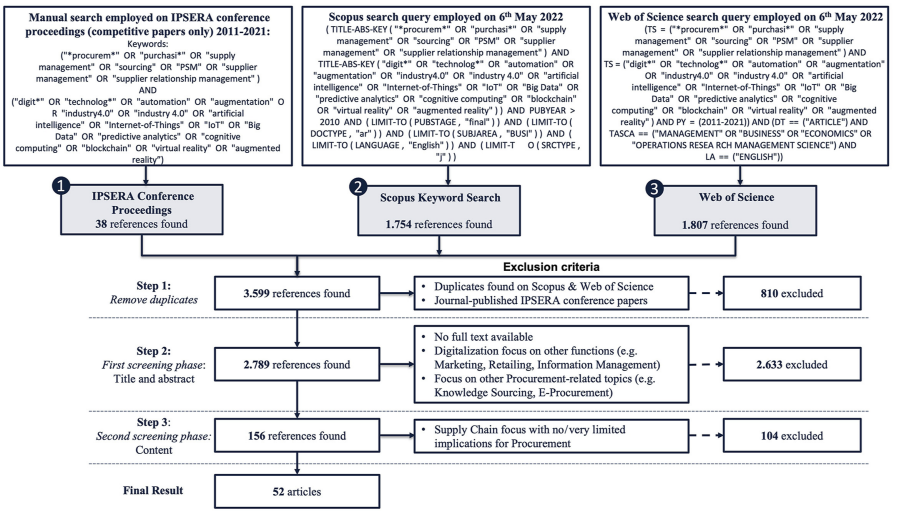

Figure 1.
Systematic search stractegy

of SCM increases the breadth of use cases and technologies within the topic area at hand, with limited applicability to procurement. Past research demonstrates distinctive aspects of digitalization within procurement; thus, we tailor our analysis and derive implications specific to this context.

4.2 Phase 2: conducting the SLR

Applying the search query in the two databases, as well as a manual search of IPSERA conference proceedings, resulted in 3,599 references (Figure 1). In a first step, duplicates were removed. Moreover, five cases in which IPSERA conference papers were subsequently published in a journal were detected. In these cases, only the latest journal-published contribution was kept, and the initial conference paper was excluded. 810 references were excluded during the first step.

In a second step, the remaining 2,789 references were screened based on their titles and abstracts. Applying the previously defined exclusion and inclusion criteria resulted in further excluding 2,633 references. Excluded papers most commonly did not focus on procurement but, rather, marketing/consumer behavior research (e.g. consumer digital buying behavior on the internet). This step was performed by two authors in parallel to ensure that subjectivity was limited in the results (Cao and Lumineau, 2015). We had an intercoder reliability of 93%, and disagreements were resolved via discussion between the two authors.

In a third step, a full text/content analysis of the remaining 156 references was conducted by the two authors. In this step, a further 104 references were excluded. The excluded papers were generally focused on SCM and digitalization, thereby providing no or only limited insights on procurement. This step resulted in a final sample of 52 articles (Figure 1).

To ensure the completeness of the results, we conducted *backward snowball sampling* to further retrieve relevant literature that may not have been captured by the two search bases or conference proceedings. All references of the previously selected papers were analyzed, and suitable papers were included by applying the same logic and exclusion criteria outlined above. This resulted in an additional three articles that were considered relevant for our study; thus, the final sample consists of 55 articles. Following prior research (Cao and Lumineau, 2015), we designed a *coding protocol* to record information about each article (e.g. method, unit of analysis, theories, results and practical/managerial implications, further research).

4.3 Phase 3: reporting findings from SLR

Following our *coding protocol*, we first summarized the findings and statistics before nudging the content toward synthesis. We followed the *concept matrix technique*, as proposed by Webster and Watson (2002), because this is an effective way to transition from the *author-centric approach* (essentially presenting a summary of the relevant articles) to the *concept-centric approach* (concepts determine the organizing framework of a review). After all, the aim of this paper is to contextualize DC theory so as to integrate the fragmented body of literature on procurement digitalization (Durach *et al.*, 2021).

The general analysis of the 55 papers shows that, although the search period begins in 2011, the first publication on procurement digitalization was in 2016. Since 2016, the number of papers published has been steadily increasing, demonstrating increasing interest in the field (Appendix 1).

Moreover, we notice a large *spread of journals* in which these articles were published. In addition to the eleven articles that were found in the IPSERA conference proceedings, the *Journal of Purchasing and Supply Management (JPSM)* published the largest number of peer-reviewed articles (six), followed by the *International Journal of Physical Distribution and Logistics Management (IJPDLM)*, the *International Journal of Operations and Production*

Management (IJOPM), the *International Journal of Procurement Management (IJPM)*, and *Production Planning and Control (PPC)* (three articles each). Two articles were found in *Supply Chain Management – An International Journal (SCMIJ)* and the *Business Process Management Journal* (BPMJ). In 22 journals, we found only one relevant article (Appendix 2).

When we consider the *research methods* used by the authors, we see that case studies are most dominant, followed by SLRs, semi-structured interviews, and surveys (Appendix 3).

Even though eleven articles conduct an SLR, the scope of our study is substantially different from these existing reviews. First, most reviews focus not on the general topic but, rather, on one specific technology (e.g. AI) or subject area (e.g. future skills). Second, out of the eleven articles, six articles choose another method (e.g. semi-structured interviews or focus groups) in addition to the SLR. Third, most reviews do not build a conceptual model based on theorizing but are, rather, of an exploratory or descriptive nature (Appendix 4).

Furthermore, the analysis shows that most studies (41 articles, 75%) under review are not *theory-based*. Only 14 articles (25%) are based on theory – with a few studies validating or applying more than one theory. The resource-based view (RBV) is applied most frequently (five studies), followed by transaction cost economies and dynamic capability theory (each four studies) (Appendix 5).

To classify the literature based on DCT, the sub-capabilities and performance outcomes of each research paper were extracted and analyzed, following the author-centric to concept-centric approach. These were extracted through carefully reading and analyzing the 55 papers in full and following the academic literature on DCs in DT (e.g. Warner and Wäger, 2019; Ellström *et al.*, 2022). As shown in Table 1, 24 sub-capabilities and seven performance outcomes were extracted using this approach.

Drawing on the concept-centric perspective, there are five sub-capabilities/performance outcomes that were mentioned in more than 20 papers, such as *automation/automating processes or tasks*, *accepting redirection and change, autonomization of processes or tasks, improved supplier relationship management, and acquisition of new skillsets by employees/ external recruitment of talent.* Moreover, only a few authors account for the majority of the 31 sub-capabilities and performance outcomes identified through this approach: while 55 papers are included in the literature review, only two papers include more than 15 sub-capabilities and performance outcomes: Flechsig *et al.* (2022) and van Hoek *et al.* (2022).

By thoroughly analyzing the content of Table 1 suitable clustering of the sub-capabilities was developed by drawing on the DC framework and its notion of sensing, seizing, and reconfiguring. *Digital sensing capabilities* consist of seven sub-capabilities that we cluster into three microfoundations, in line with the earlier work of Warner and Wäger (2019): *digital scouting, digital scenario planning,* and *digital mindset crafting.*

Digital seizing capabilities are related to the development of an actual digital strategy. Procurement leaders can have different strategic options when adopting digital technologies. On the one hand, technologies can be used at different procurement levels (e.g. operational, tactical, and strategic); on the other hand, strategic options differ based on the involved share of human and machine intelligence (*human-machine versus machine-machine interfaces).* This is a decision procurement leaders must make when defining their digital strategy and selecting digital technologies. Overall, this microfoundation can be further clustered into three sub-capabilities that differ in terms of the involvement of machine intelligence when implementing digital technologies in procurement processes: (1) *augmentation (human acts – machine supports)*, (2) *automation (machine acts – human supports),* and (3) *autonomization (machine acts independently).* We call this microfoundation *balancing digital options*. Moreover, two further microfoundations can be identified, namely *piloting*, as well as strengthening, *strategic agility*, which incorporates the notion of accepting redirection and change.

Article	Automation / Automating processes or tasks	Accepting redirection & change	Autonomous / Autonomization of processes or tasks	Improved Supplier Relationship Management	Acquisition of new skills sets by employees / external recruiting of digital talent	Human-Machine / Machine-Machine interaction	Reduced Organizational Costs	Creating unified digital infrastructure	Buidling knowledge about digital technologies (tec providers) and their use cases	Interacting digitally with multipe external partner suppliers	Forumulation of digital strategies (pre-liminary)	Promoting digital mindset	Strenthening cross-functional collaboration	Buidling knowledge about benefits and barriers of different digital technologies	Reduced Risk / Increased Resilience	Augmentation / Augmenting processes or tasks	Digital Strategy & Capability	Leveraging digital knowledge inside the organisation	Digital Maturity	Decreased Product / Materials Costs	Developing future digital scenarios	Increased Product Quality	Developing Digital Vision	Promoting digital mindset - top management committment	Creating dedicated digital transformation teams	Increased / Decreased Flexibility	Exploiting new ecosystems	Conducting Pilot / Proof-of-Concept	Receiving external support	Hiring CDO / or similar position	Increased Sustainability	No. of (sub-) capabilities & performance outc considered
Flechsig *et al.* (2022)	X	X	X	X	X		X		X	X	X	X	X		X		X	X	X		X	X		X	X	X			X			21
van Hoek *et al.* (2022)	X	X		X	X		X	X	X		X			X		X	X	X	X			X			X			X			X	17
Bodendorf *et al.* (2021)	X	X		X	X			X		X	X	X	X		X		X	X		X				X								14
Legenvre *et al.* (2020)	X	X	X	X	X	X	X		X	X	X		X		X		X															13
Jerome *et al.* (2022)	X	X	X		X	X	X	X	X	X		X	X	X										X								13
Handfield *et al.* (2019)	X	X	X		X	X				X		X	X	X		X		X			X		X									13
Glas and Kleemann (2016)	X	X	X			X	X			X			X	X					X	X			X		X							12
Colombo *et al.* (2021)	X	X			X	X	X	X	X					X		X				X		X				X						12
Viale and Zouari (2020)	X	X	X				X			X			X	X				X						X	X					X		11
Bruzzi *et al.* (2021)	X	X	X	X	X				X	X		X							X				X			X						11
Bag *et al.* (2021)	X			X	X	X	X	X			X			X	X							X					X					11
Seyedghorban *et al.* (2020)	X	X						X		X		X	X	X	X				X	X							X					11
Bienhaus and Haddud (2018)	X	X	X	X	X					X	X	X	X				X															10
Tripathi and Gupta (2021)	X	X	X	X		X									X	X				X			X	X								10
Srai and Lorentz (2019)	X	X	X	X		X	X				X					X	X		X													10
Křenková *et al.* (2021)	X	X		X	X		X		X	X				X			X	X														10
Öhman *et al.* (2021)				X	X						X	X	X		X		X	X												X		9
Keller *et al.* (2021)	X	X	X	X						X					X	X						X					X					9
Fontes and Schiele (2021)	X	X	X		X	X								X			X						X									8
Cui *et al.* (2022)	X		X			X	X				X	X				X						X										8
Fatorachian and Kazemi (2021)	X	X	X	X	X	X			X	X																						8
Schiele and Torn (2020)	X	X	X		X	X				X	X										X											8
van Hoek *et al.* (2020a)	X	X	X					X		X								X			X							X				8
van Hoek *et al.* (2020b)	X					X		X	X		X	X					X											X				8
Guida *et al.* (2021)	X	X		X			X	X						X		X																7
Schulze-Horn *et al.* (2020)	X	X	X	X		X			X									X														7
Lorentz *et al.* (2021)	X	X	X	X				X	X					X																		7
Kosmol *et al.* (2019)	X							X		X		X	X				X							X								7
Osmonbekov and Johnston (2018)	X	X				X	X	X					X																			6
Wang *et al.* (2020)	X	X																		X	X	X				X						6
Spreitzenbarth *et al.* (2021)	X	X			X				X			X									X											6
Veile *et al.* (2021)	X	X						X					X	X		X																6
Centobelli *et al.* (2020)		X						X							X					X											X	5
Allal-Chérif *et al.* (2021)	X						X						X			X		X														5
Delke *et al.* (2021)	X	X	X		X		X																									5
Modgil *et al.* (2021)	X			X	X		X								X																	5
Zeisel (2020)	X	X		X											X				X													5
Klünder *et al.* (2019)	X	X	X			X														X												5
Gunasekara *et al.* (2021)	X	X		X			X																									4
Gottge *et al.* (2020)	X	X	X			X																										4
Arvidsson *et al.* (2021)	X	X		X					X																							4
Delke *et al.* (2020)	X		X		X							X																				4
Bals *et al.* (2019)	X				X							X									X											4
Mubarik *et al.* (2019)		X		X					X	X																						4
Gu *et al.* (2021)				X				X			X					X																4
Elsaesser *et al.* (2019)	X										X								X				X									4
Biazzin *et al.* (2019)									X		X			X									X									4
Hallikas *et al.* (2021)	X	X						X																								3
Moretto *et al.* (2017)						X												X											X			3
Khan (2019)									X			X	X																			3
Paajanen and Aminoff (2018)	X							X																								2
Hofmann *et al.* (2020)	X		X																													2
Lamba and Singh (2017)															X																	1
Prato *et al.* (2021)	X																															1
Ivanov (2017)											X																					1
No. of articles considered	46	36	23	22	20	18	17	17	16	17	15	15	15	14	12	11	11	11	8	8	7	7	7	6	4	4	3	3	2	2	2	

Table 1. (Sub-)capabilities and performance outcomes extracted from the literature

Lastly, *digital reconfiguring capabilities* are the capabilities needed to operationalize the developed digital strategy. We cluster ten sub-capabilities into three microfoundations, following the logic provided by Warner and Wäger (2019): *improving digital maturity*, *redesigning internal structures*, and *navigating innovative ecosystems*.

In addition to the sensing, seizing, and reconfiguring capabilities, we also coded the *performance outcomes* of DPT. During the coding phase, we only extracted outcomes that were backed up with at least some evidence, thus leaving out references to outcomes that were only expected so as to mitigate the risk that "subsequent literature reviews all assume that the performance claim is true" (Wong, 2021, p. 201). As illustrated in Table 1, only a few papers presented proven performance outcomes, which we further clustered into efficiency and effectiveness.

5. Conceptual model of DCs for DPT

Our model proposes that, triggered by internal and external factors, *digital sensing capabilities* are key to beginning DPT. *Digital seizing capabilities* build the core of our model and are required to develop the digital procurement strategy, *digital reconfiguring capabilities* are needed when implementing the chosen strategy. While these three DCs build the main part of our conceptual model and describe what we call DCs for DPT, we also include procurement *performance outcomes* because, in line with the DC theory, firms can gain a sustainable competitive advantage through continuously employing these DCs. A processual flow is visible between the digital capabilities as illustrated in Figure 2. The following sub-sections will explain the conceptual model in more detail.

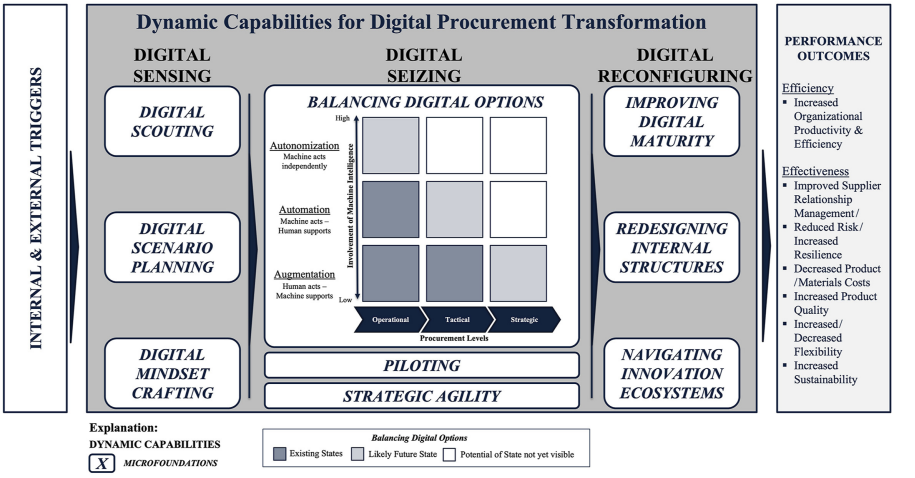

Figure 2.
Conceptual model for digital procurement transformation

5.1 Digital sensing capabilities

As mentioned in the introduction, "impressive improvements in information, communication, and connectivity technologies have unleashed new functionalities" (Bharadwaj *et al.*, 2013, p. 472). Procurement leaders must be aware of these functionalities; *build knowledge about digital procurement technologies*, the *technology providers, and practical use cases*; and gain insights into the *benefits and barriers* regarding these digital technologies. Fatorachian and Kazemi (2021) argue that, in order to successfully implement industry 4.0 technologies,

"companies need to be prepared [. . .] and to understand the capabilities and potential benefits in business processes" (p. 70), as captured by the microfoundation *digital scouting*.

Digital scenario planning is another microfoundation required to sense procurement opportunities. Being able to evaluate multiple potential scenarios "in advance to identify probable risk and disruptions, optimizing resources and releasing human effort" (Tripathi and Gupta, 2021, p. 441) is key in moving forward. Therefore, the sub-capabilities of developing *future digital procurement scenarios* and *high-level digital strategies* are crucial.

The third microfoundation of digital sensing is *digital mindset crafting*. Here, *promoting a digital mindset* (also motivated by *top management*) and *developing a digital vision* for procurement are crucial. In this context, Elsaesser *et al.* (2019) argue that "it is mandatory for companies to define their initial digital position and to create a common understanding of the phases they want to implement prior to starting digital initiatives or projects" (p. 16).

5.2 Digital seizing capabilities

The focal part of our conceptual model are the *digital seizing capabilities*, specifically the microfoundation that describes the strategy development process: *balancing digital options*. Previous findings from the information management literature show that "combinations of technologies are particularly relevant in the context of DT" (Vial, 2019, p. 122). Recent literature by van Hoek *et al.* (2022) found that a clear digital strategy and roadmap are crucial in implementing digital technologies in procurement.

We argue that procurement leaders have different options in terms of combining various digital technologies in the various procurement processes and activity levels (operational, tactical, and strategic). As a result, the level of machine intelligence involved can vary. In this context, *automation* is one of the most frequently mentioned options (see Table 1). However, we found two additional options, namely *augmentation* and *autonomization*, which require further elaboration in this context because they describe varying degrees of dependence on digital technology (i.e. machine intelligence).

According to Colombo *et al.* (2021), *augmentation* means that humans collaborate closely with technology to perform a task. In our context, the work of procurement employees will be enhanced by digital technologies that provide additional information and support. The procurement employee is still in the lead ("human acts"), while the digital technology enables him or her to be more effective or efficient ("machine supports"). Augmentation requires substantial human involvement and can thus be linked to complex, strategic procurement tasks. The enhancement or augmentation of the procurement employee entails using technology as a support mechanism, rather than automating or fully replacing a previously analogue task. An example of augmentation in the procurement context is AI applications that aim to exchange data in real time between suppliers and buyers. Supply market intelligence, predictive pricing, and costing tools are further examples (Colombo *et al.*, 2021).

As previously outlined, *automation* is a frequently mentioned option in the procurement digitalization context. Now, automated systems or technologies can process pre-defined workflows without the necessity of human interaction. Only in instances in which a deviation from the "standard process" occurs is human intervention needed to clarify what must be done because the system (or technology) is unable to proceed. Thus, these technologies take over human tasks to a large extent ("machine acts–human supports"), but some human involvement is still required for situations the system is not trained to tackle or calibrating and improving a certain system. Today's robotics process automation (RPA) technologies are a good example of automating (parts of) procurement processes (see, for instance, van Hoek *et al.*, 2022; Flechsig *et al.*, 2022). According to Viale and Zouari (2020), RPA is intended to automate manual processes using business rules and predefined activity choreography to complete multiple tasks. Hence, "procurement employees will be able to delegate order

receipts to a software robot (i.e. a bot), or configure their software robot to place automatic orders based on stock levels [. . .]" (Viale and Zouari, 2020, p. 3).

With *autonomization*, specifically programmed autonomous technologies (or systems) can process various tasks in each field of expertise independently. The system does not rely on humans (machine acts independently), and the task at hand is simple and repetitive; thus, substantially less human involvement is required as compared to augmentation and automation (Medium, 2019). In this context, Srai and Lorentz (2019) mention blockchain technology because it allows for "the flexible interconnectivity of *autonomous purchasing systems* and machine-to-machine interaction via smart contracts" (p. 80). In the AI field, Schulze-Horn *et al.* (2020) argue that "by means of machine learning approaches, in connection with growing data sets, the *degrees of autonomy* are indeed likely to rise [. . .]" (p. 632). Similarly, experts argue that AI applications are already mature enough to conduct *autonomous negotiations* based on game-theoretic insights (Schulze-Horn *et al.*, 2020).

Current *augmentation* technologies are and will be implemented to a great extent in strategic and tactical procurement activities, while the operational procurement activities are mostly *automated* (Colombo *et al.*, 2021). Moreover, the literature has shown that current technologies are not yet mature and substantial enhancement is expected to occur in upcoming years. We therefore expect that, as procurement technology solutions become smarter and more mature, the procurement organization will undergo a transformation. A stronger move toward autonomization is likely. We have visualized this trend in Figure 2 with the different shading. Ultimately, we would like to highlight the fact that the different levels of machine intelligence complement one another; i.e. for some processes or activities augmentation technologies may be favored over automation. The choice and combination must be decided in the digital strategy by procurement leaders.

In addition to the microfoundation *balancing digital options*, two further microfoundations were identified. van Hoek *et al.* (2022), for instance, outline, based on their single case study, that an initial proof-of-concept helped in making the final technology supplier decision. Moreover, it is argued that companies can learn from *pilots* as "their lack of knowledge about the business case, actual benefits, and possible systems issues [. . .]" (van Hoek *et al.*, 2020b, p. 8) becomes visible. The microfoundation *piloting* is therefore deemed valuable when seizing opportunities.

Lastly, the mircofoundation *strategic agility* is visible in the selected literature. *Accepting redirection and change* is among the sub-capabilities most frequently cited as being important (see, for instance, Bodendorf *et al.*, 2021; Delke *et al.*, 2021; Joseph Jerome *et al.*, 2022; Bruzzi *et al.*, 2021).

5.3 Digital reconfiguring capabilities

Given the strategic options firms have with respect to the level of machine intelligence involved, as well as the procurement activity and process levels involved, the actual implementation of digital technologies will require certain *digital reconfiguring capabilities*.

Here, *new skills* must be acquired at the employee level. Bodendorf *et al.* (2021) argue that "companies must [. . .] train their employees sufficiently in the use of the new tools [. . .]" (p. 16). Alternatively, the *external recruitment* of digital talent may enable the quick implementation and use of digital procurement technologies. Moreover, Moretto *et al.* (2017) identify the "need to take advantage of external consultants" (p. 89) so as to learn how to use digital technologies. In addition to the acquisition of new skills, *digital knowledge must be leveraged inside the organization*. Organizational readiness is, in this context, mentioned as being of utmost importance (see van Hoek *et al.*, 2020a). Taken together, these four sub-capabilities can be clustered as the microfoundation *improving digital maturity*.

A further microfoundation of the digital reconfiguring capability is *redesigning internal structures*, which points not only toward the procurement department but also the whole organization. From a technological perspective, it is, for instance, relevant to create a *unified digital infrastructure*. In this context, Spreitzenbarth *et al.* (2021) identify the problem that "old systems in place are never completely dismantled, but rather they are kept and used again, so that an overlapping of IT systems is created which generates problems of inconsistency of results and consolidation of analyses carried out by different entities" (p. 13). Additionally, the creation of *dedicated digital transformation teams* is mentioned as beneficial. At Maersk, a digital procurement team functions as a center of excellence (van Hoek *et al.*, 2022). Moreover, at the leadership level, a *DPT head* is frequently being appointed. Öhman *et al.* (2021) find that one of the firms in their case study "has established a network of chief digitalization officers (CDOs) in each function including procurement. At the procurement department, this CDO works closely with the procurement employees, IT people and business developers" (p. 945). This also highlights the need to *strengthen cross-functional collaboration*. Flechsig *et al.* (2022) find that the key to success is "to bring all departments and committees together and to get them to collaboration" (p. 12).

Whereas the two abovementioned microfoundations have an organization-internal focus, the third microfoundation of *digital reconfiguring capabilities* is *navigating innovative ecosystems* and includes external parties, such as suppliers. Here, *interacting digitally with multiple external partners/suppliers* has been highlighted by scholars in the field. Bodendorf *et al.* (2021) find that cross-company cooperation promotes knowledge exchange and accelerates technological acceptance. Moreover, *exploiting new ecosystems* is a further sub-capability found in the reviewed literature. Seyedghorban *et al.* (2020) find that, as companies further digitally transform, the "potentials for renovating and changing business models and reinventing the wheel to become a specialized value-adding practice by streamlining the boundary structure of its procurement function" (p. 1688) become visible. In this context, the removal of data and information boundaries between customers and suppliers is key.

5.4 Performance outcomes of DPT

While the abovementioned sub-sections outlined and explained the DCs required for DPT, this section will highlight some of the performance outcomes. Following DCT, a firm's DCs can have a positive effect on performance, which may result in competitive advantages. Generally, procurement leaders are especially interested in performance outcomes when adopting digital technologies in procurement. Multiple studies have provided proven procurement performance outcomes, which we classify into (1) efficiency and (2) effectiveness, thereby following the logic suggested by van Weele and Rozemeijer (2022):

(1) Efficiency

Reduced Organizational Costs: Empirical research has shown that "digitalization has allowed procurement leaders to reduce costs, both related to the management and execution of procurement processes [. . .]" (Colombo *et al.*, 2021, p. 10). Less labor is required in procurement, as is a shifting of resources from operational to strategic activities, where human decision-making is visible. Buyers that adopt, for instance, AI in their processes become faster, more reactive, and more efficient, thereby freeing up time for more strategic tasks (Wang *et al.*, 2020; Colombo *et al.*, 2021).

(2) Effectiveness

Improved Supplier Relationship Management: It has been empirically proven that the improved transparency and traceability gained through the use of advanced digital technologies strengthen the buyer-supplier relationship (Bienhaus and Haddud, 2018;

Gu *et al.*, 2021). In addition, an improved *assessment of supplier performance* through digital technologies was found by several authors (e.g. Guida *et al.*, 2021; Lorentz *et al.*, 2021; Zeisel, 2020; Arvidsson *et al.*, 2021; Gunasekara *et al.*, 2021).

Reduced Risk/Increased Resilience: Similar to the abovementioned performance outcome, researchers have found support for the notion that, through enhanced data performance (transparency), improved risk management with respect to the supply base is possible (Mubarik *et al.*, 2019).

Decreased Product/Materials Costs: In addition to the reduced organizational costs, as outlined above, Colombo *et al.* (2021) find that improved sourcing prices can be achieved through the adoption of technologies. Lamba and Singh (2017) find "that big data has a direct positive impact to improve sourcing costs by 2–5% annually" (p. 882).

Increased Product Quality: Further performance outcomes are quality improvements in terms of supply due to increased transparency. In this context especially, a reduction in errors and delays from suppliers is indicated by empirical research (Colombo *et al.*, 2021).

Increased/Decreased Flexibility: Mixed empirical results exist regarding flexibility. On the one hand, greater automation can reduce flexibility as procurement processes might become more rigid and standardized. On the other hand, an increase in flexibility with respect to supplier interaction has been highlighted (Colombo *et al.*, 2021).

Increased Sustainability: In their study on blockchain technology, Centobelli *et al.* (2020) find that sustainable sourcing practices can be achieved through the enhanced data transparency and verification provided by the chain.

6. Concluding implications and future research directions

This study contextualizes DCT and integrates the fragmented body of literature on procurement digitalization. Drawing on the author-centric to concept-centric approach, capabilities and performance outcomes are extracted and clustered into a conceptual model, thereby extending the literature on DCs. Building on earlier work by Warner and Wäger (2019) on DCs for DT, we identify nine microfoundations required for DPT, as well as the performance outcomes that will be the result of DPT. In the following sub-sections, we elaborate on our research findings regarding the theoretical, managerial, and practical implications, as well as highlighting future research questions, thereby answering our third research question.

6.1 Theoretical implications

From an academic perspective, our research contributes to the PSM field in several ways.

First, we reconcile some of the definitions of procurement digitalization with our first research question (e.g. Srai and Lorentz, 2019), thereby introducing the term "DPT" to stress the impact advanced digital technologies may have on the design of the procurement function and the daily work environment of procurement professionals. In addition, we outline a set of specific drivers that trigger DPT, as illustrated in Figure 2.

Second, we contextualize DCT by integrating the fragmented body of literature on procurement digitalization (Durach *et al.*, 2021) into a conceptual model. Our work extends earlier work on DC for DT proposed by Warner and Wäger (2019) by identifying nine microfoundations for DPT. We shed light on one microfoundation in particular – *balancing digital options* – because we see the need to provide insights into how digital procurement strategies can best be developed. This paper helps reveal which states (of the digital options) are currently present in the procurement literature and which are likely to occur in the near or distant future (see Figure 2), thereby conceptually extending the empirical research (e.g. Colombo *et al.*, 2021).

Third, motivated by and derived from our conceptual model, we highlight which topics and questions regarding DPT should be further investigated. Our *research agenda* aims to be a starting point for structured academic efforts and further strengthen rigorous research on DPT and related performance outcomes. We identify rich research opportunities in various procurement contexts, such as considering the negative aspects of procurement digitalization and how to quantify and measure the success of procurement digitalization with regard to performance outcomes.

6.2 Managerial and practical implications

From a practitioner's perspective, our research has important managerial and practical implications. We have discussed our findings and the developed conceptual model with three (former) CPOs from the renewable energy, chemicals, and banking industries. Overall, we received strong support for the logic of our conceptual model and insights into how it can be used in practice.

First, providing a comprehensive overview of the literature on DPT allows CPOs and their procurement teams to understand the required capabilities and underlying microfoundations that must be considered when deciding to invest in DPT. We contribute to a better understanding among practitioners and stimulate further interest in a topic that has been shown to have a transformative impact on procurement and is expected to drive procurement performance in unprecedented ways. It is expected to not only achieve productivity gains through the automation of operational tasks but also augment the capabilities of CPOs and their procurement teams by enhancing their sourcing-strategy development and decision-making, which will help them unlock greater value.

Second, we argue that our conceptual model can be used by CPOs as a starting point and framework for assessing the organizational capabilities required to digitally transform the procurement function and successfully achieve the expected performance outcomes. This will help set a more realistic ambition level for DPT and prevent people from resisting to changes in ways of working and the adoption of new digital technology.

Third, we stress the importance of *digital seizing capabilities*, specifically the microfoundation *balancing digital options*, for developing a digital strategy and roadmap for procurement. To facilitate this balancing, we suggest first zooming into the existing procurement processes, activities, and tasks at the operational, tactical, and strategic levels and then exploring relevant advanced digital technologies based on their varying degrees of machine intelligence.

6.3 Research agenda

The identified microfoundations of the *digital sensing, seizing, and reconfiguring capabilities* and the proven performance outcomes of our conceptual model open avenues for further research. We derive leading key questions from our literature study, guided by DCT and the discussions with the CPOs from our network. The main future research questions are highlighted in Table 2.

First, a *lack of knowledge of technologies* and *a lack of clarity regarding the scope of the transformation required* are frequently cited reasons why digital technologies are not adopted at a larger scale in procurement organizations (see Pellengahr *et al.*, 2016). Thus, it is relevant to understand how procurement leaders can ensure that *digital sensing capabilities* are developed and/or strengthened. Second, when considering *digital seizing capabilities*, it is relevant to identify how technology can aid the augmentation, automation, and autonomization of procurement processes and activities and, further, how the nature of the procurement organization may be impacted by these technologies (*balancing digital options*). Third, from a *reconfiguring* perspective, it is relevant and interesting to further understand

	Future research questions on DCs of DPT
Sensing capability	• In general, what are further (more) procurement-specific microfoundations of the *sensing capability*? • How do CPOs/procurement leaders ensure that these sensing capabilities are developed/learned in their procurement organizations as they are crucial when wishing to adopt advanced digital procurement technologies? • What are ways for CPOs/procurement leaders to promote a digital mindset within the procurement organization? *(Digital mindset crafting)*
Seizing capability	• Microfoundation: *balancing digital options* – by zooming in: ◦ Augmentation: To what extent are procurement professionals trusting machine-led technologies as compared to their own judgment and analytic skills (human-led technologies)? ◦ Automation: What is the user adoption and perception of automation technologies in procurement? ◦ Autonomization: To what extent will autonomization be a realistic strategy CPO's can follow (from an ethical/societal perspective)? • How can procurement leaders ensure that redirection and change is accepted by the procurement organization? *(Strategic agility)*
Reconfiguring capability	• How do procurement leaders ensure that suppliers are open to collaborate and interact? (*Navigating innovation ecosystems*) • How do procurement leaders ensure that knowledge is shared within the firm so that overall *digital maturity* can be enhanced? In addition, how can we as researchers help in educating on the digital skills that will be required when adopting advanced digital technologies? • Which leadership skills of the chief digital officer in procurement are most important/relevant? *(Redesigning internal structures)*
	Future research questions on performance outcomes of DPT
Performance outcomes	• What are further proven performance outcomes of DPT (e.g. increased innovation)? And are there any (further) negative performance outcomes (in addition to decreased flexibility) that should be considered when deciding to adopt different advanced digital technologies? • How can we quantify and measure performance outcomes of DPT? • What is the business case of DPT given the continued invest in technology?

Table 2.
Future research agenda

how procurement leaders ensure that internal stakeholders and suppliers are open to collaborating for procurement digitalization. Last, research should investigate further procurement performance outcomes, positive and negative, and how these could be measured.

6.4 Limitations

Our study has certain limitations. First, the proposed conceptual model is based on extant literature on the topic of procurement digitalization. Because we extract sub-capabilities and performance outcomes, our research strongly relies on the findings of these papers. Therefore, the conceptual model should be extended and verified through further empirical research. Moreover, building on the previous limitation, the conceptual model is essentially a snapshot of findings taken from existing literature. However, because DCs are context-specific and embedded within organizations, firms must build them over time (Augier and Teece, 2009). Therefore, a longitudinal study could further highlight developments and changes in the capabilities required for procurement leaders at different stages of the transformation journey. In addition, we realize that the digital sensing capabilities are generic to the extent that they could be applied to other functions within firms wishing to adopt digital technologies. We therefore suggest conducting further research that focuses on sensing capabilities regarding procurement. Lastly, we highlight the fact that the proven

performance outcomes are scarce (see, for instance, Colombo *et al.*, 2021) in the academic literature and limited negative performance outcomes were identified by previous authors. We therefore call for more empirical research that addresses these shortcomings.

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Appendix 1

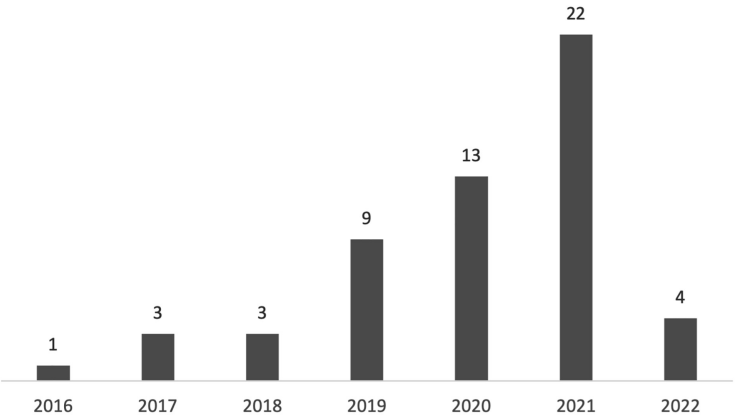

Figure A1.
Number of articles per year

Note(s): Papers up to May 2022 are included in the overview

Appendix 2

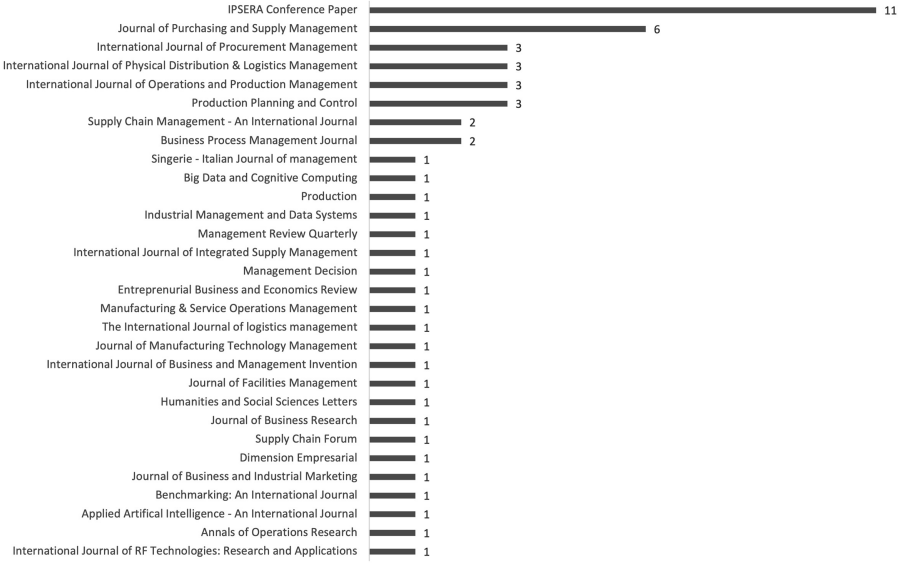

Figure A2.
Articles per journal/ conference

Appendix 3

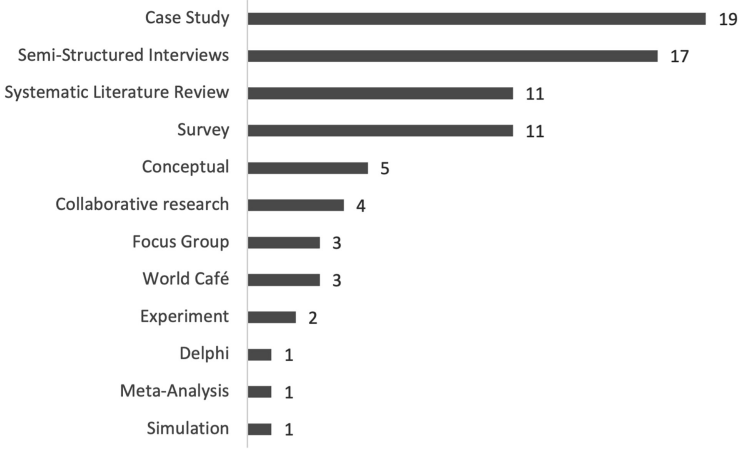

Figure A3.
Overview of methods adopted

Appendix 4

Study	Goal	Procurement main focus in SLR	SLR central method/focus of paper	General focus on procurement digitalization (not on specific technologies/sub-topics within the topic)	Build Conceptual Model/ Theoretical Framework	Focus on mechanisms of procurement digitalization
Arvidsson *et al.* (2021)	Study how BD literature has addressed PSM and how research could proceed to support purchasing managers in their attempts to benefit from BD	✓	✓			
Delke *et al.* (2021)	Analysis of current, future and Industry 4.0 oriented PSM skills	✓				
Fatorachian & Kazemi (2021)	Explores the potential impact of Industry 4.0 and its associated technological advances on Supply Chain (SC) performance.		✓	✓	✓	
Guida *et al.* (2021)	Understand the mpact of AI on the procurement process, drawing up the points of a future research agenda	✓				
Prato *et al.* (2021)	Explore the ways in which-in the context of Performance-Based-Contracts-Digital Technologies may enhance outcome measurability	✓	✓			
Spreitzenbarth *et al.* (2021)	Showcase the potential of AI methods in procurement with concrete examples from literature and applications	✓				
Hofmann *et al.* (2020)	Identify main authors, relevant topics, and practical implycations as well as upcoming developments in the procurement of business services	✓	✓			
Bals *et al.* (2019)	Analysis of current and future required competencies in PSM	✓				
Elsaesser (2019)	Explore common characteristics of digital/ digitalization as there is no mutual understanding of what the content of digitalization really is	✓		✓	✓	
Kosmol *et al.* (2019)	1. Explain why firms adopt digital procurement practices 2. Study which intermediate outcome and relational performance effects digital procurement practices have on supply chains	✓		✓	✓	
Lamba & Singh (2017)	Analyze the status of big data research in three key domains of O&SCM namely procurement, manufacturing and logistics.		✓			
This study	**Develop a finer-grained theoretical framework on digital procurement transformation**	✓	✓	✓	✓	✓

Figure A4.
Overview of SLRs on procurement digitalization

Appendix 5

Figure A5.
Frequency of theories found in articles

Corresponding author
Silke Herold can be contacted at: s.herold@maastrichtuniversity.nl