Positioning public procurement as a procedural tool for innovation: an empirical study

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ABSTRACT
Procurement has received scholarly attention as a valuable policy tool to reach desired outcomes in society, such as innovation. While interest has grown in analyzing the impact of the ‘substantive’ function of procurement (purchasing of goods and services), procurement is much more than purchases, and most public buyers’ activities are ‘procedural’, as they are aimed at improving the many internal stages of the procurement process. This study explains how procurement can be both a substantive and procedural tool, particularly in terms of innovation. Using the 2010 Innobarometer dataset that consist of 4,063 public organizations from 29 European countries, this study answers how public procurement, as a procedural policy tool, affects the implementation of public sector innovations. We find that procurement activities are positively related to innovation within public organizations. In particular, procurement as R&D for new technologies and services has an important and meaningful effect. We discuss implications for policy tools and public sector innovation literature, and we suggest that policy makers make use of more procedural tools such as procurement to increase innovation within public organizations.

KEYWORDS
Policy tools; procedural tools; public procurement; public sector innovation

Introduction

Government spending is a major component of economic activity, and public procurement, in particular, accounts for around 12% of GDP in OECD countries (OECD, 2017a, OECD, 2020). The magnitude of public procurement has captured scholarly interest and generated a vast number of articles, special issues, books, and reports (e.g. Aschhoff & Sofka, 2009; Chicot & Matt, 2018; Edler & Yeow, 2016; Edquist, 2011; Edquist, Vonortas, & Zabala-Iturriagagoitia, 2015; European Commission, (EC), 2018; OECD, 2017a; Rolfsam, Phillips, & Bakker, 2011). Among many others, some important reasons for the volume of research on procurement is that procurement can be used as a ‘policy tool [...] to achieve desired outcomes in society’ (Grandia & Meehan, 2017, p. 303), increase economic growth (Edquist & Hommen, 2000), spur innovation in the private sector (Edler & Georghiou, 2007; Edler, Georghiou, Uyarra, & Yeow, 2015), and provide an opportunity for interactive learning between procurers, suppliers, and users, and thus...
more innovations (Edquist et al., 2015). In sum, procurement affects organizations, governments, and society.

An important limitation of current research, however, is that most studies on procurement do not engage directly with our understanding of policy tools; instead, they implicitly treat procurement as a substantive tool. Indeed, the main functions of public procurement are certainly ‘substantive,’ such as purchasing goods and services and thus affecting production in society or in other organizations. However, in recent years, public procurement research has increasingly dealt with the impact of practices internal to procurement agencies – such as the professionalization and measurement of performance of public procurers (see e.g. Andres et al., 2016; El Amry, 2018; Wibowo, 2019) – which are procedural aspects of procurement. This is because most public buyers’ activities are ‘procedural,’ as they are aimed at improving the many internal stages of the procurement process for organizations.

In this article, we conceptualize procurement as a procedural policy tool, and in doing so we look at the relationship between procurement and innovation. While the substantive impact of procurement on innovation in society and the market has been explored, we argue that a changed perspective allows us to reflect on the procedural impact of procurement; that is, how public procurement can be used as a procedural tool to increase innovation in the public sector. In particular, the research question of this study is as follows: how does public procurement, as a procedural policy tool, affect the implementation of public sector innovations?

To test the impact of procurement on public sector innovation, this study uses the 2010 Innobarometer dataset; 4,063 public organizations from 29 European countries are included in the survey. While the dependent variable measures the intensity of innovation – the number of innovations (including service, process, and communication innovations) implemented by a single organization – the independent variables measure six procurement activities (public organizations’ putting out of offers to private businesses to provide goods and services). Using country fixed effects and controlling for the size, location, and sector of public organizations, this study finds strong evidence that there is a positive relationship between the activities of public procurement and the intensity of innovation in public organizations.

This study contributes to the literature in at least three ways. First, as a theoretical contribution, we conceptualize procurement as a procedural policy tool (see also Bali & Halpin, 2021; Bali et al., 2021b; Fawcett, 2021; Hannah, 2021; Stark & Yates, 2021). We theorize how procurement is used as a procedural tool, referring in particular to the promotion of innovation not only in private sector settings but also in the public sector. We also expand the scholarship of policy tools as our approach to the categories of substantive and procedural tools is based on the intent behind the tool use and not on the tool itself; this allows us to consider the procedural aspects of a consolidated substantive tool (i.e. procurement) within the category of procedural tools.

Second, this study links procurement to both policy tools and public sector innovation while considering a policy tool – public procurement – as an independent variable. Several studies recommend that scholars analyze the effects of policy tools on different outcomes (e.g. Stark & Yates, 2021) because the effects of policy tools are not well-known (Peters, 2000).
Third, despite increasing research on public sector innovation in recent years (Arundel, Bloch, & Ferguson, 2019; Clausen, Demircioglu, & Alsos, 2020; Hameduddin, Fernandez, & Demircioglu, 2020; Lapuente & Suzuki, 2020; Vivona, Demircioglu, & Raghavan, 2021), an under-explored topic within the literature is the relationship between procurement and public sector innovation. We aim at increasing our understanding of the interplay among policy tools, procurement, and public sector innovation and contribute to both theory (e.g. conceptualizing procurement as both a substantive and procedural tool) and practice (e.g. offer lessons in how to increase innovation in the public sector).

The remainder of the article is organized as follows: the following two sections present the theoretical foundations of the three concepts analyzed in this study (policy tools, public procurement, and public sector innovations) and provide a framework for their interaction. Next, data and methods for analysis are explained. Then, the article provides our findings and discusses them along with limitations, future research directions, and conclusions.

**Procurement as a policy tool**

Most simply, public procurement is defined as ‘the purchase by governments and state-owned enterprises of goods, services and works’ from other organizations, such as from firms (OECD, 2020). Procurement is not only an operational act (the purchase) but also an administrative process, which (despite national differences in procurement practices) in general consists of several stages: the initial recognition of a public need (conceptual stage); the craft of the procurement contract (design stage); the call for tenders (tendering, or offering stage); the decision-making on proposals and the award of the contract (contract stage); the actual purchase (supply or execution stage); and the post-procurement evaluation of the provision (auditing stage) (e.g. see Osei-Tutu, Ofei-Nyako, Ameyaw, & Ampofo, 2014).

For decades, procurement has been a consolidated practice in public sector organizations, but starting in the 2000s, public managers began to exploit procurement for its strategic and systemic potential beyond the mere act of purchasing (Thai, 2001). This applies especially to the European context, where the European Commission explicitly aims to promote procurement ‘to boost jobs, growth and investment, and to create an economy that is more innovative, resource and energy efficient, and socially-inclusive’ and to improve public procurement practices across Europe as ‘even a 1% efficiency gain could save €20 billion per year’.²

In particular, governments started to conceive ‘public procurement as an explicit policy tool’ (Lember, Kattel, & Kalvet, 2014, p. 27); that is, procurement has been increasingly ‘used to promote aims which are, arguably, secondary [“using procurement to promote social, industrial or environmental policies”] to the primary aim of procurement [the acquisition of goods and services]’ (Bolton, 2006, p. 193). Indeed, research has demonstrated, both theoretically and empirically, that public procurement can be a viable tool for governments to achieve their strategic goals or innovation in

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¹https://www.oecd.org/gov/public-procurement/
²https://ec.europa.eu/growth/single-market/public-procurement_en
various areas of public policy, such as industrial policy (Geroski, 1990; Kattel & Lember, 2010), environmental policy (Ghisetti, 2017; Lundberg & Marklund, 2013), healthcare (Callea, Armeni, Marsilio, Jommi, & Taricone, 2017; Miller & Lehoux, 2020; Torbica & Cappellaro, 2010), innovation policy (Edler & Georghiou, 2007; Edquist & Zabala-Iturriagagoitia, 2012), and employment policy (McCruden, 2004), as well as in providing high quality and efficient public services (European Commission, (EC), 2018).

An important categorization of policy tools relevant to procurement is provided by current studies, which make a distinction between substantive and procedural policy tools (e.g. Bali & Halpin, 2021; Bali et al., 2021a, 2021b; Hannah, 2021; Stark & Yates, 2021; Howlett, 2017; Howlett, Mukherjee, & Woo, 2018). Substantive tools are ‘those policy techniques or mechanisms designed to directly or indirectly affect the production, consumption and distribution of different kinds of goods and services in society’ (Howlett, 2017, p. 98). In contrast, procedural tools ‘are concerned with altering aspects of a government’s own workings’ (Howlett, 2017, p. 99). As compared to substantive tools (i.e. what government does), procedural tools (i.e. how government does) are not well-studied (Bali & Halpin, 2021; Bali et al., 2021b; Hannah, 2021; Howlett et al., 2018), and there are many unknowns about procedural tools in practice. Indeed, Howlett et al. (2018) point out that even though some procedural policy tools are frequently used by public administration practitioners, there is limited knowledge of their impacts and effects. This is particularly true for procurement because one major limitation of the current positioning of procurement as a policy tool is that there is a tendency in the literature to analyze procurement only as an act of purchasing and thus as a substantive tool (Grandia & Meehan, 2017, p. 307). Studies typically focus on how governments can improve society through procurement, particularly through strategic purchases.

While the main function of public procurement is certainly ‘substantive’ i.e. purchasing goods and services and thus affecting production in society, as stated in the previous section, procurement involves much more than purchasing, and most public buyers’ activities are ‘procedural’ as they are aimed at improving the many internal stages of the procurement process (e.g. the conceptual and design stages). For instance, as per our context, European countries are expected to continue to improve and innovate procurement practices and to build enhanced procurement capacities strategically (Edquist & Zabala-Iturriagagoitia, 2012; European Commission, (EC), 2018; OECD; OECD, 2017b). Thus, the next section conceptualizes procurement as a procedural tool in the context of innovation policy.

**Procurement, tools, and public sector innovation**

In order to conceptualize procurement as a procedural tool, we look at the relationship between procurement and innovation through the lenses of policy tools, as scholars directed towards the idea that 'innovation-oriented public procurement is a worthy policy tool to be understood and used' (Lember et al., 2014, p. 18). As stated above, in simple terms, procurement can be expressed as a purchasing process between public organizations and firms. Petersen, Lember, Scherrer, and Robert (2016, p. 211) cleverly explain how and why procurement can affect innovation:
Under the traditional contracting-out and public procurement approaches, innovation is mainly seen as an implicit result of competition among private providers in the marketplace. Private providers were chosen on the basis of cost efficiency, and while this in some instances led to reduced spending, especially in low-transaction-cost services, there was little if any explicit focus on extracting ideas, know-how and innovation capacity from the private sector. Innovation was thus most of all a supply-side phenomenon. Subsequently, from the late 1980s and into the 1990s, new forms of public procurement that focused more explicitly on innovating public goods and services were introduced. Thereby, innovation increasingly became a demand-side tool that provided governments with the possibility of using its market-dominating purchasing power to buy off-the-shelf services and products.

However, based on our knowledge, research (e.g. Edler & Georghiou, 2007; Edler & Yeow, 2016; Edquist & Zabala-Iturriagagoitia, 2012, 2012; Lember et al., 2014; Petersen et al) do not explain whether procurement can be a substantive or procedural tool. We argue that procurement, as a policy tool for innovation, can be intended either as a substantive tool, procedural tool, or both, depending on whether the intention of the procurement affects outside of an organization (substantive tool) or inside the organization (procedural tool). In other words, procurement can be positioned as a substantive or a procedural tool depending on its effects.

Although they are not explicit, most of the research on procurement focuses only on procurement as a substantive tool. For example, studies suggest that public procurement for innovation can make private firms competitive and successful, contributing to country-level innovation outputs (Edquist & Hommen, 2000; Edquist & Zabala-Iturriagagoitia, 2012). The public procurement of innovation is an important driver of innovation beyond the limits of the public sector (Aschhoff & Sofka, 2009; Edler & Georghiou, 2007; Edler & Yeow, 2016; Edquist & Zabala-Iturriagagoitia, 2012; Rolfstam, 2009; Rolfstam et al., 2011). In addition, procurement can make products and services more efficient, effective, and provide better services to citizens (Edler & Georghiou, 2007; Edquist & Zabala-Iturriagagoitia, 2012). Likewise, public procurement can be a powerful tool in supporting private sector innovativeness via increased demand for innovation (Edquist & Zabala-Iturriagagoitia, 2012), and it can be used strategically to advance eco-innovations (Rainville, 2017). In fact, government involvement in the procurement process can lead to even greater innovations than government subsidies for R&D (Edler & Georghiou, 2007), suggesting that procurement can be positioned as a substantive tool.

Moreover, public sector employees also play an important role in increasing innovation outputs to society and other organizations (like private firms) that are the engines for innovations (Edquist, 2011; Edquist & Zabala-Iturriagagoitia, 2012). In fact, building knowledge infrastructures within the bureaucracy through professionalism enhances innovation outputs and creative outcomes in the private sector (Smith, 2005). Therefore, as Edler and Georghiou (2007, p. 957–958) state, ‘[t]he basis for such an innovation-friendly procurement framework is the general understanding across administrations that the public purse can make a difference in the marketplace towards a more innovative culture’.

However, there are some studies that find that public procurement can affect the inside of the organization that engages in procurement (which we define it procurement as a procedural tool). Public procurement provides interaction between public and private organizations (Bloch, 2011), and it can increase interactive learning by public organizations (Hommen & Rolfstam, 2008). Therefore, procurement can increase
relevant knowledge for public organizations and incentives to develop innovation, and thus lead to more innovation in public organizations (Bloch, 2011; Edquist et al., 2015). Petersen et al. (2016, p. 199) argue that ‘[t]he history of technology development from air jets to semi-conductors illustrates that . . . when public procurement was part of larger and more systemic public policies (e.g. defense, health, and energy) it has facilitated radical innovation and learning in and between public and private sectors.’ In addition, Mergel and Desouza (2013) state that procurement can increase innovations in the public sector because when private businesses provide goods and services to public organizations, they are more open and less bound by the regulations that public organizations face, increasing the diversity of solutions for the same problem. Therefore, public procurement can increase experimentation and innovation more than traditional public service delivery for public organizations. Finally, the Australian Government (2009) suggests that the government should (and already) use procurement tools to stimulate and embrace innovations within public organizations (Australian Government, 2009). Therefore, procurement can also be used as a procedural tool.

Methodology

Data

To test the impact of procurement as a procedural tool on public sector innovation, we use survey data from the 2010 Innobarometer.³ A main goal for the 2010 survey was to analyze the innovative activities of public organizations in Europe. This survey used insights and guidelines of early innovation surveys in the United Kingdom, Scandinavia, and the Oslo Manual (Clausen et al., 2020; Torugsa & Arundel, 2017). The data were collected from European Union member countries in addition to Norway and Switzerland. A random-sampling technique was used to collect data from public organizations that have at least ten employees. General/top manager or strategic director of each organization were interviewed (structured telephone interviews) as they are the main decision-makers and familiar with innovative activities in their organizations, so the level of analysis is organizational. The sample size ranges from 10 (Malta and Cyprus Republic) to around 400 (the United Kingdom, Italy, Germany, France, and Poland). The sample size for other countries is between 50 and 101. However, there are missing variables across countries, so we could not use some of the observations. While Table 1 provides descriptive statistics of variables, Table 2 reports the number of countries and their sample size. In total, 4,063 interviews were conducted in October 2010. Organizations vary based on level (national, regional, and local) and size (small, medium, large, and extra-large).⁴

Variables

The dependent variable of this study is the intensity of innovation, which is whether public agencies implemented any innovations in the last 2 years. Table 3 provides

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³Recent Innobarometer surveys do not have questionnaires measuring public sector innovations.
⁴The following link shows a report that demonstrate details about the data and sample: http://ec.europa.eu/commfromoffice/publicopinion/flash/fl_305_en.pdf
Table 1. Descriptive statistics.

| Variable                                    | Mean | Std. Dev. | Min | Max |
|---------------------------------------------|------|-----------|-----|-----|
| Innovation intensity                        | 4.33 | 2.62      | 0   | 8   |
| ICT equipment or systems                    | 0.53 | 0.50      | 0   | 1   |
| Technologies & services for environment     | 0.43 | 0.49      | 0   | 1   |
| Other technology                            | 0.38 | 0.49      | 0   | 1   |
| Consulting to design & pilot for new services | 0.33 | 0.47      | 0   | 1   |
| RD for new technologies & services         | 0.21 | 0.40      | 0   | 1   |
| Provide services to users                   | 0.44 | 0.50      | 0   | 1   |
| Org. size: 10–49                            | 0.56 | 0.50      | 0   | 1   |
| Org. size: 50–99                            | 0.13 | 0.34      | 0   | 1   |
| Org. size: 100–249                          | 0.11 | 0.31      | 0   | 1   |
| Org. size: 250–499                          | 0.08 | 0.28      | 0   | 1   |
| Org. size: 500–999                          | 0.05 | 0.22      | 0   | 1   |
| Org. size: >1000                            | 0.07 | 0.26      | 0   | 1   |
| Location: local government                  | 0.79 | 0.40      | 0   | 1   |
| Location: regional government               | 0.15 | 0.35      | 0   | 1   |
| Location: national government               | 0.06 | 0.23      | 0   | 1   |
| Sector: general & finance                   | 0.63 | 0.48      | 0   | 1   |
| Sector: education                           | 0.34 | 0.47      | 0   | 1   |
| Sector: health                              | 0.14 | 0.34      | 0   | 1   |
| Sector: social services                     | 0.33 | 0.47      | 0   | 1   |
| Sector: culture or sport                    | 0.23 | 0.42      | 0   | 1   |
| Sector: housing                             | 0.15 | 0.36      | 0   | 1   |
| Sector: environment                         | 0.22 | 0.41      | 0   | 1   |

N = 2,968

Table 2. Country samples.

| Country                  | Frequency | %     | Cumulative % |
|--------------------------|-----------|-------|--------------|
| 1                        | Italy     | 344   | 11.59        |
| 2                        | France    | 328   | 11.05        |
| 3                        | Spain     | 309   | 10.41        |
| 4                        | Poland    | 308   | 10.38        |
| 5                        | Germany   | 295   | 9.94         |
| 6                        | United Kingdom | 217 | 7.31    | 60.68      |
| 7                        | Hungary   | 89    | 3.00         |
| 8                        | Bulgaria  | 88    | 2.96         |
| 9                        | Portugal  | 87    | 2.93         |
| 10                       | Finland   | 86    | 2.90         |
| 11                       | Slovakia  | 74    | 2.49         |
| 12                       | Greece    | 71    | 2.39         |
| 13                       | Czech Republic | 71  | 2.39         |
| 14                       | Austria   | 68    | 2.29         |
| 15                       | Romania   | 64    | 2.16         |
| 16                       | Sweden    | 62    | 2.09         |
| 17                       | Belgium   | 57    | 1.92         |
| 18                       | The Netherlands | 56  | 1.89         |
| 19                       | Latvia    | 42    | 1.42         |
| 20                       | Switzerland | 39  | 1.31         |
| 21                       | Lithuania | 36    | 1.21         |
| 22                       | Norway    | 36    | 1.21         |
| 23                       | Ireland   | 35    | 1.18         |
| 24                       | Slovenia  | 32    | 1.08         |
| 25                       | Estonia   | 31    | 1.04         |
| 26                       | Denmark   | 21    | 0.71         |
| 27                       | Luxembourg | 9   | 0.30         |
| 28                       | Cyprus (Republic) | 8   | 0.27         |
| 29                       | Malta     | 5     | 0.17         |

Total (N) 2,968
Table 3. Operationalization of variables.

1. Dependent Variable: Intensity of Innovation
   Since January 2008, did your organization introduce any new or significantly improved …
   • services?
   • methods of communicating your activities to the public, such as new or improved methods of promoting your organization or your services?
   • methods of communicating your activities to the public, such as new or improved methods of influencing the behaviour of users, citizens or others?
   • processes or organizational methods, such as new or improved methods of providing services or interacting with your users?
   • processes or organizational methods, such as new or improved delivery or logistics systems for your inputs?
   • processes or organizational methods, such as new or improved supporting activities such as maintenance systems, purchasing, accounting, or computing systems, etc?
   • processes or organizational methods, such as new or improved management systems?
   • processes or organizational methods, such as new or improved methods of organizing work responsibilities or decision making.

Yes-No question. Response categories: From 0 to 8. Cronbach’s alpha: 0.83

2. Independent Variables: Procurement
   a) Types of Goods & Services
   Since January 2008, did your organisation put out tenders to private businesses to provide any of the following goods and services?
   • ICT equipment or systems
   • Technologies or services to improve environmental or energy performance
   • Other types of technology
   • Consulting to recommend, design or pilot test new or improved services
   • R&D for new technologies and services
   • Provide one or more services to your users

3. Control Variables
   • Organizational size: Organizations number of employees: 1 = Between 10 and 49; 2 = Between 50 and 99; 3 = Between 100 and 249; 4 = Between 250 and 499; 5 = Between 500 and 999; 6 = 1000 or more.
   • Organizational location (one answer only): (a) Local: Which of the following best describes the geographic area served by the organization where you work? (0 = otherwise, 1 = Local); (b) Regional: Which of the following best describes the geographic area served by the organization where you work? (0 = otherwise, 1 = Regional); (c) National: Which of the following best describes the geographic area served by the organization where you work? (0 = otherwise, 1 = National).
   • Sector: Organization’s main areas of responsibility? (Selecting up to the three) General government activities or finance; Education; Health; Social services; Culture, sport or recreation; Housing; Environment.

operationalization of variables used in this study and Table 4 reports correlation matrix. As shown in Table 3, eight survey items are measuring the intensity of innovation, which includes different types of innovations. We use average summative index scores from a factor analysis. The Cronbach’s alpha value for the intensity of innovation is 0.83, suggesting a high reliability in the current study. According to descriptive statistics (not shown in Tables), around 12% of organizations did not report any type of innovation,

Table 4. Correlation coefficients.

|       | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
|-------|------|------|------|------|------|------|------|------|------|------|
| 1 Innovation intensity |      | 0.37 |      |      |      |      |      |      |      |      |
| 2 ICT equipment & systems | 0.37 |      |      |      |      |      |      |      |      |      |
| 3 Tech for environment | 0.29 | 0.42 |      |      |      |      |      |      |      |      |
| 4 Other technology | 0.35 | 0.41 | 0.41 |      |      |      |      |      |      |      |
| 5 Pilot for new services | 0.36 | 0.37 | 0.36 | 0.37 |      |      |      |      |      |      |
| 6 R&D for new tech & service behaviour of users | 0.34 | 0.34 | 0.32 | 0.33 | 0.45 |      |      |      |      |      |
| 7 Provide services to users | 0.37 | 0.41 | 0.37 | 0.40 | 0.43 | 0.40 |      |      |      |      |
| 8 Agency size | 0.33 | 0.33 | 0.23 | 0.35 | 0.35 | 0.21 | 0.25 |      |      |      |
| 9 Local government | −0.15 | −0.09 | 0.03 | −0.07 | −0.12 | −0.13 | −0.07 | −0.23 |      |      |
| 10 Regional government | 0.11 | 0.05 | −0.01 | 0.06 | 0.09 | 0.11 | 0.07 | 0.20 | −0.82 |      |
| 11 National government | 0.09 | 0.08 | −0.05 | 0.04 | 0.06 | 0.05 | 0.01 | 0.10 | −0.49 | −0.10 |
while around 8% reported one, 8% reported two, 11% reported three, 11% reported four, 12% reported five, 12% reported six, 13% reported seven, and 13% reported eight innovations.

Independent variables measure public procurement activities – that is, types of goods and/or services for procurement – as procedural tools. Other studies also recommend that policy tools (e.g. procedural tools) can be independent variables (Stark & Yates, 2021). The questionnaire measuring procedural tools is as follows: ‘Since January 2008, did your organisation put out tenders to private businesses to provide any of the following goods and services?” Options include ‘ICT equipment or systems’, ‘technologies or services to improve environmental or energy performance’, ‘consulting to recommend, design or pilot test new or improved services’, ‘R&D for new technologies and services’, and ‘provide one or more services to your users’. According to the descriptive statistics (Table 1), the most common types of goods and services for procurement are ICT equipment or systems (53%), followed by providing one or more services to users (44%), and technologies & services for environment (43%). The least common types of goods and services for procurement is R&D for new technologies and services (21%).

We have also controlled for size, location, and country of public organizations along with the sector in which they operate. As seen in Tables 1, 56% of public organizations in the sample are smaller organizations (between 10 and 49 employees). Only 7% of organizations are larger than 1000 employees. While 79% of organizations are local, 15% are regional, and 6% are national organizations. Most organizations are dealing with general and finance sectors (63%), followed by education (34%) and social services. Finally, according to country samples (Table 2), most organizations are located in France, Italy, Spain, Poland, and the United Kingdom, which are parallel to country populations.

**Empirical strategy**

Ordered logit model is used because the dependent variable – intensity of innovation – is measured on an ordinal scale (from 0 = no innovation to 8 = high level of innovation); while the categories of this variable are ranked, the distances between categories are not known (Long, 1997; Torugsa & Arundel, 2016).³

**Results**

While Table 5 reports results of the unstandardized ordinal logit coefficients, Table 6 reports results of the odds ratios.

In Tables 5 and 6, the first model tests the findings of the effects of the main independent variable – six different types of goods and services of procurement – along with control variables. The second model adds country fixed effects in addition to the other variables used in Model 1. The findings across the two models are consistent with each other, suggesting that the models are consistent. The findings demonstrate that

³We use robust standard errors to deal with heteroscedasticity (Verbeek, 2008). Finally, to test whether multicollinearity exists, we run variance inflation factor (VIF) scores. As none of the VIF scores are higher than 5 (the highest VIF is 3.29 in the first model and 1.56 in the second model), multicollinearity is not a problem in this study (Neter, Kutner, Nachtsheim, & Wasserman, 1996).
all types of goods and services that organizations put out tenders to private business for are positively associated with the intensity of innovation although the relationship is moderate for the second independent variable, technologies for environment (holding other variables constant). More specifically, organizations putting out tenders to private business to provide R&D for new technologies and services are almost two times more likely to innovate (odds = 1.83). Additionally, the odds ratios for organizations putting out tenders to private business for consulting to recommend, design, or pilot test new or improved services and ICT equipment or systems are 1.69 and 1.62 times more likely to innovate, respectively, holding other variables constant. Overall, the findings demonstrate that all of the procurement practices are not only positively associated with the intensity of innovation in the public sector, but the effects are substantial.

Finally, regarding control variables (size, government type, and sector) except for two variables – size of agency and culture & sport as a sector – the variables do not have any statistical effect on the intensity of innovation. While size of organization is positively

### Table 5. Regression results (DV = intensity of innovation).

| Model 1                      | Model 2                      |
|------------------------------|------------------------------|
| ICT equipment or systems     | 0.530***                     | 0.484***                     |
|                              | [0.075]                      | [0.077]                      |
| Technologies for environment | 0.200**                     | 0.256***                     |
|                              | [0.073]                      | [0.075]                      |
| Other technology             | 0.382***                     | 0.314***                     |
|                              | [0.079]                      | [0.082]                      |
| Consulting to pilot for new services | 0.427***                     | 0.523***                     |
|                              | [0.084]                      | [0.086]                      |
| R&D for new technologies & services | 0.617***                     | 0.606***                     |
|                              | [0.091]                      | [0.093]                      |
| Provide services to users    | 0.571***                     | 0.468***                     |
|                              | [0.074]                      | [0.077]                      |
| Agency size                  | 0.179***                     | 0.154***                     |
|                              | [0.023]                      | [0.028]                      |
| Location: local government   | -0.312*                     | -0.171                       |
|                              | [0.140]                      | [0.155]                      |
| Location: regional government| -0.186                      | -0.077                       |
|                              | [0.157]                      | [0.168]                      |
| Sector: general & finance    | -0.161*                     | -0.109                       |
|                              | [0.076]                      | [0.080]                      |
| Sector: education            | -0.194**                     | -0.016                       |
|                              | [0.073]                      | [0.082]                      |
| Sector: health               | -0.278*                     | -0.096                       |
|                              | [0.112]                      | [0.117]                      |
| Sector: social services      | -0.088                      | -0.017                       |
|                              | [0.072]                      | [0.074]                      |
| Sector: culture or sport     | -0.287***                    | -0.122                       |
|                              | [0.075]                      | [0.081]                      |
| Sector: housing              | -0.119                      | 0.066                        |
|                              | [0.094]                      | [0.098]                      |
| Sector: environment          | 0.054                       | 0.085                        |
|                              | [0.085]                      | [0.088]                      |

| Country fixed-effects        | –                            | included                     |
| Log-likelihood model         | -5993.301                    | -5802.729                    |
| Chi-square                   | 916.64                       | 1376.938                     |
| AIC                          | 12,034.6                     | 11,709.46                    |
| BIC                          | 12,178.5                     | 12,021.23                    |
| McFadden $R^2$               | 0.075                       | 0.104                        |

Unstandardized coefficients are reported. Standard errors are in parenthesis.

N = 2,968 * p < 0.05, ** p < 0.01, *** p < 0.001. */+Base category: national government
Table 6. Odds ratios.

|                                | Model 1 | Model 2 |
|--------------------------------|---------|---------|
| ICT equipment or systems       | 1.699   | 1.623   |
| Technologies for environment   | 1.222   | 1.292   |
| Other technology               | 1.466   | 1.369   |
| Consulting to pilot for new services | 1.533   | 1.688   |
| RD for new technologies & services | 1.854   | 1.833   |
| Provide services to users      | 1.769   | 1.597   |
| Agency size                    | 1.196   | 1.167   |
| Location: local government+    | 0.732   | 0.843   |
| Location: regional government+ | 0.831   | 0.926   |
| Sector: general & finance      | 0.851   | 0.897   |
| Sector: education              | 0.823   | 0.984   |
| Sector: health                 | 0.758   | 0.909   |
| Sector: social services        | 0.916   | 0.983   |
| Sector: culture or sport       | 0.751   | 0.885   |
| Sector: housing                | 0.888   | 1.069   |
| Sector: environment            | 1.055   | 1.089   |
| Country fixed effects          | —       | included|

Odds ratios are reported.
+Base category: national government

associated with the intensity of innovation, organizations dealing with culture and/or sport are negatively associated with the intensity of innovation.

Robustness checks

To test the robustness of the findings, this section provides additional analyses using additional control variables and models based on different estimation strategies. First, prior to publishing tenders, over half of the organizations in our sample consult with the following sources: ‘Potential suppliers/contractors’, ‘the users of your services’, ‘other organisations conducting similar procurements’, and ‘other organisations providing specialist advice.’ As consulting with different sources may impact the effects of the procurement practices on the intensity of innovation, we have controlled for these consultation variables in addition to other control variables and country fixed effects. Adding these variables does not impact the model or the t-values of the findings although consulting with the users of services and other organizations providing specialist advice is positively associated with the intensity of innovation.

As another robustness check, we also control for whether innovation or cost is more important, or if both of them are equally important for the procurement. According to descriptive statistics (not shown), while 65% of organizations reported that both cost and innovation have equal importance, 22% of them reported that low cost is more important than innovation, and 13% of organizations reported that innovation is more important than low cost. Adding these variables to the main model (Model 2) does not affect the findings. These variables are not statistically significant (p > 0.1), and the t-values of the independent variables are almost the same. Therefore, prioritization of innovation over cost or vice versa for the procurement does not alter the findings, demonstrating the robustness of the findings. We did not use these two sets of variables (consulting with different sources prior to procurement and whether cost or innovation is more important) in our main models (Model 1 and Model 2), as doing so drastically reduces sample size (from 2,968 to 1,865).
Finally, regarding the empirical strategy, instead of ordinal logit models, we have used two other models. First, we use Poisson regression models as it might be claimed that the dependent variable – intensity of innovation – is a count variable (e.g. from 0 to 8) (see Demircioglu & Audretsch, 2020). Second, we use the Ordinary Least Squares (OLS) regression as it may be stated that adding multiple categorical variables can be treated as linear (Long, 1997). The findings of these two additional models – Poisson and OLS, not shown – are similar to the original model reported in Table 2, further demonstrating the robustness of the findings.

**Discussion and implications**

We have limited knowledge and understanding of the interplay among procedural policy tools, public procurement, and public sector innovation. This article aimed at expanding our understanding of this relationship by asking how public procurement, as a procedural policy tool, affects the implementation of public sector innovations. Public organizations engaging more frequently in different procurement activities have more opportunities to learn interactively from the market and society; thus, we expected them to be more prone to innovation. Results from our analysis of the Innobarometer Survey 2010 demonstrate that agencies dealing with different procurements, regardless of the products or services purchased, tend to implement more innovations, so they are more innovative. This finding is relevant to studies of policy tools because it shows that procurement can indeed be considered a procedural policy tool. This finding is particularly relevant to the European context because procurement is a core practice used by the European Commission and EU countries (European Commission, (EC) (2018); OECD (2017b). Findings of this study suggest that procurement’s impact is not limited to the market and society in which the purchases happen; this policy tool also affects the organization engaging in the procurement. This study has at least four important implications, both academic and practical.

First, these results offer a crucial contribution to research on policy tools. Research on public procurement can focus on the effects of procurement on society or another organization (substantive tools) or the organization itself (procedural tool). Procurement is undoubtedly a substantive activity, and its positioning in policy tool literature is mostly as a substantive policy tool. Yet in line with research that suggest that most public procurers’ activities are procedural, we demonstrate that procurement does impact public organizations ‘own workings’ while affecting these organizations’ innovations, and thus procurement can also be conceptualized as a procedural tool. This is especially relevant because it challenges tool categorization and advances the possibility that complex tools such as procurement can evade categories and present aspects of both procedural and substantive tools. This may be due to the fact that categorization is linked to the intent behind the policy tool; while procurement has commonly been used with the intent of improving innovation outcomes in society (thus as a substantive tool), it has also been increasingly designed by governments to improve the activities of public purchasers (as a procedural tool). Intent may impact other policy tools, rendering the distinction between procedural and substantive tools not a dichotomous distinction but one more similar to a spectrum; procedure and substance can be understood not as the ‘form’ of policy tools but as their ‘aims.’
Second, this paper expands our knowledge of the relationship among policy tools, procurement, and innovation. While academics have explored this relationship through the concept of substantive policy tools – that is, how public procurement affects society and innovation in firms (e.g. Aschhoff & Sofka, 2009; Chicot & Matt, 2018; Edquist & Hommen, 2000; Edquist & Zabala-Iturriagagoitia, 2012; European Commission, (EC), 2018; OECD, 2017(a)) – we propose that the relevance of procurement as a policy tool for innovation goes further. In particular, we suggest that procurement is highly relevant for public sector innovation. Indeed, our findings confirm that procurement’s impact as a procedural tool is considerable. This study also contributes to literature on policy tools since it analyzes procurement in a new context, pointing out that the policy tool of procurement impacts not only societies (as a substantive tool) but also government processes. This suggests that procurement is a complex policy tool. We recommend that researchers should study not only what governments buy but also how governments buy, and how this purchasing process affects public organizations.

Third, this article provides a policy recommendation that practitioners, and especially governments, can use procurement in a strategic way to increase innovation in public and private organizations. Specifically, procurement practices should recognize the impact of all internal stages of procurement (from the conceptual stage to the auditing stage) on the procurer’s ability to innovate. In fact, while only one stage directly affects the market (the execution stage), all procurement stages provide public organizations the opportunity to expand their internal knowledge: procurement practices should be directed to make the best use of this opportunity. Public organizations are typically risk averse, so innovation in public organizations is not encouraged, and public organizations face several barriers to innovation, such as goal ambiguity, scattered accountability, unclear governance philosophy, and complex organizational structures (Rainey, 2009; Vivona et al., 2021; Wilson, 2000). Thus, public organizations need strategies, motivators, and tools to increase innovations in public organizations (Demircioglu & Audretsch, 2017; Sahni, Wessel, & Christensen, 2013). Procurement can be an important tool for public organizations to implement innovations.

Finally, regarding sectors, Tables 5 and 6 showed that the effect of procurement on innovation in the public sector is not associated with the sector in which the organization operates, which means that our findings are valid and applicable to the topics of public procurement and public sector innovation in general and not just to some particular sectors. The only sector which seems to be negatively associated with innovation intensity is ‘culture or sport’ even though the significance is lost when we include country fixed effects (Model 2). This findings conflict with some claims that some sectors (e.g. organizations dealing with information technology or organizations operating in dynamic places) can be more innovative (Damanpour, 1991). In sum, the sector does not seem to be important for public sector innovation; regardless of sector differences, public organizations can be innovative through procurement.

Limitations and future research directions

Although this study uses a large sample size representing 29 European countries (so high external validity), several limitations exist. First, the study is conducted in Europe, in which European Union and European countries provide specific policies on procurement
and how they can affect innovation (European Commission, (EC), 2018; OECD, 2020). Therefore, the findings may not be generalizable to other settings because not all countries are aiming for innovation before, during, or after the procurement process, and each country has a different trajectory regarding innovation. Therefore, we encourage researchers to analyze the effects of procurement on public sector innovation or other outcomes in different contexts, such as Asian countries.

Second, the relevance of data is limited since the Innobarometer Survey was conducted in 2010 and several changes have occurred in the last decade with respect to our knowledge of procurement as a policy tool and public sector innovation. Nevertheless, databases linking procurement to public sector innovation are rare; for instance, none of the latest editions of the Innobarometer Survey analyze procurement as it relates to innovation. Thus, when more data becomes available, future studies can test our assumptions and investigate how the relationship between procurement as a procedural tool and public sector innovation has changed.

Third, we explain the relationship between procurement and innovation in public organizations mainly through the learning/experimentation mechanism. Due to data limitations, this study does not prove how the mechanism impacts innovation or how it relates the two topics. Similarly, we do not have any information on whether organizations involved in procurement activities are required to do so by a political authority or if managers have autonomy to determine whether to be involved procurement and, if so, what types of procurement activities they would like to be involved in. In other words, the data does not provide information about whether managers have autonomy and motivation to be involved in procurement activities. Similarly, although one of the advantages of the survey is that it interviews the head or general manager of each organization, suggesting that a top manager is familiar with innovation and procurement activities, survey items related to innovation and procurement are not collected from external and more objective sources. Therefore, future studies can address these limitations by collecting more objective, comprehensive, and qualitative data to analyze how the interactive learning of public procurement activities impacts the innovativeness of the public sector.

Fourth, we address the relationship between procedural tools and public sector innovation by focusing on public procurement. But today’s complex scenarios require governments to use multiple tools (or policy mixes [Bali, Howlett, & Ramesh, 2021a; Hannah, 2021; Howlett, 2017]) or crowdsourcing/ open innovation (Hameduddin et al., 2020; Mergel & Desouza, 2013; Taeihagh, 2017). Thus, research can explore how procurement can be used in combination with other tools to improve public sector innovativeness.

Fifth, this study looks at only one facet of public sector innovation, which is the intensity of innovation. However, this variable does not capture the density of or how radical the innovation is. While most innovations in public organizations are incremental, other innovations are radical or complex (Albury, 2011; Bloch, 2011; Demircioğlu & Audretsch, 2020). Therefore, new studies may collect more comprehensive data and qualitative interviews on innovative activities to reflect the density and radicalness of innovations. Similarly, other studies may investigate the effects of procurement on other innovative activities such as the innovation climate and outcomes of innovations.

Finally, although we find evidence that procurement is positively associated with the intensity of innovation, this study does not find or argue that procurement is good or bad, or that procurement has a positive or negative impact on public values, trust, and
performance. In other words, this study has not tested any of these outcomes except in terms of the intensity of innovation. Procurement may have a negative effect on the public service, as it may increase the politicization of some public services, be subject to political capture, or based on an ideological agenda (e.g. breaking unions) (Freudlsperger, 2018). Therefore, readers should be aware of the focus and limits of this study. Therefore, future studies can analyze other outcomes of public procurement, including asking normative questions such as the benefits and harms of public procurement both in the short and longer term.

**Conclusion**

Using unique public procurement and public sector innovation data from 29 European countries and motivated by the lack of connection between the concepts of public sector innovation and procurement as procedural policy tools, this study analyzed the effects of procurement on the intensity of innovation in European public organizations. procurement can be both substantive and procedural tool depending on how it is positioned. This empirical study finds evidence that procurement as a procedural tool is positively associated with innovation in public organizations. Specifically, public organizations putting out tenders to private businesses to provide procurement, regardless of the sector of activity and of the products and services purchased, tend to be more innovative and implement more innovations than organizations that do not engage with procurement. This suggests that governments, through more conscious policies, may improve procurement practices to foster public sector innovation. We recommend that future studies collect more comprehensive data, including in-depth interviews, to understand and evaluate how different procurement activities are associated with different types of innovative activities. We also recommend that future studies examine the effects of procedural tools on other outcomes such as government performance and trust.

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