



The adoption of green public procurement practices: Analytical challenges and empirical illustration on Swedish municipalities

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ABSTRACT

The objective of this paper is to investigate the determinants of the adoption of green public procurement (GPP) practices at the local authority level. A conceptual contribution of the paper is an analytical framework, which acknowledges that the adoption of green criteria in tenders should be modelled as a conditionally independent decision from the decision to rely on GPP strategies (guidelines). This approach can help provide novel insights into how various political, organizational, and individual characteristics influence GPP. The paper provides an empirical illustration by concentrating on the role of organizational size. This analysis is based on survey responses from civil servants representing 140 Swedish municipalities. The results are based on the bivariate ordered probit estimator and suggest that large municipalities are more likely to rely on GPP strategies but also less prone to adopt green criteria in tenders when controlling for the presence of such strategies. In large organizations, the centralization of the procurement implies efficiency gains, but it will often be accompanied with longer organizational distances between the procuring and the environmental departments. The paper also highlights the wider implications of the proposed framework, including how future research on GPP practices could approach the role of various political and individual factors.

1. Introduction

By using the purchasing power of public authorities to choose environmentally friendly goods, green public procurement (GPP) can help green technologies and products become competitive in the private market while at the same time contributing to existing environmental objectives (e.g., Bouwer et al., 2006; Ghisetti, 2017; OECD, 2015; Rainville, 2017).¹ In several developed countries, public procurement constitutes a considerable share of GDP. Public officials are often responsible for procurement expenditures representing between 10% and 15% of total GDP (Hall et al., 2016). For instance, the Member States of the European Union (EU) spend on average 14% of GDP on publicly procured goods and services (EC, 2020b). The use of green criteria in tenders, therefore, constitutes an opportunity for public procurement to significantly influence the diffusion of green technologies and products.

Almost all OECD countries have developed strategies or policies that support the incorporation of environmental ambitions in the public procurement process, and a majority of these countries monitor the outcomes of their policy initiatives (OECD, 2021). Nevertheless, despite

the many strategy documents promoting, guiding, and monitoring the uptake of various GPP practices, the inclusion of environmental considerations in the procurement processes at the local – e.g., municipal – level is typically voluntary (Pouikli, 2021). For this reason, it is essential to increase our knowledge about the factors that will influence the propensity of local authorities to pursue GPP practices (see also EC, 2020a; Testa et al., 2012).

The objective of this paper is to investigate the determinants of the adoption of GPP practices at the local authority level. The conceptual contribution of the paper is to model the inclusion of green criteria in specific procurement tenders as a conditionally independent decision from the decision to introduce and rely on GPP strategies (guidelines). This contrasts with existing research, which typically employs reduced-form models that treat all individual, organizational, and political GPP influences as exogenous variables (see further Section 2). Such an approach thus ignores the endogeneity of GPP decision-making, including the possibility of heterogenous impacts on the decisions to adopt and rely on GPP strategies on the one hand, and to incorporate green criteria in specific procurement tenders on the other.

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¹ The EU Commission defines GPP as a process through which public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured (EC, 2020b).

In the paper, we develop an analytical framework, which recognizes the endogeneity of these two decisions, and highlights the generic value of this approach. This framework addresses the key roles of so-called street-level bureaucrats, i.e., civil servants working at the end of the policy chain, making operational decisions, and acting based on official policy. Research suggests that the influence of such individuals on the GPP practices in public authorities could be significant (Cheng et al., 2018; Vejaratnam et al., 2020). The discretion of the street-level bureaucrats will however be influenced by both organizational characteristics (e.g., pooling of resources, degree of centralization) and political factors (e.g., political party rule).

The relevance of this analytical framework is illustrated in the empirical context of the uptake of GPP in the transport sector among Swedish municipalities. This investigation rests on survey responses from procurement managers representing 140 municipalities, and various secondary data. While a key argument in the paper is that the proposed framework could serve as a generic point of departure for future research work on GPP practices in public authorities, including the formulation of novel hypotheses (see Section 3), the empirical illustration in the paper focuses on the organizational aspects.² Specifically, we attempt to shed novel light on the relationship between the adoption of GPP practices and organizational size.

While the results of previous studies often suggest that the size of the organization is positively correlated with the propensity to adopt GPP practices, we emphasize that large organizations tend to be confronted with an efficiency-flexibility trade-off. In large organizations, there may exist important efficiency gains through the centralization of the procurement process, e.g., due to a reliance on formalized procedures, pooling of resources, and economies of scale (e.g., Patrucco et al., 2019). Nevertheless, at the same time, this could be accompanied with longer organizational distances between the procuring and environmental departments, in turn leading to reduced flexibility such as difficulties to accommodate specific, e.g., green, requests in the procurement process (e.g., Grandia, 2016). In this context, large organizations could be more prone to adopt central GPP strategies but will nevertheless (*ceteris paribus*) find it more difficult to incorporate green criteria in tenders. In the empirical analysis, we test these hypotheses by employing the bivariate ordered probit model specification, which permits the decision to adopt green criteria in tenders to be endogenous to the adoption and reliance on GPP strategies.

As noted above, we achieve this in the context of GPP practices in Swedish municipalities with respect to sustainable transport solutions (e.g., procurement of bio-fueled or electric vehicles). This empirical case is interesting and relevant for several reasons. First, the transport sector constitutes a significant share of total greenhouse gas emissions (25% at the global level), and GPP has the potential to contribute to the decarbonization of this sector by helping market actors overcome technological hurdles and stimulating technology diffusion (Adhikari et al., 2020; IMF, 2018). Moreover, Sweden has ambitious climate policy goals and municipalities have a lot of discretionary power, something that combined motivates a more in-depth study of their GPP practices (see Hall et al., 2016; SEPA, 2020). For instance, through various policy support mechanisms, including GPP at the local level, the country has become a forerunner in the development of upgraded biogas for transport sector use (Larsson et al., 2016), and quite a few municipalities procure electric vehicles (e.g., Palm and Backman, 2017). Still, our paper illustrates that there is great heterogeneity across the different municipalities in terms of GPP practices as well as organizational size, and it is therefore useful to exploit this variation in the data to provide a

² This paper does not explore the efficiency of GPP, e.g., in comparison to alternative environmental and climate policy instruments (e.g., Cheng et al., 2018). Still, also such evaluations could likely benefit from addressing the endogeneity of GPP practices at the local level. See Section 7 for some brief remarks on this.

more in-depth understanding of the determinants of such practices.

The remainder of the paper proceeds as follows. Section 2 provides an overview of the existing literature that has investigated the adoption of GPP practices in public organizations. In Section 3, we outline the analytical framework, discuss its key concepts and relationships, and introduce the empirical illustration. Section 4 presents the content and design of the survey and other data collection issues, while Section 5 outlines the econometric specification. The empirical results are presented in Section 6 and then discussed in Section 7. Section 8 concludes the paper and provides some avenues for future research.

2. Literature review

There is a growing literature on GPP, and previous work has addressed both the implementation and uptake of GPP practices as well as the effectiveness of such policy approaches (see Cheng et al. (2018) for a review). The latter strand of the literature involves quantitative research on the environmental and economic impacts of GPP. Examples include Simcoe and Toffel (2014) who report evidence of how GPP can enhance the diffusion of environmental technologies in the building sector by affecting the demand from private companies. Lindström et al. (2020) show how Swedish municipalities' procurement of organic food has induced the conversion of farmland to such food products, while Brusselaers et al. (2017) show that the GPP of wood in Europe has overall stimulated the consumption and production of certified wood (although also noting the presence of heterogenous effects across regions). Other studies have elaborated on the design of GPP in the presence of multiple objectives as well as partly overlapping policy instruments (e.g., Lundberg and Marklund, 2018). This paper contributes to the former strand of research addressing the uptake of GPP practices, not least as increased knowledge about the determinants of GPP adoption could increase the likelihood of positive environmental outcomes but also help increase the knowledge about important design issues as well as barriers to GPP. Previous research has investigated the impacts of individual (civil servant), organizational and political characteristics on GPP practices.

The motivations of the civil servants that are involved in the GPP process, have been found to influence the uptake of GPP practices in various public authorities. Lipsky (1980) introduced the concept of street-level bureaucrats, which refers to civil servants that interpret and execute public policy by using a great amount of discretion. Street-level bureaucrats may often become informal policy makers (Bouchard and Carroll, 2002; Gains, 2009; Hall et al., 2016); they develop practices to reduce uncertainty in their daily work.³

The motivation among civil servants to procure green products has been shown to emerge from both awareness and know-how (Cheng et al., 2018; Vejaratnam et al., 2020) where awareness will precede know-how (Sonnichsen and Clement, 2020; Vluggen et al., 2019;). Without individual beliefs and values, the procurers could opt for the low-cost options rather than the greener alternatives (Vejaratnam et al., 2020). Individual awareness is affected by several factors, such as the attitudes of senior civil servants (Brammer and Walker, 2011; Zhu et al., 2013) and the use of economic incentives (Ahsan and Rahman, 2017; Palm and Backman, 2017). Know-how is closely related to formal training, e.g., courses in GPP, but also to learning and interaction among civil servants. Marsden et al. (2011) remark that civil servants can rely on their "trusted networks of peers for lessons, as here they can access the 'real implementation' story and the unwritten lessons," (p. 511).

The empirical evidence on the role of civil servant characteristics and motivation is mixed. For instance, Testa et al. (2012, 2015) identify civil

³ Lipsky (1980) remarks that "the decisions of street-level bureaucrats, the routines they establish, and the devices they invent to cope with uncertainties and work pressures, effectively become the public policies they carry out," (p. 3).

servants' lack of training in GPP as a key barrier to GPP uptake, but this result is not found in other work (Cheng et al., 2018; Vejaratnam et al., 2020). Marsden et al. (2011) report that interaction among civil servants was the most important source of learning whereas official training was not (see also Walker and Brammer (2009) who emphasize the importance of awareness rather than formal education). Moreover, there is some evidence that female civil servants are more inclined to address green values in the procurement process compared to male ones (e.g., Mansia and Pandey, 2016), but also in this case, previous research provides a mixed picture and there are other studies that show no such gender effect (e.g., Grandia, 2016). In this paper, we address individual characteristics in the form of gender, GPP education (formal training), and work experience (informal learning from peers), in turn hypothesizing that female procurement managers as well as those with formal GPP education and long work experience are more likely to endorse GPP practices.

Previous research also acknowledges the organizational contexts in which these individuals act. Studies show that the regulations and principles surrounding the procurement efforts typically play important roles for the propensity of local authorities to pursue GPP. Financial constraints are one key reason for the decision not to procure green (Brammer and Walker, 2011; Preuss, 2007); cost-effectiveness is one of the strongest guiding principles of the procurement process, and it could override green criteria associated with higher costs (Nykvist and Nilsson, 2009).

Public authorities that wish to pursue GPP could, though, assist this process by adopting a GPP strategy, which helps provide clarity and increases civil servants' abilities to prioritize among offers (Brammer and Walker, 2011; Hall et al., 2016; Meehan and Bryde, 2011). The existing literature confirms the importance of GPP strategies, but these strategies must not be too vague or too detailed (Preuss and Walker, 2011). For instance, in Sweden, the lack of clear environmental requirements in the strategy has been identified a key barrier to GPP in the case of road maintenance tenders (Faith-Ell et al., 2004). Still, there are examples of too rigid GPP strategies creating problems, e.g., in the transport sector (Aldenius and Khan, 2017). Previous research has also illustrated how follow-ups and evaluations of GPP strategies can help increase GPP uptake (Vluggen et al., 2019).

As noted above, we devote particular attention to the role of the size of the public authority (see further Section 3). A typical argument in the existing literature is that small organizations imply a lack of sufficient resources, i.e., economic resources but also competence, and this decreases the propensity for the uptake of GPP (Testa et al., 2012). Still, also here, the empirical evidence is mixed. Whereas Testa et al. (2012) as well as Michelsen and Boer (2009) find size to have a positive effect on GPP, Brammer and Walker (2011), Prier et al. (2016), and Sonnichsen and Clement (2020) report no such effect.⁴ For instance, Prier et al. (2016) argue that small local authorities are capable of adopting GPP practices to the same extent as larger ones; instead, the presence of environmental criteria, i.e., GPP strategies, plays a more profound role. Finally, it should also be noted that various previous studies adopt different operationalizations of size, such as the size of the population governed by the local authority (Testa et al., 2012; Michelsen and Boer, 2009; Sonnichsen and Clement, 2020), or the number of employees in this authority (Prier et al., 2016). Our empirical study addresses the role of organizational size, including the use of different operationalizations of this variable. However, in contrast to the above studies, we test the hypotheses that organizational size will have a positive impact on the propensity to adopt GPP strategies, but a negative influence on the

⁴ The literature suggests that limited economic resources may primarily be a barrier to GPP among non-western countries (Vejaratnam et al., 2020), with evidence reported for, for instance, Saudi Arabia (Islam et al., 2017), Ghana (Adjei-Bamfo and Maloreh-Nyamekye, 2019) and China (Geng and Doberstein, 2008; Zhu et al., 2013).

decision to incorporate green criteria in tenders when controlling for the presence of such strategies (see further Section 3.2).

A third category of GPP determinants is political factors (e.g., Keranen, 2017; Hall et al., 2016; Vejaratnam et al., 2020). Previous studies have shown that lack of political leadership could be an important barrier to the uptake of GPP (Hall et al., 2016; Smith et al., 2016; Vluggen et al., 2019). Political parties with a clear green agenda can be expected to be keener to pursue more ambitious GPP practices. For instance, the green party representation in Swedish municipality political leadership has been shown to influence local environmental policies (e.g., Folke, 2014; Pettersson-Lidbom, 2008; Sjoberg, 2016), while a similar effect has not been found in the U.S. context (Ferreira and Gyourko, 2009; Warren, 2008). Moreover, some political leaders could emphasize the role of cost-minimization in procurement processes (Nykvist and Nilsson, 2009). In this paper, we highlight both such prioritizations as well as the role of green party rule.

As noted above, an important contribution of the present paper is to move beyond the reduced-form approach that has dominated earlier research on the determinants of the adoption of GPP practices. Specifically, the existing literature explains the propensity to adopt environmental criteria in procurement tenders (the dependent variable), and treats the individual, political and organizational factors, including the presence of GPP strategies, as independent (exogenous) variables. In this paper, though, we instead model the inclusion of green criteria in tenders as a conditionally independent decision from the decision to rely on GPP strategies (guidelines). Section 3 elaborates on the underlying rationales for this generic approach and outlines an analytical framework, which, among other things, can be used to acknowledge the trade-offs in pursuing GPP practices in large public organizations.

3. Analytical framework

3.1. Generic approach

Fig. 1 provides an illustration of a simple analytical framework, which describes some of the important relationships underlying the adoption of GPP practices in public authorities. As noted above, we concentrate on two outcomes of these practices: (a) the adoption and reliance on GPP strategy documents, and (b) the implementation of

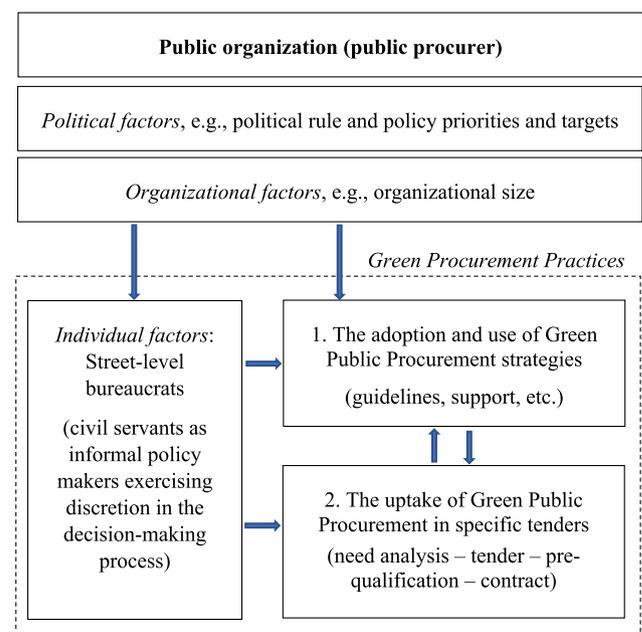


Fig. 1. Green procurement practices at the municipal level: an analytical point of departure.

green requirements in specific procurement tenders. The framework illustrates how decisions regarding these practices will be influenced first of all by exogenous factors such as general policies at both the national and the local level, as well as by the organization of the public administration. It is reasonable to assume that these factors will in turn be related to issues such as the political rule and, as elaborated in more detail below, the size of the organization.

Previous work shows that human behavior in organizations can be explained by a combination of organizational and individual factors, as well as by various internal and external adaptation processes (e.g., Argyris, 1957). Fig. 1 displays how individual street-level bureaucrats could influence both the reliance on GPP strategy documents and the uptake of GPP in tenders, thus suggesting that these two decisions will be endogenously determined. This notion has gained support in previous qualitative research. For instance, Sevä and Jagers (2013) as well as Sevä and Sandström (2017) studied bureaucrats holding office in Swedish municipal administrations. The authors found these bureaucrats to be key players in the implementation of environmental policy, both in terms of influencing the governing structures and processes and the adoption of policies (see also Clement et al., 2003; Christoph Erdmenger, 2017).⁵ Thus, the discretion of street-level civil servants implies that the decision concerning the adoption of and reliance on GPP strategy documents will not be taken independently from the decision on the implementation of green criteria in specific procurement tenders.

Clearly, local civil servants will not act in isolation. Management research has emphasized the importance of inter-personal, intra-organizational, and inter-organizational communication for successful policy uptake (see Yang and Maxwell (2011) for a review, and Gattiker and Carter (2010) for an environmental policy context). Hence, civil servants share information, integrate knowledge and meaningfully collaborate in the relevant decision-making processes (Temby et al., 2016). For our purposes, it is useful to note that individual learning will be determined by both formal training (e.g., GPP courses) and by interaction with other professionals in the daily practices. The latter can be assumed to be correlated with the length of work experience, among other things (Marsden et al., 2011).

Another important implication that follows from the analytical framework is that the individual, organizational and political factors may to varying extents influence the two decisions to adopt GPP strategies and use green criteria in tenders. This should be a useful starting point for future research, including the formulation of novel hypotheses. For instance, the individual (street-level bureaucrat) could have a direct influence on the use of green criteria in tenders, but he/she could also help promote such use by advocating for the adoption of GPP strategies (guidelines) since these will facilitate the continuous work on incorporating green criteria in tenders. Still, it should be fair to hypothesize that the discretion of the individual will be more profound when it comes to the former (direct) impact compared to the latter, which presumably could be more heavily affected by political factors such as political party representation.

Various organizational characteristics will likely also impact civil servants' ability to influence GPP practices, including the opportunities to interact with other individuals in the same public organization (e.g., across the procurement and the environmental departments). While the proposed analytical approach has generic relevance and value for how previous research could study the individual, organizational and political determinants of GPP practices, our empirical contribution (illustration) emphasizes the role of the size of the municipality organization. This issue is further elaborated below.

⁵ The civil servants can even become the main policy makers and implementers, not least in areas where a large degree of discretion is required and if the elected politicians find the area controversial or difficult (Bouchard and Carroll, 2002; Greg Marsden and Stead, 2011).

3.2. The relationship between organizational size and GPP practices

In this section, we take stock in the observation that previous GPP research has devoted a lot of attention to the relationship between organizational size and the uptake of GPP but with mixed results. Small municipalities can face barriers to GPP due to financial constraints and a lack of competence (Testa et al., 2012), but this explanation does not gain strong empirical support in the literature. Even though many local authorities face difficulties when prioritizing between cost minimization and various green criteria, the financial constraints are typically not the main reasons. Instead, there may often exist a need for clearer instructions on how to decide on these prioritizations, not least in the form of GPP strategies and guidelines (Cheng et al., 2018; Vejaratnam et al., 2020).

While the larger organizations may possess more resources, higher competence, and an ability to influence existing markets through GPP, they also face important challenges. As the size of an organization increases, it becomes more complex (Miller, 1993; Williamson, 1976). To deal with this, there will typically be an increased division of labor, more levels of hierarchy, and an increased formalization of procedures (Kahn et al., 1964). In the public procurement context, public organizations often deal with this by pooling all purchases to a centralized procurement unit (e.g., Glock and Broens, 2013; Glock and Hochrein, 2011; Michelsen and Boer, 2009; Wood, 2005).

This, though, leads to a difficult trade-off. On the one hand, the centralization of procurement can lead to efficiency gains through pooling of expertise, formalized procedures, as well as economies of scale (Karjalainen, 2011; Patrucco et al., 2021; Patrucco et al., 2019). On the other hand, such centralization could also increase the formalization of the GPP practices as well as the (organizational) distance between the civil servants in charge of the environmental policy and procurement units, respectively. This reduces flexibility, including the ability to accommodate specific requests in the procurement process (e.g., Clement et al., 2003; Dimitri et al., 2006; Glock and Hochrein, 2011; Grandia, 2016; Keranen, 2017).

Previous studies have concluded that such reduced flexibility tends to decrease the likelihood for the uptake of various criteria in tenders (Cheng et al., 2018; Hall et al., 2016; Keranen, 2017; Lidberg, 2011).⁶ Furthermore, while the procurement and the environmental policy units may jointly adopt GPP strategies and guidelines as a one-time effort (with occasional updates), the organizational distance between the two units makes collaboration harder in the continuous efforts to design and issue specific procurement tenders (Cheng et al., 2018).

The above allows us to hypothesize that: (a) large public organizations are more likely to adopt and rely on GPP strategies (guidelines); but (b) these are also less likely to incorporate green criteria in tenders when controlling for the presence of GPP strategies. These two hypotheses are illustrated in Fig. 2 and can be tested by employing an empirical model that recognizes the endogeneity of these two decisions (see further Section 5).

The above discussion also suggests that the role of the individual characteristics – e.g., gender, work experience, and formal GPP training – could be less profound in larger organizations. The introduction of additional levels of hierarchy and an increased formalization of procedures implies that the discretion of individual civil servants becomes more constrained. In addition, the relationship between the adoption of GPP practices and the size of the organization could be non-linear, and follow an inverted U-shaped pattern (see Hortas-Rico and Rios (2020) and Solé-Ollé (2006) for applications to other forms of public spending). The efficiency gains of centralization could be modest in small public

⁶ Organizational changes leading to the procurement process moving upwards to the political or top management level have also been shown to lead to diminished priorities for GPP (Preuss and Walker, 2011; Vejaratnam et al., 2020).

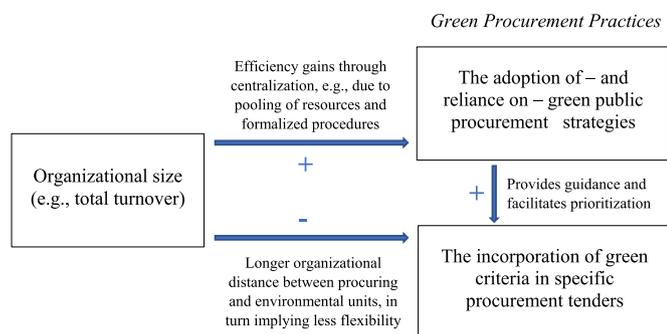


Fig. 2. The relationship between organizational size and GPP practices: hypotheses.

organizations. These gains, however, grow with size, but with the emergence of less flexible organizations GPP initiatives may not be prioritized to the same extent. Our empirical approach allows for also these hypotheses to be tested.

In sum, we conclude that: (a) conceptually, it is essential to recognize the use of green criteria in tenders as a conditionally independent decision from the decision to rely on GPP strategies; and (b) empirically, the efficiency-flexibility trade-off could affect the relationship between the size of the organization and the adoption GPP practices, not least in the form of heterogeneous impacts on the adoption of GPP strategies and the incorporation of green criteria in tenders, respectively.

4. Data

4.1. Green public procurement among Swedish municipalities

In Sweden, public procurement is regulated in the **Public Procurement Act (2016:1145)**, which in turn is based on the EU Public Procurement Directives (2014/24/EU and 2014/25/EU). Still, although strongly recommended, the uptake of GPP is pursued on a voluntary basis (EC, 2020a; SCA, 2016; Swedish Government, 2015). Overall, in 2018, total public procurement amounted to 14% of Sweden's total GDP, and out of this as much as 71% was reported green (EC, 2020a; NAPP and SCA, 2018; ECB Statistics, 2020). One reason for this relatively high share is that the national Swedish Transport Administration accounts for a large share of total procurement volumes, and it is fully (100%) committed to GPP.

However, the adoption of GPP practices at the municipal level is less frequent and differs a lot across municipalities. Compared to many other countries, Sweden has a relatively decentralized government structure with strong municipalities (Hall et al., 2016). These thus experience a lot of discretion in deciding whether to pursue GPP or not. There are 290 municipalities in Sweden, and some of these are therefore relatively small. For this reason, it has been recommended (e.g., see SOU 2013:12) that small municipalities could cooperate and form joint procurement units. So far, however, this has not been common, and we ignore this opportunity in the empirical analysis.⁷ Our sample consisting of 48% of all Swedish municipalities (see Section 4.2) includes only one example. Specifically, in 2017, the municipalities Essunga, Grästorp, Lidköping, Skara and Vara decided to form a joint procurement unit, but of these only one form part of the data sample.

A more common approach to support public procurement processes in Swedish municipalities, not least the uptake of GPP, has been to adopt strategy documents. As noted above, these offer a framework (guidance for making prioritization) for decision-making, e.g., on how to prioritize

among economic and environmental criteria. In the Swedish context, these strategies cannot be enforced similarly to a law or an administrative rule. In addition, the guidelines are expressed in general terms, thus leaving significant room for interpretation and requiring a civil servant's discernment, although they also provide some guidance, such as environmental criteria (Lindfors and Ammenberg, 2021).

4.2. Survey logistics and design

Most of the data used in this investigation were collected in a web survey targeting civil servants at all (290) municipalities in Sweden. In May 2018, the final survey was distributed by e-mail to the civil servants that could be identified as procurement managers. The focus on this group of officials can be attributed to the significant roles these play in leading and managing the procurement activities at the respective municipalities. Their job descriptions also incorporate responsibility for initiating, developing and implementing more efficient processes and working practices, as well as for safeguarding that the activities of the procurement units are well-aligned with all other operations of the municipality. The procurement managers at municipalities in Sweden are often also directly involved in many of the tenders issued. As such, these officials can be expected to have first-hand knowledge about the political priorities (e.g., the emphasis on cost-effectiveness), and the extent to which GPP practices are adopted in the organization.

The web questionnaire contained a total of 15 questions concerning, first of all, the propensity to adopt GPP practices in terms of: (a) the reliance on strategy documents (guidelines for GPP); and (b) the use of green requirements in specific procurement tenders. Although this risks inviting a certain amount of subjectivity on the part of the respondents, not least with respect to (b), there are no available data on GPP in Swedish municipalities (unless these are collected manually tender by tender in each municipality). The web survey also collected information about various individual, organizational and political variables, which all can help explain the outcomes in (a) and (b), respectively.

The variables that were constructed based on the survey responses are presented and explained in Section 4.3, which also introduces all variables drawn from secondary sources. An important aim of the survey was to keep it simple and short to secure a high response rate. For this reason, we avoided potentially sensitive questions concerning, e.g., individual norms and attitudes, as well as the use of demanding questionnaire designs. In the end, three reminders were sent out by e-mail, and the final response rate was 48%, i.e., 140 out of 290 municipalities.

Several measures were taken to secure the quality of the survey. First, as suggested by Testa et al. (2012), the survey was complemented with information on key definitions to minimize the risks of misinterpretation. Notably, this information made it clear that a reliance on GPP in the transport sector implied a focus on procurement of transport fuels (e.g., biogas), public transport services (e.g., buses), vehicles (e.g., cars used by employees), and/or transportation services (e.g., school taxi). Based on previous research, we know that in Sweden, GPP for transport at the municipality level does mostly, but not exclusively, concern purchase of cars used in the municipality's services (Lundberg et al., 2009). The environmental criteria involve, for instance, fuel efficiency requirements and environmental classifications of wheels.⁸ Second, a full version of the web survey was tested on a few civil servants, including the procurement manager, in one Swedish municipality. This test confirmed that the survey questions were clear and relevant, and it only resulted in a few revisions in the questions posed. The responses emanating from the test survey are not included in the data displayed and analyzed below.

⁷ Previous studies show that the efficiency gains from such cooperation may not emerge in the same way as if the centralization takes place within the authority (Smith et al., 2016).

⁸ GPP can be pursued by applying so-called technical specifications, selection criteria, award criteria, and contract performance clauses. However, the survey did not address the specific nature of the environmental criteria used in the procurement contracts.

4.3. Operationalization of variables and descriptive statistics

Table 1 provides descriptive statistics for all variables included in the empirical investigation. As noted above, we study two dependent variables. First, the propensity to use environmental criteria in the procurement contracts, *GPP uptake*, was measured on a five-point Likert scale where zero (0) indicates “never” and four (4) “always”. Second, the municipality’s reliance on GPP strategy (guideline) documents, *GPP strategy*, was measured along the same scale (0–4). Hence, the *GPP strategy* variable measures not only whether such strategy documents exist or not, but also the extent to which they are relied on in the decision-making process.

From Table 1, it is evident that there is a lot of variation across municipalities in both variables. 22% of the respondents indicated that their municipality never (9%) or rarely (13%) pursues GPP, while 46% stated that they do this often (37%) or always (9%). The corresponding data for the *GPP strategy* variable show that 39% responded

Table 1
Descriptive statistics for the dependent and independent variables.

Variable name	Description	Mean	Std. Dev.	Min	Max
Dependent variables					
<i>GPP uptake</i>	The extent to which the municipality adopts green criteria in tenders, five-point ordinal scale where 0 is “never” and 4 “always”	2.26	1.08	0	4
<i>GPP strategy</i>	The extent to which the municipality relies on formal GPP strategies, five-point ordinal scale where 0 is “never” and 4 “always”	2.04	1.42	0	4
Independent variables					
<i>Individual:</i>					
<i>Gender</i>	One (1) for female, and zero (0) for male.	0.54	0.50	0	1
<i>Work experience</i>	The respondent’s work experience in terms of number of years at the municipality	8.47	8.99	1	40
<i>GPP education</i>	Dummy variable that takes the value of one (1) if the respondent has completed a GPP education (and zero (0) otherwise).	0.49	0.50	0	1
<i>Organizational:</i>					
<i>Size(log)</i>	The logarithm of public expenditures of the municipality (million SEK)	21.28	0.87	19.26	24.40
<i>Political:</i>					
<i>Price</i>	The extent to which price is prioritized in the choice between different tenders, four-point ordinal scale where 0 is “disagree entirely” and 3 “agree entirely”	1.44	1.04	0	3
<i>Green party</i>	Dummy variable that takes the value of one (1) if the Green party formed part of the local government coalition in 2018 (and zero (0) otherwise).	0.41	0.49	0	1

that they never (19%) or rarely (20%) rely on GPP strategy documents, while 42% stated that they rely on such guidelines often (22%) or always (20%). Table A1 in the Appendix provides the full distribution of responses for these two key variables.

The independent variables first include a set of individual characteristics of the respondents, such as gender, work experience in terms of number of years employed at the municipality, and a dummy variable equaling one (1) if the respondent had completed a course in GPP (and zero otherwise).⁹ As noted above, we hypothesize that female procurement managers as well as those with long work experience and formal GPP education are more likely to endorse GPP practices.

In terms of organizational variables, we focus on the size of the municipality, *Size*. This variable is addressed by measuring the total public expenditures for each municipality. Specifically, *Size* was constructed by multiplying the municipality expenditures per capita from the database Kolada (2020) with the total population based on Statistics Sweden (2020). These data are for the year 2018. In the model estimations, we take the natural logarithm of *Size* to reduce the risk of overstated effects due to outliers. For instance, one municipality has public expenditures that are 15 times larger than the average municipality in the sample. As noted above, we also test non-linear specifications by incorporating the square of *Size(log)*, thus allowing us to test for the presence of an inverted U-shaped relationship between municipality size and GPP practices.

We include two political variables. First, to measure the political priority given to cost-minimization in the public procurement process, the civil servants were asked to which extent they agreed with the following statement: price is always a decisive factor in the choice between different tenders in the procurement process. The responses were used to construct the variable *Price*; it is measured on a four-point Likert scale where one (0) indicates “disagree entirely” and three (3) corresponds to “agree entirely”.

Finally, the propensity of municipalities to promote the adoption of GPP practices may also be influenced by the constituency of the governing political parties. We therefore hypothesize that the participation of the Green party in the local government will have a positive influence on GPP. This hypothesis is tested by including one dummy variable, *Green party*, which takes the value of one (1) if the Green party of Sweden is part of the local government coalition (and zero otherwise). The required data were collected from the Swedish Association of Local Authorities and Regions (SKR, 2020). Our focus on green political positions rather than the share of green votes, is motivated by the fact high vote shares do not necessarily imply that green preferences will be able to influence the GPP decision-making process unless the green parties can collude with other political parties and assume power in that way (see also Lauf et al., 2020).¹⁰ Overall, the data are representative in terms of average municipality size and political rule.

5. Model specifications

Since our two dependent variables are measured on an ordered scale, we specify ordered probit models. As benchmarks, we first estimate two univariate ordered probit models, which assume that the data-generating processes for *GPP uptake* and *GPP strategy*, respectively, are entirely independent. In a second step, we instead adopt the seemingly unrelated bivariate ordered probit model, thus recognizing that *GPP uptake* and *GPP strategy* are simultaneously determined. Failing to address such endogeneity, in other words assuming that the

⁹ The responsible civil servants were also asked about their age in years, but this variable was excluded from the sample due to its relatively high correlation with the work experience variable (a correlation rate of 64%).

¹⁰ We also tested to include the share of votes for the Green party in the 2018 municipality elections but the results only indicated statistically insignificant results.

municipalities' various GPP practices are independent, could produce inconsistent parameter estimates, which in turn leads to erroneous statistical inference (Wooldridge, 2010). The need to consider endogeneity in a GPP context, e.g., due to organizational complexity, has recently been raised also by Chen et al. (2022).

We first introduce the univariate ordered probit model whose general form can be specified as in eq. (1):

$$y_i^* = x_i' \beta + u_i \tag{1}$$

where y_i^* denotes the magnitude of the dependent variable for each municipality i , and x_i' is the vector of independent variables. β is the vector of regression coefficients. Since y_i^* is a latent variable that cannot be observed, we instead make use of the categories of responses so that:

$$y = \begin{cases} 0, y^* \leq 0 \\ 1, 0 < y^* \leq a_1 \\ 2, a_1 < y^* \leq a_2 \\ 3, a_2 < y^* \leq a_3 \\ 4, a_3 < y^* \leq a_4 \end{cases} \tag{2}$$

This can be reformulated as:

$$y_i = j \text{ if } a_{j-1} < y_i^* \leq a_j \tag{3}$$

where a_j thus represents the unknown cut-off points for the latent variable. Furthermore, the probability that observations i , i.e., the five ordered responses (0–4), will 'select' alternative j can be expressed as:

$$p_{ij} = p(y_i = j) = p(a_{j-1} < y_i^* \leq a_j) = F(a_j - x_i' \beta) - F(a_{j-1} - x_i' \beta) \tag{4}$$

where F is the normal cumulative density function in the standard probit model. As our analysis builds on the use of five response alternatives (j), the ordered probit will have four intercepts ($j-1$) and five marginal effects. The signs of the estimated coefficients tell us whether the latent variable y_i^* increases following an increase in the independent variables, while the associated marginal effects must be calculated separately. In the univariate ordered probit model, the marginal effect of an increase in a regressor x_r on the probability of selecting alternative j can be calculated as:

$$\partial p_{ij} / \partial x_{rj} = \{ F'(a_{j-1} - x_i' \beta) - F'(a_j - x_i' \beta) \} \beta_r \tag{5}$$

Moreover, the marginal effects of each variable on the different alternatives ($j = 0, 1, 2, 3, 4$) sum up to zero. The univariate ordered probit models have been estimated using the standard maximum likelihood technique in the Stata software. We investigate two ordered dependent variables, *GPP uptake* and *GPP strategy*, and include all of the independent variables outlined in Table 1.

Previous research has employed various probit models to explore topics in public procurement, e.g., various legal issues (Buccino et al., 2020), barriers from a supplier perspective (Uyarra et al., 2014), the adoption of green criteria (Yu et al., 2020) and GPP uptake (Testa et al., 2012). However, since it is likely that the error terms resulting from our separate ordered probit models are likely to be correlated, we adopt the seemingly unrelated bivariate ordered probit approach. In this specification, the two univariate models are estimated jointly, and the *GPP strategy* variable is included as an independent variable in the *GPP uptake* model. We therefore have:

$$Y_i^{U*} = x_i' \alpha_i + \phi Y_i^S + u_i^U, Y_i^U = \begin{cases} 0, y^* \leq 0 \\ 1, 0 < y^* \leq a_1 \\ 2, a_1 < y^* \leq a_2 \\ 3, a_2 < y^* \leq a_3 \\ 4, a_3 < y^* \leq a_4 \end{cases} \tag{6}$$

$$Y_i^{S*} = x_i' \alpha_i + u_i^S, Y_i^S = \begin{cases} 0, y^* \leq 0 \\ 1, 0 < y^* \leq a_1 \\ 2, a_1 < y^* \leq a_2 \\ 3, a_2 < y^* \leq a_3 \\ 4, a_3 < y^* \leq a_4 \end{cases} \tag{7}$$

where Y_i^{U*} denotes the latent variable measuring the uptake of GPP, while Y_i^{S*} represents the corresponding latent variable for the adoption of and reliance on GPP strategy documents. The two error terms u_i^U and u_i^S are assumed to be jointly normal with correlation ρ (rho).

The strength of the ordered probit model is that it allows us to explore direction of effects, and the statistical significance level of those, on an outcome variable. It should be noted, though, that the marginal effects cannot be calculated for the bivariate ordered probit model due to variable dependencies between the two different parts of the model. What is left to explore are changes in predicted outcomes for marginal (manual) changes in variable magnitudes, keeping everything else constant in the model. To gain some information about the magnitudes of the independent variable *Size(log)* on GPP practices, we estimated the predicted probabilities of *GPP uptake* and *GPP-strategy* for the different uptake levels (0–4): first based on the original modeling outcome, and then for outcomes based on a re-estimated model where the *Size(log)* variable is assumed to be 10% higher. In this way, we can evaluate the impact of municipality size on the propensity to pursue the two GPP practices.

Finally, we also introduce a set of interaction effects. Specifically, we interact *Size (log)* with the individual characteristics of the respondents: *Gender*, *GPP education*, and *Work experience*. This approach is pursued to test if the role of the individual, and her attributes, becomes less profound in the GPP decision-making processes in larger compared to smaller municipalities.

6. Results

Table 2 presents the estimated coefficients from our two univariate ordered probit models, and the bivariate ordered probit model specification (models 1–3). The statistical significance levels are based on robust standards errors (given in parentheses). The results from the two univariate models suggest that the most important determinant of the uptake of GPP is the reliance on GPP strategy documents. The reliance on such guidelines tends in turn to be more profound in larger municipalities and in the cases where the respondent is a woman. Moreover, the propensity to rely on GPP strategy documents decreases with increased priorities given to cost-minimization in the procurement process. The associated marginal effects at the means are reported in Table A2 in the Appendix. However, the results from the bivariate ordered probit model indicate a statistically significant ρ , thus suggesting correlation between the various unobserved factors affecting the municipalities' decisions to rely on GPP strategy documents and incorporate green criteria in procurement tenders, respectively. The seemingly unrelated bivariate ordered probit model is thus preferable over the univariate models as it accounts for the endogeneity in the GPP decision-making process.

The results from the bivariate order probit model (model 3) are presented in Table 2, while the predicted probability changes are reported in Fig. A1 in the Appendix. The decision to rely on GPP strategy documents at the municipal level tends, just as in the univariate specification (i.e., model 2), to be positively related to the size of the municipality. This relationship is statistically significant. For instance, the average predicted probability that a municipality will "always" adopt GPP strategy documents is 20%. With a 10% increase in *Size (log)*, the average predicted probability increases to 46%, i.e., a 132% increase in the predicted probability. All percentage changes in predicted probabilities in strategy document adoption and GPP uptake following a 10% increase in *Size(log)* are shown in Fig. A1.

Table 2
Maximum likelihood estimates from the univariate and bivariate ordered probit models (Models 1–3).

	Univariate ordered probit models		Bivariate ordered probit model	
	Model 1	Model 2	Model 3	
	<i>GPP-uptake</i>	<i>GPP-strategy</i>	<i>GPP-uptake</i>	<i>GPP-strategy</i>
<i>GPP-strategy</i>	***0.406 (0.085)		***0.873 (0.063)	
<i>GPP education</i>	0.246 (0.018)	0.185 (0.192)	0.004 (0.195)	0.167 (0.194)
<i>Gender</i>	0.018 (0.185)	**0.412 (0.195)	−0.279 (0.192)	*0.370 (0.195)
<i>Work experience</i>	−0.002 (0.010)	0.004 (0.011)	−0.006 (0.011)	0.005 (0.011)
<i>Size(log)</i>	0.108 (0.112)	***0.417 (0.120)	**−0.266 (0.106)	**0.393 (0.116)
<i>Price</i>	−0.092 (0.089)	*−0.161 (0.978)	0.061 (0.965)	−0.154 (0.097)
<i>Green party</i>	−0.049 (0.186)	0.095 (0.192)	−0.061 (0.188)	0.064 (0.187)
<i>N</i>	140	140	140	
Pseudo-R ²	0.1151	0.0655		
Log-likelihood	−176.860	−210.342	−384.5685	
ρ (rho)			***0.881 (0.091)	

Our results also suggest that municipalities with female respondents appear to be more likely to report a reliance on GPP strategy documents. Other individual characteristics, such as *GPP education* and *Work experience*, are not found to have any statistically significant impacts on *GPP strategy*. As in the univariate model, there is also no *Green party* effect. This thus suggests a limited role for street-level influences. Still, such influences are also likely to be components of the unobserved factors, and therefore requires further attention in future studies.

Table 2 shows that *GPP uptake* is positively related to *GPP strategy* ($P < 0.01$). However, while we find no statistically significant relationship between the organizational size and *GPP uptake* in the univariate model, the bivariate ordered probit model reports a *negative* and statistically significant impact when controlling for the presence of GPP strategies. In other words, once the reliance on GPP strategy documents, including its positive correlation with municipality size, is accounted for, the likelihood for *GPP uptake* in the transport sector decreases with higher municipality sizes. For instance, a 10% increase in municipality size implies that the predicted probability for *GPP uptake* to equal 4 (“always”) decreases from 29% to 18% (a percentage decrease of 39%), while the corresponding change in the probability for GPP uptake to equal 3 decreases by 2 percentage points (see Fig. A1 in the Appendix).

Given the profound role of municipality size in shaping GPP practices at the municipal level, we explore this relationship further. In a first step, we include the interaction between *Size(log)* and the individual characteristics *Work experience* and *Gender*. Table 3 shows the results from these alternative model specifications (models 4–5), which also serve as robustness tests of the results presented in model 3. The empirical results suggest that none of the added interaction effects were statistically significant. In our sample, there is no evidence for the notion, e.g., put forward by Clement et al. (2003), that the influence of individuals (street-level bureaucrats) on GPP practices is more profound in smaller organizations (since these offer more discretion on the part of the individual civil servants). We also tested the corresponding size interaction effects for *GPP education* and the age of the individual, respectively, but also these coefficients were statistically insignificant. However, it is important to note that the results indicate that the remaining conclusions are overall robust to the inclusion of these interaction effects.

In order to further challenge the robustness of our results, we test other ways of operationalizing the size of municipalities. Specifically, we explore two alternative operationalizations, one in which the total population in each municipality is divided into three categories – small, medium, and large – and another in which the total public expenditures

of each municipality are divided into the same three categories. Table A3 in the Appendix illustrates the results from these two alternative model specifications, and this table confirms that our results remain overall robust to the different operationalizations. Finally, we also investigated a model specification in which *Size(log)* could have a non-linear – e.g., an inverted U-shaped – influence on the GPP practices. Still, the added squared term, $Size(log)^2$, was not statistically significant (neither for *GPP uptake* nor for *GPP strategy*).

7. Discussion

Our findings support the notion that GPP practices at the municipal level, i.e., the reliance on strategy documents and the use of green criteria in specific tenders, tend to be simultaneously determined. Both these decisions will be influenced by the same key players, i.e., street-level bureaucrats that may (or may not) be committed to GPP. The (simultaneous) unobserved factors can, in principle, be any individual, organizational, and political characteristics that influence these two decision processes. Nevertheless, given the central role attributed to civil servants in the design and implementation of GPP practices (Erdmenger, 2017), the unobserved factors are likely to be – at least in part – individual (civil servant) characteristics. GPP at the local level is voluntary and therefore requires some of amount of personal motivation and competence. Providing a more in-depth understanding of these civil servant attributes, e.g., values, attitudes, etc., constitutes an important avenue for future research (see also Section 8).

One important reason for acknowledging the simultaneity of GPP practices is to avoid drawing incorrect conclusions about the role of various explanatory factors. We provide an empirical illustration of this by devoting specific attention to the role of organizational size. While the regular (unconditioned) ordered probit model results showed no statistically significant effect of municipality size on the likelihood for *GPP uptake*, the seemingly unrelated bivariate model did. Larger municipalities are more likely to rely on GPP strategy documents than smaller ones. However, once this reliance on guidelines, including the positive relationship with municipality size, is accounted for, the results suggest that larger municipalities are *less* likely to introduce green criteria in the various tenders.

These results are interesting as they reveal aspects of GPP practices at the local level that have previously not been adequately addressed in the literature (see also below). The increased adoption of GPP strategy documents with increasing municipality size is in line with existing

Table 3
Maximum likelihood estimates from the bivariate ordered probit models with interaction effects (Models 4–5).

	Bivariate ordered probit model		Bivariate ordered probit model	
	Model 4		Model 5	
	<i>GPP-uptake</i>	<i>GPP-strategy</i>	<i>GPP-uptake</i>	<i>GPP-strategy</i>
<i>GPP-strategy</i>	***0.875 (0.063)		***0.868 (0.070)	
<i>GPP education</i>	0.025 (0.196)	0.144 (0.192)	0.010 (0.200)	0.137 (0.200)
<i>Gender</i>	−0.267 (0.195)	*0.355 (0.199)	−0.873 (4.020)	−0.392 (4.859)
<i>Work experience</i>	−0.200 (0.208)	0.222 (0.206)	−0.006 (0.012)	0.006 (0.012)
<i>Size(log)</i>	**−0.349 (0.138)	***0.487 (0.165)	**−0.268 (0.140)	*0.294 (0.169)
<i>Price</i>	0.060 (0.096)	−0.154 (0.097)	0.053 (0.097)	*−0.166 (0.098)
<i>Green party</i>	−0.061 (0.188)	0.064 (0.186)	−0.059 (0.189)	0.061 (0.187)
<i>Size(log)*Work</i>	0.009 (0.010)	−0.010 (0.010)		
<i>Size(log)*Gender</i>			0.028 (0.189)	0.201 (0.228)
<i>N</i>	140		140	
<i>Log-likelihood</i>	−384.086		−384.5685	
<i>ρ (rho)</i>	***0.880 (0.095)		***0.864 (0.115)	

literature – a larger organization implies increased complexity, which calls for formalization of work procedures (Chen et al., 2022; Wang et al., 2020). This in turn increases the likelihood for GPP uptake, something that also is supported by the existing literature (Cheng et al., 2018; Vejaratnam et al., 2020).

A novel result, however, is the negative relationship between the size of the municipality and the uptake of green criteria in tenders. The rationale behind this finding can, as suggested above, be traced to the inflexibility of larger organizations. These organizations are typically associated with several levels of hierarchies, and in the context of public procurement, centralization to specific procurement units (Glock and Broens, 2013). Centralized procurement has been shown to be associated with less flexibility, short-termism, and a reduction in the accommodation of specific requests (Clement et al., 2003; Da Costa and Motta, 2019; Dimitri et al., 2006; Glock and Hochrein, 2011; Grandia, 2016; Keranen, 2017). Since GPP is voluntary and framed as a request (on the part of the environmental unit), there is a risk that environmental objectives will receive less attention in organizational structures where procurement processes are centralized. It should be noted that these organizational challenges are more likely to affect the continuous efforts to design and issue specific tenders, and thus less so the adoption of GPP strategies. The latter is more of a one-time effort (although with occasional updates).

These are general remarks, but they are likely to be relevant in the specific context of Swedish municipalities. In 2018, the same year as when our survey was sent out, a supporting agency for Swedish municipalities, *SKL kommentus*, conducted an evaluation of ‘sustainable’ public procurement practices in the country. The authors conducted interviews with representatives of ten Swedish municipalities, and identified the division of responsibilities within municipalities as one of the key reasons why the uptake of GPP has not been more frequent (SKL kommentus, 2019). The report also concluded that in the case of a centralized procurement unit, the procurer is not expected to take part in the municipality’s environmental work, and she is typically not obligated to translate the organization’s environmental goals into GPP. This disconnect, the authors argue, implies increased risks for environmental criteria to fall between the cracks. For this reason, the procurers’ personal motivation and dedication to environmental considerations are often keys to increased GPP (SKL kommentus, 2019).

The above suggests that our paper complements the previous studies

that have addressed the relationship between organizational size and the uptake of GPP, including Michelsen and Boer (2009) on Norway, Aldenius and Khan (2017) on Sweden and Testa et al. (2012) on Italy. They conclude that larger municipalities are more likely to procure green. For instance, Michelsen and Boer (2009) remark that a “certain minimum size of the municipalities and counties seem to ensure the required amount and types of knowledge on the purchasing processes,” (p. 164). Aldenius and Khan (2017) note that for larger public organizations the opportunities to affect market development will often be greater. Nevertheless, while such findings can be considered reasonable ‘reduced-form’ results, they overlook the fact that this impact tends to be mediated through a higher adoption and reliance on GPP strategy documents in large municipalities. Large municipalities, though, also involve challenges, and once we control for the presence of strategy documents, the relationship between organizational size and GPP uptake becomes negative.¹¹ Moreover, the organizational inflexibility that helps explain this finding could also carry implications for how cost-effective GPP is as a policy tool (e.g., compared to a Pigouvian tax policy). For instance, the weight attributed to carbon dioxide emission reductions would likely differ across authorities of different size. Arvidsson and Stage (2012) report some related results in the context of the public procurement of waste treatment options in Sweden.

Our results indicate no significant impact of neither GPP education nor work experience on the adoption of GPP practices. This is in contrast to earlier literature, such as Bouwer et al. (2006) and Testa et al. (2012). Still, a closer look at these two studies reveals that they primarily address awareness rather than know-how and formal training per se. Awareness is also found to be important in the international reviews by Cheng et al. (2018) and Vejaratnam et al. (2020). Although training is one way to increase awareness, it is not the only one. In addition, while our results on the role of individual training and work experience could be interpreted to suggest that there is little scope for discretion on the part

¹¹ To illustrate this point, we applied the econometric approach used by Michelsen and Boer (2009), and estimated pairwise Kendall’s tau-b correlations using our data sample. Just as Michelsen and Boer (2009), we find a positive and statistically significant ($P < 0.01$) correlation. The coefficient of 0.214 between municipality size and GPP uptake is also close to their estimate of 0.272.

of the street-level bureaucrats, we would argue against this. As noted above, the unobserved factors could likely be attributed to various civil servant characteristics (e.g., norms, attitudes).¹²

In this context, the analytical approach outlined and illustrated in this paper has added value, which goes beyond the case of organizational size. Addressing the potentially heterogenous impacts of also individual and political variables on the use of GPP strategy documents and the inclusion of green criteria in specific tenders, respectively, could shed additional light on some of the ambiguous results presented in previous research. For instance, past studies show mixed results in terms of the importance of GPP education on the adoption of GPP practices in public organizations (see Section 2). Our approach, though, permits a test of the hypothesis that this individual characteristic will have a relatively small impact on the adoption of GPP strategies – something that may be more influenced by the nature of the political leadership – but a more profound effect on the likelihood of incorporating green criteria in tenders.

8. Conclusion and avenues for future research

The objective of this paper was to investigate the determinants of the adoption of GPP practices at the local authority level, and we have pursued this in the empirical context of municipalities in Sweden. At the conceptual level, the analysis suggests that it is essential to recognize that the GPP practices involve decisions on both the adoption and reliance on strategy documents (guidelines for GPP), as well as the inclusion of green criteria in specific procurement tenders, and where the latter is a conditionally independent decision from the decision to rely on GPP strategies. By building on this simple, yet important, research design, novel conclusions about the determinants of GPP practices can be made.

In the paper, we illustrate this empirically when it comes to the influence of organizational size on the adoption of GPP practices. The results indicate that larger municipalities are more prone to rely on GPP strategy documents than smaller ones. Nevertheless, once this effect is accounted for, municipalities are less likely to implement green criteria in the procurement process. These findings can be traced back to the difficult trade-off between efficiency and flexibility. In large organizations, the centralization of procurement implies efficiency gains, e.g., through pooling of resources and the introduction of formalized procedures, but this is often accompanied with a longer organizational

distance between the procuring and the environmental departments.

As noted above, our analytical framework opens for novel research on the determinants of GPP practices, not least in terms of increased empirical work on the role of individual (street-level) influences and the potential for heterogenous impacts on the reliance on GPP strategies and the inclusion of green criteria in specific tenders, respectively. There is also a need for considering and testing different ways of addressing and operationalizing values, preferences, and know-how. As remarked above, the (simultaneous) unobserved factors in our econometric analysis are likely to consist – at least in part – of individual (civil servant) characteristics. Future work that can address the role of civil servants in influencing the organization of public procurement, e.g., decisions on centralization, is also called for (see also Patrucco et al., 2019). Finally, our empirical illustration suggests that disconnected organizational structures may constitute a key barrier to the uptake of GPP, but this notion could be further problematized (including novel variable operationalizations). For instance, Da Costa and Motta (2019) argue that the rigidity in organizational structures does not have to be a problem if managed properly. In this context, the theoretical framework developed by Albano and Sparro (2010) on how to develop flexible centralized procurement units could – in combination our proposed framework – serve as a point of departure for additional empirical work.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

We have provided the data as an attached document (Excel file) to this submission

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecolecon.2022.107655>.

Appendix

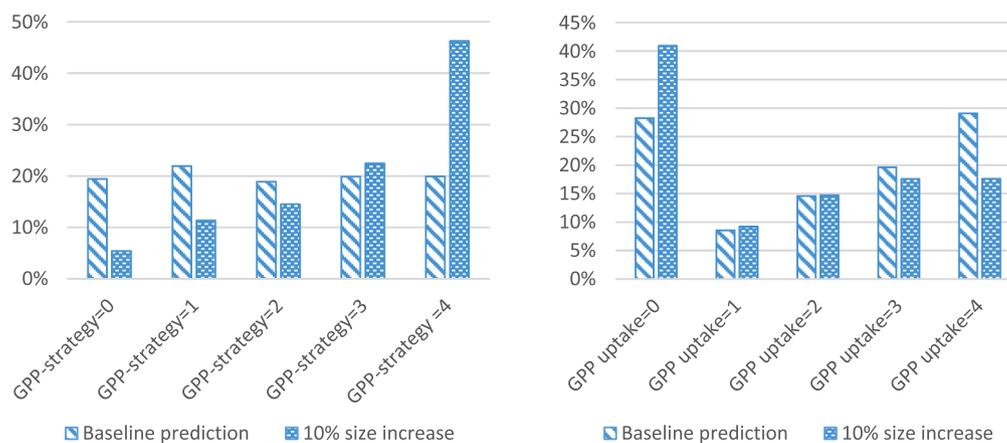
Table A1
Summary of survey responses, GPP uptake and GPP strategy (Likert scale)

	0	1	2	3	4
GPP uptake	12	18	45	52	13
GPP strategy	27	28	26	31	28

¹² Still, it also important to note that the reasons why we opted not to include specific questions about norms and attitudes were related to: (a) the ambition to secure a high response rate; and (b) the fact that previous research has shown a strong link between personal motivation and formal training (i.e., GPP education) (see Section 2).

Table A2
Marginal Effects based on the Univariate Ordered Probit Model Estimates (Models 1 and 2 in Table 2).

	<i>GPP uptake: dy/dx</i>		<i>GPP strategy: dy/dx</i>	
<i>GPP strategy</i>				
0	-0.04	***		
1	-0.06	***		
2	-0.06	***		
3	0.11	***		
4	0.05	***		
<i>Size(log)</i>				
0	-0.01		-0.09	***
1	-0.01		-0.05	***
2	-0.01		0.00	
3	0.03		0.05	***
4	0.01		0.10	***
<i>Price</i>				
0	0.01		0.04	
1	0.01		0.02	
2	0.01		0.00	
3	-0.03		-0.02	
4	-0.01		-0.04	
<i>GPP education</i>				
0	-0.02		-0.05	
1	-0.04		-0.02	
2	-0.04		0.00	
3	0.07		0.02	
4	0.03		0.05	
<i>Female</i>				
0	0.00		-0.10	*
1	0.00		-0.05	**
2	0.00		0.00	
3	0.01		0.05	*
4	0.00		0.11	**
<i>Work experience</i>				
0	0.00		-0.00	
1	0.00		-0.00	
2	0.00		-0.00	
3	0.00		0.00	
4	0.00		0.00	
<i>Green party</i>				
0	0.00		-0.02	
1	0.01		-0.01	
2	0.01		-0.00	
3	-0.01		0.01	
4	-0.01		0.02	



(a) Predicted average probability that a municipality will adopt and rely on GPP strategy documents (b) Predicted average probability that a municipality will adopt green criteria in tenders (conditioned on the choice to rely on GPP strategy documents)

Fig. A1. Predicted percentage changes in the probabilities for GPP uptake and GPP strategy given a 10 % increase in Size(log).

Table A3

Maximum likelihood estimates from the bivariate ordered probit models using different size operationalizations.

	Bivariate ordered probit model		Bivariate ordered probit model	
	Population size (categories)		Public expenditures (categories)	
	GPP-uptake	GPP-strategy	GPP-uptake	GPP-strategy
GPP-strategy	***0.869 (0.063)		***0.865 (0.064)	
GPP education	0.001 (0.195)	0.171 (0.194)	-0.019 (0.194)	0.199 (0.192)
Gender	-0.261 (0.191)	*0.326 (0.195)	-0.252 (0.191)	-0.320 (0.195)
Work experience	-0.006 (0.011)	0.004 (0.011)	-0.006 (0.011)	0.004 (0.011)
Size (categories)	**0.298 (0.133)	**0.434 (0.136)	**0.264 (0.128)	***0.415 (0.136)
Price	0.066 (0.096)	*0.167 (0.096)	0.071 (0.096)	*0.171 (0.095)
Green party	-0.061 (0.190)	0.070 (0.190)	-0.066 (0.191)	0.069 (0.190)
N	140		140	
Log-likelihood	-386.088		-386.249	
ρ (rho)	***0.885 (0.091)		***0.881 (0.344)	

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