

CAN E-PROCUREMENT BE A PANACEA FOR UPGRADING THE COMPETITION AND EFFICIENCY IN PUBLIC PROCUREMENT?

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Abstract

The aim of this paper is to analyze whether electronic public procurement (EPP) has a positive and statistically significant impact on the efficiency and economy of the public procurement process as well as on broader participation of micro, small and medium enterprises (MSMEs), both of which are recognized as strategic goals of a government. For this purpose, focusing on transparency, efficiency, centralization and bidder participation, we use a database of 65,394 public contracts awarded in the Republic of Slovenia in 2016-2020. Our research shows that there is a strong positive correlation between EPP on the one hand and: (1) higher transparency, expressed by a decreasing share of non-transparent procedures; (2) higher efficiency and economy indicated by the degree of centralization; and (3) broader participation of MSMEs on the other hand. Contrary to expectations, the introduction of the EPP did not increase the intensity of competition and the acceptance of framework agreements as an instrument of centralized and collaborative procurement.

Keywords: electronic public procurement, efficiency and economy, competition, transparency, centralization.

1. Introduction

Public procurement refers to the procurement of products, works and services by central governments, municipalities, institutions, and public enterprises at both levels. In the Member States of the European Union, the value of public procurement, seen as an important tool for job creation and competitiveness (Dragos and Neamtu, 2013), reaches €2 trillion annually, representing 14% of their GDP and making them major consumers in the market (European Commission, 2022b). When the public sector spends public funds on such a large scale, it must comply with the principles of public procurement, including economy, efficiency and effectiveness, competition among tenderers, transparency of public procurement and equal treatment of tenderers (art. 3 of Public Procurement Act, Republic of Slovenia).

EU directives and national public procurement legislation in European countries emphasize transparency as one of the key principles, meaning that all potentially interested suppliers are informed and invited to participate in competitive tendering. In addition, transparency enables efficient monitoring and control, thus preventing irregularities that restrict competition (OECD, 2021a). Free competition is another important principle of public procurement. Intense competition forces bidders to compete more vigorously by offering lower prices (Grega and Nemec, 2015) and/or higher quality of the procurement items, resulting in the most favorable price-quality ratio for the buyer (Tukiainen and Halonen, 2020). This has been confirmed by the results of a study of public procurement in Sweden, which states that a small increase in the number of bidders can lead to significant savings in procurement costs (Hyytinen, Lundberg and Toivanen, 2018).

Economy, efficiency and effectiveness are among the most important principles of public procurement (art. 3 of Public Procurement Act, Republic of Slovenia). The centralization of public procurement has considerable potential to improve both the economy and efficiency of the process. Aggregation of demand puts a purchaser in a favorable position to buy ‘in bulk’, putting pressure on purchasing prices and costs. Replacing multiple purchasing processes with a single one significantly reduces transaction costs and increases procurement efficiency.

In later years, public procurement became increasingly seen as a lever for achieving broader policy objectives, rather than being limited to the efficient use of public funds (Trybus, 2010; Panagopoulos, 2016). The objectives of promoting the purchase of products and services that meet standards of ecological neutrality (Green Public Procurement or GPP), supporting the employment of women or youth without work experience, the disabled and other vulnerable groups (Socially Responsible Public Procurement or SRPP), and promoting an increase in the share of MSMEs have changed the procurement award process from being solely focused on maximizing economic efficiency (Trybus, 2010; Sapir, Schraepen and Tagliapietra, 2022).

Furthermore, recent public procurement reforms include the digitalization of the process. Since the procurement process has traditionally involved extensive paperwork, wide use of information and communications technologies (ICT) provided an opportunity for

contracting authorities to make procurement for goods and services more transparent and efficient (Ferk, 2016a). Digital transformation has its roots in the rapid growth of e-commerce and is linked to e-government solutions in many areas (Şandor, 2012) such as justice, health, administrative procedures and others. The strategic goal of digitalization in the EU is the creation of a digital single market and the introduction of the ‘once-only principle’ in the public sector of the member states.

One of those e-government solutions is Electronic public procurement (EPP), which is defined as a set of instruments, technologies and organizational solutions supporting public procurement processes, particularly considering the possibility to manage tendering procedures (Gardenal, 2010). The EPP focus is on electronic submission of bids using electronic means of communication in accordance with article 22 of Directive 2014/24/EU.

The primary goal of this paper is to evaluate the impact of EPP on key aspects of the public procurement process in the Republic of Slovenia. Specifically, the study aims to investigate whether the introduction of EPP has positively affected transparency by reducing the use of non-transparent procedures, enhanced the efficiency and economy of procurement through centralization, and increased competition by attracting more bidders. Additionally, the paper seeks to assess whether EPP has facilitated broader participation of MSMEs, a strategic goal for many governments to foster economic growth and innovation.

To achieve these objectives, the paper employs a quantitative analysis based on a dataset of 65,394 public procurement contracts awarded in Slovenia between 2016 and 2020. The research compares data from two periods—before and after the mandatory introduction of EPP in 2018—using statistical methods such as t-tests and chi-square tests. These analyses evaluate the impact of EPP on factors like transparency, competition, centralization, and MSME participation. By testing specific hypotheses related to these outcomes, the study provides empirical evidence on the effectiveness of EPP in enhancing public procurement processes.

2. Literature overview

2.1. How does e-procurement affect the transparency and competition of the procurement process?

The legal framework, as a prerequisite for the introduction of electronic procurement in the EU, was created by two directives: Directive 2004/17/EC and Directive 2004/18/EC, which was extended by a series of directives in 2014, with Directive 2014/23/EU on concessions, Directive 2014/24/EU on public procurement and Directive 2014/25/EU on utility procurement. Main advantages of digitalization of public procurement were (a) increasing the transparency of public procurement activities, and (b) collecting consistent, up-to-date and reliable data on procurement processes (OECD, 2019a).

The possibility of finding all tender notices in one place is an important step towards increasing competition. Namely, when all notices are published in electronic form in one place it is much easier for potential bidders to access them than in case of a fragmented,

paper-based system of publishing notices (Adam, Hernandez Sanchez and Fazekas, 2021). Full and easy accessibility of information regarding opportunities for public contracting attracts more bidders thus increasing competition.

E-procurement can be seen as a comprehensive transformation of the procurement process, leading to a significant reduction in information costs and an improvement in accessibility, thereby increasing both transparency and the intensity of competition in the public procurement market. In addition, e-procurement is a prerequisite for the collection of data needed for data-driven policy making based on empirical evidence and objective facts (Sava, 2023). Emery, Mélon and Spruk (2020) believe that one of the main benefits of e-procurement is that it reduces the discretionary power of public officials in public procurement. Further, e-procurement has the potential to reduce unduly lengthy procedures, improve the quality of goods and services procured and increase public sector accountability.

E-procurement platforms integrate the entire public procurement process, from communication to the processing, treating and storage of data in a consolidated and easily accessible electronic form (Costa, Arantes and Tavares, 2013). Electronic platforms provide user-friendly, real-time access to all relevant public procurement data and offer secure storage of this data, reducing the possibility of loss or malicious tampering. This has made monitoring and retrospective control much more effective, reducing the risk of corruption. In addition, the reduced personal contact between a contracting authority's employees and bidders reduces the opportunities for corrupt activities (Neupane, Soar and Vaidya, 2014).

A World Bank guide (World Bank, 2011) cites greater transparency and competition as the most important benefits of EPP, which also has an impact on the fight against corruption. Its Action Plan for the Implementation of the e-procurement legal framework estimates that governments can save up to 5–20% of their expenditure through mechanisms such as increased competition and better access to public markets for economic operators.

Several studies have confirmed the positive impact of competition and e-procurement on savings in public procurement. Gavurova, Tkáčová and Tuček, (2017) claimed that each new bidder brings an average price reduction of 2.9%. The results of Pavel and Sičáková-Beblavá's (2013) research of the competitive contracting conducted through E-auctions in 15 Slovak cities show that an increase of 0.7 in the average number of tenders submitted can be attributed to the introduction of electronic tools. The increased competition resulted in a decrease of the winning price by approximately 2.4% compared to the expected price (Pavel and Sičáková-Beblavá, 2013, p. 123). When e-procurement was introduced in Bangladesh and Argentina, it encouraged the use of open competition procedures, resulting in an increase in the average number of bids submitted by 1–2, a decrease in individual bids by 10–16% and price reductions of 7–8% (De Michele and Pierri, 2020; Blum *et al.*, 2023).

Empirical studies on public procurement in Italy, India and Indonesia also support the assumptions about the positive influence of electronic procurement on competition

(Coviello and Mariniello, 2014; Lewis-Faupel *et al.*, 2016). The possibility to find all tender notices in one place, such as the public procurement portal, has been seen as a major step towards strengthening competition (Adam, Hernandez Sanchez and Fazekas, 2021).

The study by Bauhr *et al.* (2020), which covered 3.5 million public procurements undertaken in the EU in the period 2006–2015, found a correlation between increased transparency and open competition due to digitalization, on the one hand, and reduced corruption, on the other. The influence of open competition and transparency on corruption was also confirmed in the study by Knack, Biletska and Kacker (2019), which analyzed 34,000 companies in 90 developing countries.

Soudry (2004) argues that the introduction of electronic instruments, such as electronic procurement and electronic auctions, contributes positively to increasing transparency in public procurement. Transparency allows bidders to monitor any procurement process and to appeal if they find that their rights have been violated due to discrimination or other irregularities that have prevented them from participating (Adam, Hernandez Sanchez and Fazekas, 2021). Furthermore, transparency is seen as one of the most important prerequisites for free competition, meaning that all potentially interested suppliers are informed and can participate in competitive tendering (OECD, 2016).

A significant advantage of digitizing public procurement is that it eliminates paper-based work and thus reduces unnecessary administrative work, which in turn means lower transaction costs. Lower transaction costs make procurement more profitable to tenderers, thus making it more attractive for bidders to compete. In addition, e-procurement enables more efficient monitoring of public procurement through the collection and provision of accurate, up-to-date and easily traceable data (OECD, 2021b).

Emery, Mélon and Spruk (2022) examined the contribution of e-procurement to economic growth. They compared the economic growth rates in the two Australian states: Western Australia and New South Wales after the introduction of e-procurement. In Western Australia, which has efficient controls and low rates of irregularities and corruption, the positive impact of e-procurement on economic growth was significant. In New South Wales, on the other hand, where the audit found many irregularities and cases of corruption, the impact of e-procurement on economic growth was close to zero. The authors concluded that the magnitude of the impact of e-procurement on economic growth depends on the quality of governance, the strength of regulatory oversight and differences in transaction costs.

Raventós and Zolezzi (2015) estimated that electronic tendering in Chile contributed to a reduction in purchase prices of more than 8% due to a decrease in corruption and less collusion between suppliers. Matas (2018) estimates that the introduction of electronic instruments in Slovenia reduced prices by just over 3%. However, estimates of savings from the introduction of e-procurement vary widely. While some authors such as Shalev and Asbjornsen (2010), Tassabehji (2010), Sashi and O’Leary (2002) and Beall *et al.* (2003) claim that electronic instruments, such as electronic auctions, can reduce costs considerably, even by up to 40%, others such as Smeltzer and Carr (2003) and Singer *et al.* (2009)

argue that this figure is much lower and that a double-digit percentage of price reductions is not realistic.

It is important to point out that e-procurement does not lead automatically to more savings as well as to higher compliance. One of the important weaknesses of e-procurement in the EU was limited integration or interoperability among existing procurement frames that undermined its efficiency (Ferk, 2016b). The impact of digitalization on the transparency of public procurement can be assessed on the basis of the change in the proportion of non-transparent procedures such as the negotiated procedure without prior notice (NPPN) in the total number of contracts awarded. A negotiated procedure without prior notice is considered as a non-open and a non-competitive procedure. The consequence of not publishing a call for tenders is that eligible companies cannot be informed about existing business opportunities, which impairs both the transparency of public procurement and the intensity of competition.

The European Commission's document 'Making Public Procurement work in and for Europe' (2017, p. 11) calls on national authorities to apply fully transparent public procurement procedures, including through the introduction of e-procurement. In this paper, we examine whether there exists a correlation between non-transparent procurement procedures, measured by the share of NPPN in the total number of contracts awarded, on the one hand, and the introduction of e-procurement in the Republic of Slovenia, on the other. When assessing the impact of e-procurement on competition, the average number of bids per tender before and after the introduction of e-procurement is used as the indicator.

2.2. Digitalization as a stimulus for procurement centralization

In the EU, centralized procurement is seen as a tool to improve the performance of public procurement, especially in terms of its economy and efficiency (OECD, 2011a). The most visible and emphasized advantage of this type of public purchasing is based on high-quality purchasing, which makes procurement more attractive to bidders, resulting in more intense competition, lower prices and more favorable purchasing conditions (Jovanović, Milosavljević and Žarkić-Joksimović, 2019; OECD, 2019b). In addition, considerable savings can be achieved in transaction costs, as one contracting authority carries out the procurement procedure on behalf of several contracting authorities (Čudanov, Jovanović and Jaško, 2018). Furthermore, centralized procurement bodies (CPBs) usually have experienced professionals, which increases the chances of successful procurement procedures (Comba and Hamer, 2021). Increasing the use of centralized procurement is one of the six priority objectives of EU public procurement (European Commission, 2017). The centralization of procurement brings advantages in the form of a higher degree of standardization of the procurement subject and a more formalized and better structured procurement process, which increases cost efficiency (Karjalainen, 2009). In addition, centralization contributes to more efficient monitoring and control, as it is easier to monitor compliance with a single aggregated procurement process than with dozens of decentralized processes.

Due to art. 90 of Directive 2014/24/EU, in the EU central purchasing bodies were among the first to implement electronic means of communication, a form of digitalization. By enabling contracting authorities to centralize procurement functions, electronic platforms help to reduce administrative costs per procurement unit.

Electronic platforms greatly improve the efficiency of monitoring and control of centralized procurement procedures by keeping procurement documents in electronic form so that any subsequent attempt to alter tender documentation to cover up irregularities can be easily detected (Neupane, Soar and Vaidya, 2014). It could be said that e-procurement reinforces the benefits of centralization and vice versa (Karjalainen, 2009).

One could argue that e-procurement is a prerequisite for centralized procurement. To create an applicable analysis of purchasing conditions for certain subjects procured by different contracting authorities and compare them, a CPB needs an advanced electronic system that provides accurate information on the procurement of CAs. The aim of CPB experts is to identify standardized procurement items that are best suited for bundling, as well as contracting authorities that would benefit from participating in joint procurement.

The positive relationship between digitalization and centralization was recognized more than a decade ago. Johnson *et al.* (2007) pointed out the positive influence of organizational centralization on the use of e-procurement. At the same time, e-procurement promotes the centralization of procurement by helping CPBs to make purchasing more efficient (Dimitri, Dini and Piga, 2006). E-procurement enables savings in the cost of public procurement officers' labor and other administrative expenses related to public procurement, compared to the traditional paper form.

In this paper, we investigate whether the introduction of the EPP in Slovenia has positively contributed to the centralization of public procurement, which would be expected since e-procurement promotes the centralization of procurement by helping CPBs to make purchasing more efficient. We used the share of centralized procurement in the total number of contracts as an indicator of the degree of centralization of public procurement. As a second, indirect indicator of centralization, the share of framework agreements (FAs) is used, as this instrument is often used in joint and centralized procurement (OECD, 2011b) and framework agreements together with CPBs are key elements of centralized procurement systems (OECD, 2011a).

2.3. Does e-procurement contribute to MSMEs wider participation at public sector market

Micro, small, and medium-sized enterprises (MSMEs) make up 99.8% of all companies in the EU, with 90% being micro-enterprises that employ fewer than 10 people, and half of those only one person, the owner (European Commission, 2022a), indicating their high importance for both the European economy and employment. Additionally, MSMEs produce 10 times more patents per employee than larger companies in the same sector, highlighting their innovativeness (Clark III and Moutray, 2004).

Despite their importance for the economy and employment, MSMEs struggle to secure public procurement contracts. While they account for over 65% of private sector turnover, MSMEs win only 45% of public contracts (European Commission, 2022c). This discrepancy highlights a gap between their economic role and their involvement in public procurement success.

According to Karjalainen (2009) one of the main factors for this is their unwillingness to compete for public sector contracts. According to a survey by the Institute of Employment Studies/Small Business Service (IES/SBS), less than a tenth of the MSMEs surveyed in the UK (7%) expressed an interest in supplying public authorities, with even fewer self-employed entrepreneurs showing interest (IES/SBS, 2006). There are several reasons for this. Firstly, there are perceived differences between private sector procurement processes and the public ones, which are perceived as more complex, bureaucratic, and costly. Secondly, MSMEs participating in public sector tenders show that a lack of trust in the procurement processes and in the contracting authorities is a major obstacle (European Commission, 2021). Thirdly, MSMEs face higher tendering costs, up to 50% more than for private sector contracts, and limited access to relevant information further deters participation (Fee, Erridge and Hennigan, 2002).

Besides the aforementioned reasons, the low credibility of public procurement processes is recognized in many countries as the main obstacle to wider participation by all bidders, MSMEs or otherwise, which has multiple negative effects (Berg, 2022).

One of the reasons for this low level of trust within MSMEs is bid rigging and collusion. This occurs when a few bidders coordinate to exclude potential competitors, enabling them to offer less competitive prices and terms. A smaller number of bidders, preferably 2 to 3, makes it easier to collude. All this is done to influence the outcome of the tendering process in their favor (Schoeberlein, 2022). This naturally reduces the willingness of other potential bidders to compete for contracts with the government (European Commission, 2022b), as they feel their chances of winning are low, especially if other bidders have an advantage due to previous knowledge, privileged information or prior contracts (Albano *et al.*, 2006).

The integrity of public procurement is the first factor that MSMEs evaluate when deciding whether to participate. Suppose the contracting authority and a particular bidder agree in advance that this bidder will be awarded the contract. Even if the CA initiates the procedure and invites bidders to submit their bids, giving the impression that the procedure is proper, which it is not, if a MSME that is a potential bidder recognizes this situation it will not evaluate other aspects of the contract such as the profitability of the contract and the transaction costs associated with participating in the tender. However, if the tender passes the 'credibility check', an MSME assesses whether the value of a procurement contract and the expected profit are high enough to participate in a competition at all (Shalev and Asbjornsen, 2010).

E-procurement can be helpful in overcoming the three main barriers to wider participation of MSMEs in public procurement: (1) bureaucracy and extensive paperwork;

(2) difficulties in providing information on new business opportunities to supply government; and (3) risks of collusion and rigged tenders associated with corrupt practices. By simplifying document management and improving transparency due to all relevant information about a tender being in one place, e-procurement lowers barriers to MSME participation (Costa, Arantes and Tavares, 2013). Additionally, secure storage of procurement data and enhanced monitoring due to e-procurement help strengthen trust in the public procurement process (Neupane, Soar and Vaidya, 2014), which is an important prerequisite for the participation of MSMEs.

Despite its benefits, e-procurement can also pose challenges for MSMEs, since it requires familiarity with information and communications technology (ICT), which some MSMEs may lack, potentially excluding them from the process (Di Mauro, Ancarani and Hartley, 2020). The OECD study (2019b) confirms that MSMEs struggle to adopt advanced digital tools, which can limit their ability to compete. This suggests that digitalization, while beneficial in some respects, could inadvertently reduce MSME participation in public procurement. The PwC study (Velthuijsen *et al.*, 2018) indicates that this weakness should be overcome through policy measures to promote the development of appropriate skills and complementary investments.

Considering all the possible positive aspects of MSME participation in this process but also taking into account that there are some challenges for their participation, in this research, we will test whether the EPP has positively contributed to broader participation of MSMEs in the Republic of Slovenia and whether its influence was insignificant. To analyze the above-mentioned relationships, we hypothesize the following:

H1: The introduction of electronic public procurement had a positive impact on increasing transparency by reducing the share of negotiated procedures without publication in public tenders in Slovenia.

H2: The introduction of electronic public procurement had a significant positive impact on increasing competition as measured by the average number of tenders per procurement procedure in Slovenia.

H3: The introduction of electronic public procurement has promoted centralized procurement in Slovenia.

H4: Electronic public procurement has increased the use of FAs in Slovenia.

H5: The introduction of electronic public procurement had a significant positive impact on the participation of MSMEs in public procurement tenders in Slovenia.

3. Methodology

We have collected data on public procurement from the Public Procurement Portal managed by the Ministry of Public Administration of the Republic of Slovenia. Procurements from 1 April 2016 to 31 March 2020 were included in the dataset. This period was chosen because the Public Procurement Act, which was adopted in November 2015, came into force on 1 April 2016 and e-procurement became mandatory on 1 April

2018. Therefore, a time span of two years before the introduction and two years after the introduction of mandatory e-procurement was chosen, resulting in a dataset of 65,394 procurements, 31,470 before the introduction of e-procurement and 33,924 after. The results are based on data from an SQL database on the parameters number of bids, shares of centralized procurement contracts, FA and MSMEs.

The analysis was carried out using the statistical software package IBM SPSS. To determine whether there are statistically significant differences in the average number of bids between non-electronic public procurements (nEPP) and electronic public procurements (EPP), t-tests for independent samples were used. The Student's t-test is a statistical hypothesis test used to determine whether there is a significant difference between the means of two groups (Sedgwick, 2010). The chi-square test for independent samples was used to analyze the differences between the EPPs and the nEPPs in terms of other characteristics (centralized, framework agreement and MSME participation). The chi-square test is a statistical method for analyzing categorical data and determining whether there is a significant association or relationship between two categorical variables (Zibran, 2007).

4. Results

Table 1 shows the total number of procurements analyzed and the proportion of each type of procedure. As it can be seen, the total number of EPPs is slightly higher than the total number of nEPPs (33,924 compared to 31,470). The share of negotiated procedures without prior publication in the total number of public procurements procedures is lower for EPPs than for nEPPs. For the purpose of testing hypothesis H1, the chi-square test for independence with post-hoc analysis was applied. The result obtained shows that the hypothesis was statistically confirmed and that the proportion of negotiated procedures without prior notice has decreased since the introduction of electronic public procurement ($\chi^2 = 12.292, p = 0.000$).

Table 1: Number of procurements by type during analyzed period

Type of procedure	Number of procurements		Share %	
	nEPP	EPP	nEPP	EPP
Competitive dialogue	22	32	0.07%	0.09%
Competitive procedure with negotiation	231	331	0.73%	0.98%
Open procedure	15,216	16,243	48.35%	47.88%
Restricted procedure	80	75	0.25%	0.22%
Small value purchases	13,679	15,071	43.47%	44.43%
Negotiated procedure without prior notice	1,701	1,629	5.41%	4.80%
Negotiated procedure with prior notice	541	543	1.72%	1.60%
Total	31,470	33,924	100.00%	100.00%

Source: Authors' analysis

Table 2 shows the results of the t-tests for independent samples. The analysis was performed both for the entire sample and for specific types of procedures. The average number of bids is lower for EPP than for nEPP (3.09 vs. 2.60) and the result is statistically significant. Only in the case of competitive dialogue (3.16 vs. 1.91) and the restricted procedure (6.92 vs. 6.00) is the average number of bids higher, but there is no evidence of statistically significant differences in the restricted procedure. In all other procedures, apart from the competitive dialogue, the average number of bids in the EPP is statistically significantly lower. The results obtained indicate that our hypothesis H2 has been disproved, and that competition has not only not increased with the introduction of electronic public procurement but has actually decreased significantly.

Table 2: T-tests for average number of bids

	Mean	SD	t
All procedures			15.832**
nEPP	3.09	4.147	
EPP	2.60	3.668	
Competitive dialogue			-2.252*
nEPP	1.91	0.868	
EPP	3.16	2.952	
Competitive procedure with negotiation			2.417*
nEPP	2.55	2.241	
EPP	2.12	1.737	
Open procedure			10.227**
nEPP	3.50	5.388	
EPP	2.91	4.721	
Restricted procedure			-.716
nEPP	6.00	5.578	
EPP	6.92	9.726	
Small value purchases			16.112**
nEPP	2.89	2.430	
EPP	2.44	2.260	
Negotiated procedure without prior notice			3.051**
nEPP	1.21	1.228	
EPP	1.11	0.518	
Negotiated procedure with prior notice			4.156**
nEPP	2.23	2.036	
EPP	1.78	1.539	

* p<0.05; ** p < 0.01

Source: Authors' analysis

Table 3 shows the results of the chi-square tests for independence between procurement method and centralization. The percentage of centralized procurements is statistically significantly higher in the EPP than in the nEPP (4.06% vs. 2.51%) and this is particularly noticeable in the competitive procedure with negotiation, where its share is twice as high (16.31% vs. 8.23%). In restricted procedures and both negotiated procedures with and without prior notice, there is no statically significant relationship between centralization and procurement method. For the other types of procedures, there is a statically significant relationship. On this basis, we can say that hypothesis H3 was confirmed, and that the introduction of electronic public procurement has promoted centralized procurement in Slovenia.

Table 3: Chi-square tests for centralization

	non centralized	centralized	χ^2	Phi
All procedures			122.022**	0.043
nEPP	97.49%	2.51%		
EPP	95.94%	4.06%		
Competitive procedure with negotiation			7.177**	0.118
nEPP	91.77%	8.23%		
EPP	83.69%	16.31%		
Open procedure			74.546**	0.049
nEPP	96.16%	3.84%		
EPP	94.05%	5.95%		
Restricted procedure			0.000	-0.042
nEPP	97.50%	2.50%		
EPP	98.67%	1.33%		
Small value purchases			57.444**	0.045
nEPP	99.04%	0.96%		
EPP	97.92%	2.08%		
Negotiated procedure without prior notice			0.442	-0.013
nEPP	97.18%	2.82%		
EPP	97.61%	2.39%		
Negotiated procedure with prior notice			0.000	-0.009
nEPP	98.89%	1.11%		
EPP	99.08%	0.92%		

* $p < 0.05$; ** $p < 0.01$

Source: Authors' analysis

Table 4 shows the results of the chi-square tests for independence between the procurement method and the use of framework agreements. The percentage of FA is lower for EPP than for nEPP (36.06% vs. 39.68%), which is a statistically significant result. There is no statistically significant relationship between the FA and the procurement method in

the competitive procedure with negotiation, the restricted procedure and the negotiated procedure with prior notice. In the other types of procedure, the use of FA in the EPP procedure is statistically significantly lower than the use of FA in the nEPP procedure. This is contrary to expectations, so that hypothesis H4 was refuted.

Table 4: Chi-square tests for FA

	no FA	FA	χ^2	Phi
All procedures			91.096**	0.037
nEPP	60.32%	39.68%		
EPP	63.94%	36.06%		
Competitive procedure with negotiation			1.777	0.062
nEPP	90.48%	9.52%		
EPP	86.40%	13.60%		
Open procedure			101.735**	-0.057
nEPP	42.94%	57.06%		
EPP	48.61%	51.39%		
Restricted procedure			0.000	-0.014
nEPP	15.00%	85.00%		
EPP	16.00%	84.00%		
Small value purchases			7.040**	-0.016
nEPP	75.40%	24.60%		
EPP	76.74%	23.26%		
Negotiated procedure without prior notice			9.439**	-0.054
nEPP	87.48%	12.52%		
EPP	90.85%	9.15%		
Negotiated procedure with prior notice			1.063	-0.033
nEPP	74.68%	25.32%		
EPP	77.53%	22.47%		

* $p < 0.05$; ** $p < 0.01$

Source: Authors' analysis

Table 5 shows the results of the chi-square tests for independence between procurement method and MSME participation. The percentage of procurements with MSME participation is around 7% higher when it comes to EPP as opposed to nEPP (80.90% vs. 73.58%). MSME participation is higher in each type of procedure in the EPP and all results except for the competitive dialogue are statistically significant. This confirms hypothesis H5, which states that the introduction of e-procurement has a significant positive impact on the participation of MSMEs in public procurement tenders in Slovenia.

Table 5: Chi-square tests for MSME

	no SME	SME	χ^2	Phi
All procedures			500.196**	0.087
nEPP	26.42%	73.58%		
EPP	19.10%	80.90%		
Competitive dialogue			0.000	0.031
nEPP	50.00%	50.00%		
EPP	46.87%	53.13%		
Competitive procedure with negotiation			4.835*	0.097
nEPP	34.63%	65.37%		
EPP	25.68%	74.32%		
Open procedure			33.056**	0.032
nEPP	25.88%	74.12%		
EPP	23.09%	76.91%		
Restricted procedure			7.290**	0.232
nEPP	31.25%	68.75%		
EPP	12.00%	88.00%		
Small value purchases			647.788**	0.150
nEPP	25.16%	74.84%		
EPP	13.36%	86.64%		
Negotiated procedure without prior notice			18.521**	0.075
nEPP	33.16%	66.84%		
EPP	26.27%	73.73%		
Negotiated procedure with prior notice			23.878**	0.150
nEPP	47.32%	52.68%		
EPP	32.60%	67.40%		

* $p < 0.05$; ** $p < 0.01$

Source: Authors' analysis

5. Discussions

Following the introduction of the EPP in Slovenia, the number of public procurement contracts awarded increased by 7.8%. This confirms that digitalization has had a positive impact on the development of the public procurement market through a combined effect of increased transparency, improved credibility, and perception of the integrity of public procurement, and the simplification of document management through the reduction of paper-based work leading to a reduction in transaction costs.

The positive impact of the EPP on transparency is reflected in a decrease in the proportion of negotiated procedures without prior notice from 5.4% to 4.8%. This non-transparent procedure was used by some contracting authorities with the aim of awarding a

contract to a favored bidder where the risk of detection is low due to limited transparency. However, with the introduction of the EPP, contracting authorities were required to submit to the Public Procurement Portal a plan for the use of NPPN with justification and proofs including related documents, as well as an announcement of the procedure. As the information associated with NPPN became visible and could be easily reviewed without the ability to amend or remove it, as can be the case with paper documents, NPPN became less useful for contracting authorities wishing to ‘fix’ a procurement process.

The next finding of our research is that the introduction of electronic public procurement in Slovenia has not increased competition among bidders, as measured by the average number of bids per procedure. On the contrary, after the introduction of EPP, competition decreased significantly, from 3.09 to 2.60 bids per procedure on average. It could be that the positive effects of reduced corruption risk, increased trust and credibility of the procurement process, increased efficiency due to lower transaction costs and easier access to information on the procurement needs of the public sector have been undermined by other factors specific to the country (Špaček, Csótó and Urs, 2020) or that more time is needed for the changes to take full effect.

One of the potential factors arises from the EPP itself. As is discussed in the earlier sections of the paper, the introduction of electronic tendering places additional demands on bidders, who must be familiar with ICT, which discourages those who are not particularly tech-savvy from bidding for public contracts. In this way, the digitalization of procurement has a negative impact on bidders’ participation, especially in the early stages of EPP operations. The ‘knowledge barrier’ that prevents bidders with low ICT skills from using e-platforms could be overcome by helping them to develop their digital capacities.

The analyses showed that, as expected, the EPP promoted centralized procurement in Slovenia. The share of centralized procurement was statistically significantly higher in the EPP (4.06%) than in the nEPP (2.51%). This is in line with the claim that CPBs were the main users of the EPP at the beginning. In some cases, CPBs manage e-platforms, which is the case in Slovenia.

The introduction of the EPP created the conditions for further improvement of Slovenian public procurement through centralized procurement accompanied by greater standardization of procurement subjects, a reduction in transaction costs by replacing several procurement processes with one, and cost savings through large-scale purchasing.

The next finding of the study was that the use of FA in the EPP was significantly lower than in the nEPP. The lower proportion of FAs that followed the EPP, contrary to expectations, could be due to a conflict between the body signing the FA and the parties on whose behalf the FA is signed. As in the principal-agent theory, there are two parties in the implementation of the FA: one is the contracting authority, which delegates the procurement authorities and procedures to another party (the agent) to carry them out on its behalf (Karjalainen, 2009).

The problem arises when their objectives are different, and it is difficult for the principal to control how the agent fulfills what the principal expects from him. The main

concern of the agent is to avoid formal complaints and to standardize the procurement subject to the highest possible degree to achieve maximum cost savings through the purchase of goods in bulk (Schotanus, 2021). However, the contracting authority's interest is to get exactly what is needed, i.e. procurement items that meet CA's needs to the highest possible degree. If the contracting authority disagrees with the product specifications in the established framework agreement and thinks that it can get better terms and conditions than those in FA it may decide not to buy the goods or services based on the FA, but to conduct a separate purchase, known as 'maverick buying' (Karjalainen, Kempainen and Raaij, 2009). This effect may outweigh the benefits of the EPP for wider utilization of the FA and lead to a decrease in the FA share.

The analysis confirmed the positive impact of the EPP on increasing the participation of MSMEs in public procurement. This 7% increase in the share of MSMEs in the EPP can be interpreted to mean that digital technologies are encouraging the participation of these companies in public procurement. However, recent studies have shown that MSMEs are generally reluctant to bid for public sector contracts, as the procedures are different from those of the private sector to which they have become accustomed. They are also much more complex and involve a high administrative and documentation burden, which can increase participation costs by 20 to 50% (European Commission, 2021). Considering that the analysis found that competition in public procurement in Slovenia has decreased with the introduction of the EPP, but the participation of MSMEs increased, this could indicate that MSMEs recognize the benefits of the EPP for their business and that more trust should be placed in the ability of MSMEs to adapt to procedural changes brought about by advances in information and communication technology, provided they see a clear interest.

The growing role of MSMEs in supplying the Slovenian public sector is expected to have a positive impact on employment and innovation capacity at the national level. In addition, the increased competitiveness resulting from more MSMEs bidding for government contracts should lead to more favorable purchasing conditions for public sector clients.

6. Conclusions

Numerous studies and research papers have argued that the EPP has made a positive contribution to transparency, competition, efficiency and the economy of public procurement. These statements have been widely accepted by the EU, the OECD, the World Bank and other international organizations, and included in their documents on public procurement.

In this paper we have analyzed the impact of the EPP on transparency, the intensity of competition and the economy and efficiency of public procurement in the Republic of Slovenia. The analysis is based on 65,394 public procurement contracts awarded in the period from 1 April 2016 to 31 March 2020. As the EPP became mandatory in 2018, the

period could be divided into two sub-periods: two years before and after the introduction of the EPP.

Our research has shown the existence of a strong positive correlation between EPP on the one hand and: (1) higher transparency, expressed by a decreasing share of non-transparent procedures; (2) higher efficiency and economy expressed by the degree of centralization; and (3) a higher participation of MSMEs on the other hand.

Contrary to expectations, the EPP has not succeeded in increasing the intensity of competition as measured by the number of bids and the use of framework agreements as an instrument of centralized and collaborative procurement. This could be due to a considerable influence of factors not directly related to EPP and adaptation to relatively recent changes in the procurement market. Further studies should analyze factors relevant to the intensity of competition, such as the risk of manipulation in public procurement, collusion and corruption, the level of transaction costs, etc., to determine their significance and impact.

In addition, the assessment of public procurement efficiency should also include indicators other than the degree of centralization, such as the average duration of the procurement processes. By expanding the number of indicators and factors and testing their correlations with strategic objectives such as competition and efficiency, relevant factors for strategic objective fulfilment can be more accurately assessed, allowing policy makers to design policies more effectively.

One of the limitations of the study is the relatively short period of time that has passed since the introduction of EPP in this particular instance. Future research should focus on situations where a longer period of time has passed since the introduction of the EPP to overcome the effects of the adaptation of the public procurement market to these changes.

The next limitation of this research is that it is based on data on procurement in one country. A further analysis that includes more countries at different stages of public procurement development would be useful, as the priorities and relevance of factors change with the development of public procurement. At an early stage in the development of a public procurement system, for example, the focus is on compliance and fulfilment of formal requirements, with an emphasis on the cheapest purchase. However, as the system evolves, performance indicators and factors expand, new strategic objectives arise, such as encouraging greater participation of MSMEs, and new instruments, such as framework agreements, are used.

By establishing a clear link between public procurement and government priorities, policy makers can gain a clearer understanding of the role of public procurement and its opportunities, but also its limitations (OECD, 2019c). For this purpose, further analysis of the impact of EPP and its effects on transparency, efficiency, competition and MSME participation, as well as government strategic objectives, is needed.

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