

Digital Transformation in Public Procurement: A Review of Challenges for the Participation of SMEs

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Abstract

Small- and medium-sized enterprises (SMEs) are often struggling with digital transformation and are underrepresented in public procurement procedures. This underrepresentation causes substantial loss of economic potential. Contemporary research and development on the ongoing digitalization of public procurement is not targeting SMEs sufficiently. Therefore, this research aims to close the gap by analyzing both, literature and current digitalization projects with regard to targeting SMEs' needs. Based on practical and scientific sources, we provide a synthesis of issues that SMEs face in public procurement. Furthermore, potential technical and organizational solutions are discussed and mapped along a matrix to the identified problem areas. The evaluation of problem areas and their mapped solutions indicates that technical solutions must be integrated as part of an organizational framework in order to be effective and comprehensive for being useful and beneficial to SMEs.

Keywords

Digital Transformation, Public Procurement, Challenges of SMEs

1. Introduction

Digital transformation is affecting all kinds of businesses, including in the private and public sectors [1][2]. While it offers many benefits [3][4], the adoption of digital transformation also brings risks for organizations [5]. These risks can affect different aspects such as stakeholders, technology, processes, culture, organization, and strategy [5]. Especially the public sector is lagging behind in the implementation of digital innovations, as argued in [41][7]. This also affects the domain of public procurement, which suffers from poor interoperability and coordination across involved actors [8], ineffective implementation of new policies [9], and lacking technical support [9].

Public procurement processes are not covered by digital solutions in a holistic fashion. As public procurement makes up around 15% of the GDP of the European Union, improvements to it are economically vital and of high relevance. Yet, the unclear process structure, lacking technical support, and complex legal frameworks make it hard for SMEs to participate in public procurement procedures in a profitable manner. As SMEs usually do not have dedicated legal

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departments, fully understanding the legal obligations and connected legal risks remains a challenge. Furthermore, SMEs have less capabilities to cover the fixed costs that come with the preparation of tenders. However, a better inclusion of SMEs in public procurement offers a great economic potential as SMEs can provide specialized services and may act more flexibly. With regard to sustainability, it may also be easier to find local service providers and products by including SMEs.

This paper aims to analyze the current factors that impede SMEs from participating profitably in public procurement processes. Based on this analysis, technical solutions and recommendations for action are defined to overcome the challenges. The research is driven by the following two key Research Questions (RQ):

RQ1: Which factors are making public procurement procedures unprofitable and unattractive for SMEs?

RQ2: Which technical solution components can facilitate the digital transformation in public procurement, which are tailored towards the inclusion of SMEs?

We apply a holistic view where the participation of SMEs is considered a socio-technical system and process. The implementation of technical solution components and innovation can accomplish parts of the solution, while it is also necessary to address organizational issues in the communication between public entities and SMEs. The latter demands for a clear organizational framework. In order to design an effective solution, a clear differentiation is necessary among problems that can be solved by digital transformation, and challenges that need to be resolved by implementing organizational changes. Hence, soft factors as Governance, Risk Management, and Compliance have to be integrated in the solution. SMEs need to carefully manage their limited resources, making a good management of tendering documents and their contents paramount. The potential risks need to be clearly communicated. Also ensuring compliance to all included legal regulations is a complex endeavor that needs to be considered. To answer above research questions, this paper employs Design Science Research (DSR), which is focused on approaching the problem from practical and science-based sides at the same time, deploying both analytical and empirical methods.

The paper is structured as follows: The research design and used methodology is explained in Section 2. In Section 3, the theoretical foundations are established by analyzing literature regarding public procurement, digital transformation, and the inclusion of SMEs. This analysis provides a first theoretical overview of the problems that SMEs face, thus partly answering RQ1. In Section 4, fitting technical solution components are introduced, which address RQ2. Based on the defined technical solutions and identified theoretical issues, empirical methods are utilized in Section 5 to verify together with SMEs, if the defined solutions are fitting their needs and if they face further problems not addressed by literature sufficiently. Section 6 sums up the results and critically assesses the core contributions of the paper, concluding with further research needs.

2. Methodology

This work employs a Design Science Research (DSR) approach [12], which includes three interconnected research cycles that are based on the Design Science Research Methodology

[13]. Each iteration can be mapped to the rigor, the relevancy, and the design cycle prescribed by DSR. While each cycle proposes contributions on its own, the combination of these results leads to the final and overall contribution of this paper as the result of the design cycle.

A literature review based on Webster and Watson [14] is performed to create a rigorous overview of factors that affect the attractiveness of public procurement for SMEs. The literature review itself was conducted based on keyword search along the process of [15], using keywords such as “Digital Transformation”, “Public Procurement”, “e-Procurement”, “Governance” in combination with “SMEs” as an overarching concept. Literature databases such as SCOPUS, Web of Science, Elsevier, and Google Scholar were searched. In a second step, the found literature entries were analyzed based on their title. Articles that are not relevant for the research context were filtered out. In a second step of selection, fitting papers were selected based on their abstracts and conclusion of contributions. This led to a final selection of papers that were evaluated after a full read. In several following iterations of the research process, references from selected papers were considered to further verify and evaluate preliminary results of the analysis.

Limited pilot phases were performed for developed technical solutions as part of several connected projects. In total, three sets of interviews / workshops were performed with different audiences, and three solutions were piloted and tested. First, an implementation pilot with German SMEs was conducted together with the Landesbetrieb Mobilität Rheinland-Pfalz (LBM) [16], and accompanied by workshops. Second, a workshop was conducted with procurement experts from the public sector in Germany, representing the Cooperation project for digitalization of Public Procurement [17]. Third, a workshop with SME and industry representatives was conducted during the Smart County Convention 2023 [18]. The final design cycle of the research combined the findings of both previous cycles (rigor and relevancy cycles) into a holistic solution and final contribution to this paper. Gaps between the observations from literature and the practical findings from the dialog with SMEs are identified and defined as targets for further research.

3. Theoretical Foundation

This section provides an overview of relevant theoretical concepts. Factors that might affect the attractiveness of public procurement procedures and digital transformation for SMEs as well as potential problems are analyzed in particular. Based on a literature review, the four main concepts “Digital Transformation”, “Public Procurement”, “Governance, Risk, and Compliance”, and “Interoperability” are analyzed below. Finally, a synthesis of the results and literature matrix is provided.

3.1. Digital Transformation

Digital Transformation is used as a term for the introduction of Information Systems (IS) and digital innovations into organizations such as public bodies or enterprises [1][3]. Successful digital transformation is of growing importance and paramount for all sorts of organizations. A taxonomy for digital transformation by Kutzner et al. shows that the topic touches a big and still

increasing array of research and business activities [19]. Literature has shown how digital transformation can achieve measurable improvements in the efficiency and agility of business processes [20]. However, even though digital transformation promises great advantages, literature has also pointed out several challenges and required competencies for successful digital transformation of companies, which span from categories theoretical learning and analysis to practical communication and management [21]. Ramane et al. have created a framework to measure the digital maturity of organizations based on the digital readiness and digital impact. It suggests that the ideal level of digital transformation is not set in stone but should be determined by the individual situation of each organization [22].

3.2. Public Procurement and E-Procurement

Public Procurement includes all procurement procedures that are initiated by public bodies [23]. Such procedures generally require a tendering phase, following certain legal requirements to ensure a fair competition for all participating economic operators [24][23]. Different types of procedures such as open or restricted procedures may be used to suit the individual procurement context [25][26]. Furthermore, procurement procedures in the EU that reach a certain financial threshold must be tendered EU-wide, making cross-border interoperability a specific concern. Procurement procedures themselves are complex processes that are grouped into multiple process phases such Pre-Award, Awarding, and Post-Award [27]. E-Procurement essentially considers the digital transformation of procurement procedures, to increase the efficiency and profitability of procurement [9][28]. As such E-Procurement needs to consider multiple architectural layers from organizational and legal matters, to data standardization and technical infrastructures [29][25]. As such, the digital transformation of public procurement faces many diverse interdisciplinary challenges. Overall literature shows that the integration of SMEs into public procurement is affected by many different factors and can be improved by a wide array of measures. This includes elements that must be implemented by both, public entities and companies themselves. The integration of technological tools, specialized policy design and implementation, changes to the way procedures are executed, and organizational management are all important measures with positive impact of SMEs participation [30][31].

3.3. Governance, Risk, and Compliance

Governance, Risk, and Compliance (GRC) is a collection of aspects of increasing importance for businesses and organisations of all kinds. The concept includes the effective governance of processes, resources, and data, the management of risks, and compliance to both, internal agreements and external legal regulations. This leads to many practices in the field being not suitable for SMEs [_code_8], causing many procurement related problems. First, SMEs face a hard time properly governing their resources and data to effectively create fitting tenders. Along this, Data Governance is of special importance for SMEs and for public procurement. Data governance covers all aspects regarding authority and control over data in the scope of an organisation [1]. A systematic elaboration of data governance aspects provided in [34]. As SMEs in general produce and manage a smaller amount of data, it is also hard for the SMEs to establish

sufficient infrastructures for handling information. Overall, literature suggests many GRC related issues that can impede the attractiveness of public procurement for SMEs.

4. Technical Solutions for the Digital Transformation of Public Procurement for SMEs

Chapter 4 introduces relevant technical solutions that might be applied to target challenges faced by SMEs, based on literature and relevant reports / legal regulations. These and some additional solutions are later mapped to the specific problem areas in Chapter 4.

4.1. Extended ESPD (European Single Procurement Document)

The ESPD was legally introduced in 2014 as a means for bidders to easily provide a standardized self-declaration regarding their qualification to participate in public procurement procedures – see EC Directives 2014/24/EU [35] and 2014/25/EU [36]. It can be seen as a technical solution to reduce effort on both EO and CA sides [38]. Especially SMEs can benefit from using the ESPD, as it provides a full list of exclusion and selection criteria in public procurement in a standardized way. Furthermore, the ESPD is viable for all EU member states, thus greatly helping in cross-border interoperability, which is usually hard for SMEs. Overall, the ESPD encompasses self-disclosed details about a company's financial standing, capabilities, and appropriateness against predefined criteria according to the European Public Procurement directives [36][35]. It replaces the need to furnish exhaustive evidence and documentation to demonstrate adherence to legal and specific standards. Under legal mandate, contracting authorities (CAs) within member states must acknowledge the qualification criteria outlined in the standardized ESPD format. Consequently, the ESPD streamlines cross-border procurement processes, facilitating easier identification and fulfillment of essential criteria for Economic Operators (EOs) [37]. Additionally, the ESPD can be extended to also request and handle evidences. As such it can be connected to a Once-Only Technical Infrastructure in context of the Single Digital Gateway regulation [53] to further reduce administrative loads from bidders and SMEs.

4.2. Pre-Award Catalogues

Framework agreements are commonly utilizing electronic catalogues for ordering after the awarding phase in public procurement. These are successfully used in practice and reduce administrative burdens for CAs and especially EOs, who are able to reuse their own catalogue systems [39]. The overall principle of electronic catalogues can also be applied to the Pre-Award phase. Peppol has introduced a standardized specification for a Pre-Award Catalogue. It is designed to enhance the efficiency of the pre-award phase by consolidating procurement information in a structured manner. This facilitates a significant increase in data consistency and quality. Introducing a catalogue request, initiated by the CA, allows for the reuse of documents for similar procedures, thus promoting efficiency. Additionally, this system enables the automatic generation, comparison, and evaluation of tenders based on existing catalogues. This is especially helpful for SMEs as it greatly reduces the burden of defining an initial offer to a procurement procedure.

4.3. Dynamic Procurement Systems (DPS)

Dynamic Purchasing Systems (DPS) serve as a digital special kind of restricted procurement procedures aimed at optimizing and strengthening the competitiveness of public procurement procedures for CAs [40]. At any point in time, EOs have the opportunity to participate if they meet the qualifications and criteria set by the CAs. This system not only promotes inclusivity but also enhances competitiveness. Rather than being awarded contracts directly, suppliers must engage in competition for each business opportunity within the Dynamic Purchasing System (DPS). Research findings support the notion that this requirement fosters a more competitive environment [41][42], including for SMEs.

5. Verification of Results

The results of sections 3 and 4 provide a clear overview of problems for the integration of SMEs into public procurement, and potential technical solutions to mitigate those. To verify these theoretical results, two workshops were performed in order to gather practical insights from both the SME and CA perspectives as described in section 2. The first workshop focused on the CA perspective, while the second workshop was performed with multiple SME participants explaining their issues and perspectives.

Table 1 provides a consolidated overview of 21 identified individual challenges for the integration of SMEs mapped towards 13 clusters of influence factors from literature.

Table 1:
Challenges for the integration of SMEs in public procurement procedures

Influence Factors	Challenges of SMEs identified in literature and along workshops with stakeholders	Sources
(A) Digital Capabilities	(1) SMEs lack the capabilities to endorse digital transformation	[43][31]
(B) System Integration	(2) Available IS-Solutions are not tailored towards SMEs	[41][30][31]
(C) Technical Procurement optimizations (E-Procurement)	(3) Lacking capabilities to create and manage standardized documents	[44][45][46][37]
(D) Semantic (High), Data Governance (High)	(4) Redundant effort for SMEs during tender creation	[39][26]
	(5) It is hard for SMEs to find relevant and profitable procedures	[41][9][44][40]
(E) Policy definition	(6) Policies are not tailored towards SME inclusion	[47][48]
	(7) Policies for SMEs are not translated well into practice	[9]
(F) Tendering Criteria	(8) Purely price-based awarding	[49]
	(9) Ambiguous evidence requirements	[49][45][46]
(G) Dynamic Procedures	(10) Procedures are not planned properly based on the tendered goods	[40][42]
	(11) Lacking room for dynamic dialog between CAs and EOs	Workshop 2
(H) CA Capabilities	(12) CAs are not capable of defining precise procurement documents	Workshop 2
	(13) CAs are not connected well to the business processes of Eos	[25][26] Workshop 2

	(14) CAs has a big resistance to change	[6][7] Workshop 1 & 2
(I) Data Governance	(15) Lacking high quality data	[33] Workshop 2
(J) Risk Management	(16) Risks are not clearly outlined in Procurement documents	[32] Workshop 2
	(17) Risks cannot be covered by SMEs	[33][50][51] Workshop 2
(K) Compliance to legal regulations	(18) Lacking legal capabilities by SMEs to understand regulations	[33][50] Workshop 2
	(19) Increased fix costs for SMEs by needed compliance measures	[33][50][51] Workshop 2
(L) Legal Interoperability	(20) Different legal regulation in different countries	[52]
(M) System Interoperability	(21) Lacking Interoperability between procurement systems	[29][26]

To provide an additional knowledge contribution, technical solutions and organizational measures discussed in literature, current practical projects, and the workshops were mapped towards the identified problem areas. The results show that in theory most problems for SMEs can be targeted, with policy design as an exception that can only be addressed on a political level. However, many gaps cannot be addressed by technical solutions or organizational measures alone. Interestingly, these gaps overlap for the most part, and technical solutions cannot be applied to issues where organizational measures are applicable and vice versa. The results indicate a demand for solution architectures that integrate both, technical solutions and organizational measures in a holistic way (cf. [26]). However, current approaches from the public side are more focused on delivering technical innovations for SMEs. This research, however, suggest that technical solutions cannot be effectively deployed for SMEs without embedding them into carefully built organizational frameworks. Table 2 shows the entire mapping of problems and solutions in detail.

Table 2:

Challenges for the integration of SMEs in public procurement mapped to existing technical solutions and organizational measures

Challenges for the Integration of SMEs in Public Procurement Procedures	Technical Solution	Organizational Measures
SMEs lack the capabilities to endorse digital transformation	out of scope	n.a.
Available IS-Solutions are not tailored towards SMEs	Development of IS for SMEs	n.a.
Lacking capabilities to create and manage standardized documents	pACT, ESPD, etc.	n.a.
Redundant effort for SMEs during tender creation	Pre-Award Catalogues	n.a.
It is hard for SMEs to find relevant and profitable procedures	DPS	n.a.
Policies are not tailored towards SME inclusion	Out of scope of paper	n.a.

Policies for SMEs are not translated well into practice	Out of scope of paper	n.a.
Purely price-based awarding	ESPD	n.a.
Ambiguous evidence requirements	ESPD-Extension	n.a.
Procedures are not planned properly based on the tendered goods	No solution	Market review, Market exploration
Lacking room for dynamic dialog between CAs and EOs	No solution	More dynamic tendering process
CAs are not capable of defining precise procurement documents	No solution	Market review, Market exploration; Dialog
CAs are not connected well to the business processes of Eos	No solution	Market review, Market exploration
CAs has a big resistance to change	No solution	out of scope
Lacking high quality data	Peppol	n.a.
Risks are not clearly outlined in Procurement documents	No solution	Risk definition phase
Risks cannot be covered by SMEs	Criterion based service	n.a.
Lacking legal capabilities by SMEs to understand regulations	Criterion based service	n.a.
Increased fix costs for SMEs by needed compliance measures	Criterion based service	n.a.
Different legal regulation in different countries	ESPD	n.a.
Lacking Interoperability between procurement systems	Peppol	n.a.

6. Conclusion

This research provided an analysis of problem areas and solutions for the participation of SMEs in public procurement across three cycles of research – following DSR as the underlying methodology. The approach combined findings from literature, practical projects, and empirical findings from workshops with different actor perspectives, resulting in a comparative overview of many problem areas for the participation of SMEs. Furthermore, a mapping of which solutions can be applied to which problem areas was provided. Gap identification for both technical solutions and organizational measurements was developed based on the mapping. The research strongly suggests that technical solutions need to be implemented in the context of an organizational framework to be effective.

While these results provide a better understanding for the issues faced by SMEs and how they can be addressed, a detailed concept of how to establish such an organizational framework is still missing. Further research will therefore focus on answering what kind of organizational framework is required to include SMEs specifically. Furthermore, the identified organizational measures and technical components need to be integrated and developed toward a holistic reference architecture regarding the organizational framework. A methodical framework for its development could also be derived and is published in [26]. Finally, the results of the research, especially of both workshops, need to be verified by further studies to approve the validity of the results.

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