



Analysis

What factors influence the uptake of GPP (green public procurement) practices? New evidence from an Italian survey

Francesco Testa ^{a,*}, Fabio Iraldo ^{a,b}, Marco Frey ^{a,b}, Tiberio Daddi ^a

^a Sant'Anna School of Advanced Studies, Piazza Martiri della Libertà 33, 56127 Pisa, Italy

^b IEFE—Institute for Environmental and Energy Policy and Economics, Bocconi University, Milan, Italy

ARTICLE INFO

Article history:

Received 24 July 2011

Received in revised form 1 June 2012

Accepted 17 July 2012

Available online 4 August 2012

Keywords:

Green public procurement

Local authorities

ISO 14001

Environment

ABSTRACT

Green public procurement (GPP) is becoming a cornerstone of environmental policies both at European Union and Member State levels. Drawing upon a database of public authorities located in three Italian regions, this paper assesses the determinants and drawbacks of green procurement adoption. In particular, using an econometrical approach we tested the following propositions: (i) the existing awareness on GPP practices, tools and regulations does support public authorities to develop GPP strategies; (ii) the support of external experts in purchasing function does support public authorities to develop GPP practices; (iii) the small dimension of public authority is an obstacle to adopting GPP practices; (iv) ISO 14001 certified public authorities are more likely to develop GPP practices. The econometric analysis shows that the dimension of public authorities and the level of awareness of the existing tools for supporting GPP have a positive and significant effect on the probability that they adopt GPP practices.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

Green public procurement (GPP) is becoming a cornerstone of environmental policies both at European Union and Member State level (Tukker et al., 2008). Since the International Conference on Environment and Development at Rio de Janeiro in 1992,¹ the awareness on the role of GPP in supporting sustainable consumption and production patterns strongly increased and, today, is spreading through the public authorities (PAs) both as a policy instrument and as a technical tool.

The high purchasing power of PAs is a market factor with enormous potentialities. Each year the public authorities in the EU spend roughly the equivalent of 16% of the EU Gross Domestic Product on the purchase of goods, such as office equipments, building components and transport vehicles; services, such as buildings maintenance, transport services, cleaning and catering services and works (EC, 2008a). Public procurement can shape production and consumption trends, therefore, a significant demand from public authorities for “greener” goods is surely able

to create or enlarge markets for environmentally friendly products and service (Li and Geiser, 2005). In other words, the diffusion of GPP can effectively contribute to decreasing the environmental pressure caused by unsustainable consumption patterns and can help stimulating a “critical mass” of demand on the final and intermediate markets for more sustainable goods and services which otherwise would be difficult to get onto the market. By operating as a market trigger, GPP can act as a strong stimulus for eco-innovation. (Iraldo et al., 2007).

In the last decade, the use of environmental criteria in public tenders has been increasingly diffusing. For instance, many national initiatives can be accounted in the United States (Swanson et al., 2005), in South Africa (Bolton, 2006, 2008) and in Asia (Ho et al., 2010). Especially in the European Union there was a strong and convinced promotion of these instruments, so that green procurement is gradually turning into a legally binding instrument (European Commission, 2008a).

Although there have been many national and local experiences on green public procurement and many operational tools and guidelines have been created to support the use of environmental criteria in public purchasing processes (GPP implementation), academic papers on this field have not been numerous, and green public procurement is a relatively new area of research (Nissinen et al., 2009).

Existing research mainly focused on the development of tools to assist green procurement implementation in public policy (Swanson et al., 2005; Walker and Brammer, 2009), on the potential and effective benefits of green procurement (Hall and Purchase, 2006; Rüdener et al., 2007; Testa et al., 2011), on the obstacles and drawbacks that can negatively affect GPP uptake (Walker and Brammer, 2009) and on the use and state of environmental procurement criteria (Nissinen et al., 2009; Parikka-Alhola et al., 2007).

* Corresponding author. Tel.: +39 050883829; fax: +39 050883936.

E-mail address: f.testa@sssup.it (F. Testa).

¹ “Governments themselves also play a role in consumption, particularly in countries where the public sector plays a large role in the economy and can have a considerable influence on both corporate decisions and public perceptions. They should therefore review the purchasing policies of their agencies and departments so that they may improve, where possible, the environmental content of government procurement policies, without prejudice to international trade principles” (Agenda 21, chapter 4 par. 23).

The existing research focused primarily on best practices and case studies (Mathisen and Solvoll, 2008; Murray, 2000; Preuss, 2007) or merely used descriptive analysis of samples of public organizations (Michelsen and de Boer, 2009; Walker and Brammer, 2009). These approaches offered very useful evidence and indications to practitioners and policy makers for implementing effective GPP, but did not provide sufficient proofs to generalize their findings.

In our study we analyze what are the factors that influence the inclusion of green criteria in the public tenders by way of an econometrical analysis. In order to perform our empirical investigation, we used qualitative data collected by a standard questionnaire within the PROMISE project funded by the European Commission—DG Environment. Drawing upon a sample of 156 public organizations from three Italian regions, we tested if variables as the level of awareness on the existing and available toolkits to support GPP, the dimension of public authorities, the adoption of a certified EMS (Environmental Management System) and the use of external expertise, have an influence on the “probability” that a local government or, more generally, a public authority implements GPP.

The paper is structured as follows: first, we provide an overview of green public procurement, its legal framework and uptake in the EU. The following section shows the main findings emerging from the literature related to the propositions of the study. Subsequently, we describe the data set and the estimation methodology. After discussing the results, in the final section of the article we conclude with some indications for future research and managerial implications.

2. GPP: Legal Framework and Uptake in the EU

At the European level, the recognition of the fundamental role of green public procurement in decreasing environmental impacts and in promoting market awareness was firmly established in the Green Book of Integrated Products Policy (EC, 2001a) and in the Sixth Environment Action Programme (EP, 2002). However, the European Communication n. 274/2001 represents the most important document concerning GPP (EC, 2001b). In fact, this document highlights the opportunities for public authorities to integrate environmental considerations in their procurement procedures and it gave birth to many experimental initiatives aimed at supporting public authorities in the adoption of green purchasing practices (Iraldo and Testa, 2007). This communication has provided operational guidance to contracting public offices on what environmental criteria have to be included and in which phases of a public procurement procedure. The indications of the Communication have been embedded within the Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on “the coordination of Procedures for the award of public works contracts, public supply contracts and public service contracts, which has changed the legal framework on public procurement at the EU level” (EC, 2004a). The Directive expressly provides the possibility for contracting authorities, to take into account environmental issues at each stage of the procurement process (Parikka-Alhola, 2008): the inclusion of environmental criteria in public tenders may be:

- in **technical specifications** (article 23), i.e. in required and verifiable characteristics, so that products and services respond to their intended use (e.g. raw materials, recycled wood or glass for their windows, or a given production process). The inclusion of environmental performance or functional requirements may also be referring to the specifications defined by the so-called European (multi) national “eco-labels”, when they meet certain conditions, such as being based on scientific information or adopted in a participatory process with all stakeholders and so on, e.g. eco-labels type I (ISO 14024) and, in particular, to the European eco-label certification (EC, 2010);
- in assessing the **technical expertise** of competitors (article 50) by requiring bidders the demonstration of their technical expertise in implementing environmental management measures, through an

EMAS registration (EC, 2009) or an ISO 14001 certification for services procurement and only in the mentioned appropriate cases (i.e. those contracts whose performances can cause damage to the environment and therefore require measures for its protection);

- in selecting the **award criteria** (article 53), choosing between lowest price or most economically advantageous tender for the contracting authority. In the second case, environmental requirements can be included, just if they are linked to the call for tender objective, they do not provide the contracting authority an unrestricted freedom of choice and, finally, they are expressly mentioned and comply with EU principles;
- in the **execution of a supply or service contract** (article 26) (e.g. ecological transport, recovery packages, reuse of finished product, chemical concentrates to be diluted only at the moment of actual use, etc.).

Another important step has been taken thanks to the GPP Communication “Public Procurement for a Better Environment” (EC, 2008b). This communication aims at providing guidance on how to reduce the environmental impact caused by public sector consumption and how to use GPP to stimulate innovation in environmental technologies, products and services. At EU level, the European Commission set a target that, by 2010, 50% of all public tendering procedures should be green, where “green” means compliant with endorsed common “core GPP criteria”.

There are also several other policy and strategy documents that support the development and implementation of GPP. Table 1 provides a brief description.

Despite a relatively developed European and national legislation, the “institutionalization” of GPP in local public policies had a limited application (both in Italy and in the EU), while several experimental initiatives and pilot projects were successfully developed (Iraldo et al., 2007). This situation is largely due to the lack of comprehensive and clear operational rules governing the inclusion of environmental selection criteria in procurement procedures and contract procurement of goods and services (e.g. technical specifications, selection criteria and rewarding, contract terms).

A recent study carried out by Bouwer et al. (2006), on behalf of the European Commission, measured the distribution of GPP in EU countries on the basis of answers to 860 questionnaires and by analyzing the use of environmental criteria in more than one thousand call for tenders carried out in all Member States.

With reference to the “state of the art” in GPP, considering the specific Member States, the study showed that in 7 (Austria, Denmark, Finland, Germany, Great Britain, Holland and Sweden—identified by the study as the “Green 7”) the use of green public procurement is more consolidated than in the other 18, thanks both to numerous “green calls” implemented and to a higher level of maturity and awareness of the GPP-related instruments, such as:

- Strong political push through (for instance) national guidelines or action plans;
- Public means of information and national eco-labels;
- Use of innovative tools in procurement procedures such as *life cycle thinking* and *green contract variants*.

In addition, recent studies have been carried out at the regional and national level, in particular, focusing on the Nordic countries. For instance, Parikka-Alhola et al. (2007) found that in the product groups with a potentially high environmental impact, green criteria were present in 37% of award decisions. In the calls for tenders where the weights were given for award criteria, environmental criteria accounted for 5–20% of the award decision, and proportioned this to the total sample, an average weight for green criteria was 3.3%. The dominant award criteria were price (51% of weight) and quality (37% of weight), leaving less weight to delivery terms (7%) and social issues (1.7%) (Parikka-Alhola et al., 2007). Moreover, Nissinen et al. (2009) found that the product groups with apparent “high”, “medium” and “low” greenness had

Table 1
EU policies supporting GPP.

EU policy	Description
<i>Communication from the Commission to the Council and the European Parliament, European Commission, 2004 on The European Technologies Action Plan (ETAP)</i>	The action plan refers to the role of GPP in improving market conditions to promote eco-innovation
<i>Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions, a lead market initiative for Europe, 2007</i>	The lead market initiative is the European policy for six important sectors that are supported by actions to lower barriers to bring new products or services onto the market. As the public sector is a significant purchaser in each of these lead markets, specific resources have been funded under this Initiative to assist in the procurement of innovative and/or more sustainable solutions from these markets
<i>Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services</i>	The directive aims at enhancing the cost-effective and efficient end-use of energy in Member States. Moreover it states that "Member States shall ensure that the public sector fulfils an exemplary role in the context of this Directive. To this end, they shall communicate effectively the exemplary role and actions of the public sector to citizens and/or companies, as appropriate." The Directive also encourages the exchange of best practice in energy-efficient public procurement between public sector bodies at the national and international levels
<i>Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings</i>	The recast EPBD introduces or strengthens a number of measures related to the energy performance of new and existing buildings. Particular relevant for public authorities is the requirement set out in Article 9 of the EPBD which requires Member States to ensure that after 31 December 2018, new buildings occupied and owned by public authorities are nearly zero-energy building
<i>Regulation No 106/2008 of the European Parliament and of the Council on a Community energy-efficiency labelling programme for office equipment</i>	The regulation highlights that the energy star performance and technical requirements provide a useful reference point in the development and application of GPP criteria for many products
<i>Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organizations in a community eco-management and audit scheme (EMAS)</i>	Public authorities wishing to apply green public procurement can also use EMAS to clearly organize and monitor their environmental policy objective
<i>Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products</i>	About GPP, the directive states that, in concluding public contracts, public authorities "shall endeavour to procure only such products which comply with the criteria of having the highest performance levels and belonging to the highest energy efficiency class." Member States are also empowered to set minimum criteria for the procurement of energy-related products
<i>Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products</i>	The ecodesign directive aims to reduce the environmental impact of products, including life-cycle energy consumption, by providing EU-wide rules for the design of energy-related products. The directive is of specific relevance to the development and application of technical or performance-based specifications by public authorities in their procurement
<i>Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel</i>	Ecolabels are placed on certain products to enable consumers to choose those which have been recognised as less harmful to the environment. Ecolabel criteria are a useful guidance for public purchasers for setting environmental criteria in their tenders
<i>Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the sustainable consumption and production and sustainable industrial policy action plan (COM (2008)) 397 of 16 July 2008</i>	Under the action plan the Commission undertook to further strengthen GPP and published the communication on GPP. More specifically, the communication proposes tools which should enable the main obstacles to increased take-up of GPP to be addressed, such as: setting common GPP criteria; encouraging publication of information on life-cycle costing (LCC) of products; increasing certainty about legal possibilities to include environmental criteria in tender documents; establishing support for the promotion and implementation of GPP through a political target linked to indicators and monitoring;

clearly different proportions of green calls for tenders in Nordic countries in the year 2003 (73%, 44% and 30%, respectively).

3. Theory and Propositions

3.1. Benefit and Obstacles of GPP

Green public procurement, nowadays, plays a key role in the European environmental strategy. The potential environmental benefit that could be obtained if environmental requirements were systematically included in public tenders is rather clear and measurable (Parikka-Alhola, 2008).

For instance, by switching public demand towards greener energy supplies would bring savings for 60 million tons of greenhouse gases, i.e. 18% of quotas assigned to the European Union by the Kyoto Protocol. Another impressive example is the following: if all public authorities in the EU required energy-efficient computers, 830 thousand tons of CO₂ would not be released into the atmosphere (Ochoa and Erdmenger, 2003).

Moreover, GPP can shape production and consumption trends and a significant demand from public authorities for "greener" products will create (or enlarge) markets for environmentally friendlier products and

services (Li and Geiser, 2005). In other words, public demand, when oriented towards innovative solutions and products, has the potential to improve delivery of public policy and services, often generating improved innovative dynamics and benefits from the associated spillovers (Edler and Georghiou, 2007).

The relation between GPP and eco-innovation has not been investigated in-depth yet. As stated earlier, public purchasing in the EU amounts to a total of 16% of the EU GDP. This provides public authorities with the real power to help move eco-products into mainstream. Additionally, this gives producers real incentives to pursue innovative solutions (Rüdenauer et al., 2007).

In order to encourage the potential positive effects of GPP on innovation, the European Commission has recently launched a "Guide on promotion of innovation through public procurement" (EC, 2007). This guide outlines 10 practical approaches that will help promote (eco-) innovative solutions. It explains how to set up and implement procurement procedures so as to stimulate innovation and research.

Moreover, the European Commission plans to establish an EU voluntary system for third party verification of the performance claims of new technologies (ETV), which would ease the verification of compliance with environmental specifications set out in tender documents. Finally,

by way of the lead market initiative strategy, the EC stresses the role of GPP to foster the development and market take-up of new products and services.

The impact of GPP on innovation and competitive performance was recently investigated by Testa et al. (2011). Based on survey data and by applying a regression they found that effectiveness of GPP is strongly related with the investments in technological innovations and reputation (even if the last relation is weakly supported). These results provide strong indications. It is confirmed that environmental policies, even if applied by way of “soft” instruments such as GPP, are able to influence the innovation abilities of the firm.

Despite evident benefits that the diffusion of GPP can provide to the whole economic system, several obstacles and drawbacks were encountered by local authorities in its application. The above mentioned study on GPP implementation (Bouwer et al., 2006) identified three major obstacles encountered by Public Administrations (PAs):

- **Economic:** 44% indicated as main obstacles the perception of increased cost of green products compared to those *not environmentally friendly*;
- **Political:** 35% complained about a lack of organizational resources (including time and money) and of promotion policies for GPP;
- **Cognitive:** 25% complained about a lack of operational and/or information tools and a lack of training; and 35% on a lack of competence in environmental matters and in establishing environmental criteria.

The latter obstacle emerges also from an analysis of calls for tenders, developed to assess the application of GPP. The analysis was carried out by classifying more than 1000 documents both by purpose of competition (e.g. purchase of paper, office supplies, construction work, etc.) and by degree of green criteria (*not green, gray, light green and solid green criteria*). The analysis showed that in many cases, environmental criteria included in call for tenders are unclear. That indicates a lack of knowledge on technical issues and a lack of training in environmental matters by the officers (Bouwer et al., 2006).

Similar results emerged also from a survey carried out in Italy on 249 Italian public administrations (Iraldo et al., 2007) and in UK on 106 organizations from across the public sector (Walker and Brammer, 2009). In the Italian survey, it emerged that among PAs adopting GPP practices (25% of respondents) main problems were:

- Lack of information about the real environmental impacts of the products (27%);
- Difficulty in finding suppliers (27%);
- Difficulty in the preparation of call for tenders and purchasing (23%);
- Lack of guidelines by higher-order authorities (20%);

This last problem, together with internal organizational difficulties, appears to be the main cause that leads 75% of PA respondents to desist from the inclusion of green criteria in the public tenders.

Moreover, a survey carried out by OECD, to investigate the implementation of GPP in National Environmental Policies, found that the most cited barrier by interviewed national representatives was the lack of training for public procurement officers, the lack of information on financial aspects and lack of information on environmental benefits.

These drawbacks were tackled, at the EU and national level, mostly by promoting the use of internet tools on GPP, that have become the most important instrument to deliver environmental information to purchasers, and by developing environmental criteria for the higher possible number of product/service groups (Marron, 2003; Nissinen et al., 2009). Moreover, the European Commission published a guidebook in several languages (EC, 2004b) and established, in the framework of the training toolkit on GPP, two set of GPP criteria (the second on July 2010) covering product and service groups in 18 sectors. Also national guidelines have been published, e.g. in Italy, where the Ministry of Environment has launched a National Action Plan on GPP

and has defined, for some product/service groups, a set of minimum environmental requirements in order to clarify how green criteria can be included in the several stages of public tenders (Iraldo et al., 2008).

It is plausible that these tools and guidebooks increased the information flow on how to adopt green criteria in public tenders and, as a consequence, the level of competences and skills inside the public authority. For this reason, our work mainly aims at understanding if the knowledge and use of these instruments are effective to support public authorities to consider green criteria in their purchasing decisions.

These considerations suggested the first proposition to be verified in our work.

Proposition 1. The awareness on GPP toolkit and regulations does support public authorities to develop GPP practices.

Additionally to these guidance tools, public authorities can fill the gap in internal competences and know-how also by asking for support from external experts on green public procurement. This leads us to our second proposition.

Proposition 2. The support of external experts in purchasing function does support public authorities to develop GPP practices.

The lack of internal know-how, as well as the presence of other significant barriers to the development of GPP practices, is often linked to the small size of organizations that, being characterized by a structural lack of resources, are not able to develop internal competence on how to include green criteria in the public tenders. Confirmations on these assumptions are provided, also, by recent studies applying to GPP issues statistical methods such as correlation tests. Using data collected by a standard questionnaire from 111 public authorities in Norway, Michelsen and de Boer (2009) found clear correlation between the size of municipalities and the focus on green procurement. The size of a municipality is also correlated with several other aspects, such as the existence of a purchasing department and a purchasing strategy. This evidence is circumscribed to Nordic countries and verified by a simple correlation analysis. We aim to test it also in the Italian context using a regression analysis. This leads us to our third proposition.

Proposition 3. The small dimension of public authority is an obstacle to adoption of GPP practices.

3.2. EMS and GPP

Investigating the factors that can support a public authority to develop GPP practices, one cannot undervalue the possibility that there are some complementary factors which can strongly influence the attitude of a public administration to develop such practices.

This is especially true when a public authority pursues environmental excellence by means of different tools or solutions that are strongly synergetic with (and might suggest the adoption of) GPP practices. A prominent example of these tools is represented by environmental management systems (EMS), especially when implemented according to formal standard such as ISO 14001 and EMAS (Iraldo et al., 2009). EMSs like ISO 14001 e EMAS can provide a good basis to develop straightforward and practical GPP implementation and monitoring tools. It would therefore be beneficial to promote and highlight the links between EMS and GPP and how they support each other's goals (Rüdenauer et al., 2007).

In the last years, one can easily observe that more and more EU public authorities are adopting a certified ISO 14001 or EMAS-registered EMS (Norén and von Malborg, 2004; Testa et al., 2011).

The choice of public authorities to adopt an EMS is closely related to their nature and functions, e.g. the role they play in being an example for the communities they govern (firms and citizens) and their need to obtain and maintain their consensus (political consensus above all, within a broader framework of stakeholders' relations) (Daddi et al., 2010; Lozano and Vallés, 2007).

A crucial aspect of certified EMS implementation is the identification and assessment of environmental aspects (Ridolfi et al., 2008). ISO 14001 standard and EMAS scheme explicitly distinguish between “direct” and “indirect” environmental aspects, classifying the second as “an environmental aspect which can result from the interaction of an organization with third parties and which can, to a reasonable degree, be influenced by an organization” (International Standard Organization, 2004).

Just like private organizations, public institutions produce environmental aspects generating direct impacts on the environment such as air emissions, water discharges, production and disposal of solid and other wastes, but they mostly have major “indirect” environmental impacts arising from the way they deliver their services and exert their land planning and control powers (Emilsson and Hjelm, 2007; Von Malmborg, 2003).

In particular, the environmental performance and practices of contractors, subcontractors and suppliers are significant “indirect” environmental aspects (as defined by the EMAS Regulation) that a public organization which has implemented a management system should manage and try to improve. The inclusion of green criteria in public tenders is undoubtedly the most proper way to do it. Moreover, the implementation of a certified EMS implies the adoption of specific operational procedures to manage the significant environmental aspects, even when these are connected to the activities of suppliers and providers of different goods and services. To be compliant with ISO 14001 and EMAS, furthermore, a management system requires that all personnel involved in those activities that can generate environmental impacts is properly trained and possesses adequate skills and competences.

Starting from these considerations, and using a wide sample covering Italian municipalities and provinces, our work aims at demonstrating that an ISO 14001 certified EMS is a key-determinant and a facilitator for the adoption of GPP practices. This leads us to the last proposition for our analysis.

Proposition 4. ISO 14001 certified public authorities are more likely to develop GPP practices.

4. Methods

4.1. Data Description

To analyze the factors influencing the adoption of GPP practices we used data collected by means of interviews within the PROMISE project, co-funded by the European Commission Life + programme. The PROMISE project aims at exploring the dynamics among the main actors in a market arena, in order to define and implement communication strategies and tools able to tackle on citizens lifestyles and on choices of producers, retailers, consumers and public authorities as well as to raise their awareness about environmental impacts of products.

The focus on three Italian regions (representing the 190.38% of Italian resident population and 15% of overall national territory—ISTAT, 2010) is justified by their active experience in supporting GPP both by legislative initiatives and by in-field projects (for a detailed overview of these initiatives see Iraldo and Testa, 2007).

The survey was implemented in the first half of 2010 in Lazio, Liguria and Emilia Romagna, at municipality and province levels, and aimed at collecting information on green procurement adoption and its drawbacks.

The data were collected by a telephone interview using a standard questionnaire. The interviewers engaged in the survey had been previously trained through *ad hoc* meetings to learn the approach to be applied. The questionnaire was composed of 15 questions distributed into four sections: the first section focuses on the characteristics of the public body; the second section investigates the awareness on environmental issues at strategic level; the third and fourth sections aim at measuring the public “green initiatives” towards citizens and market.

Overall, 156 public authorities were interviewed, both municipalities and provinces: 53 from Emilia Romagna, 50 from Liguria and 38 from Lazio Region. The respondents were purchasing managers or environmental managers. Table 2 shows some details about the interviewed public authorities and the sampled population.

In order to minimize the common method bias that can affect a questionnaire survey (i.e. social desirability bias, leniency bias, acquiescence bias, consistency motif) several procedural remedies were used, such as:

- A methodological separation amongst the different measurements of the study was created in order to get a temporal and psychological separation. Furthermore, we used different response formats for the questions;
- In order to minimize the items ambiguity, ambiguous or unfamiliar terms were not used; vague concepts or complicated syntax were avoided; questions simple, specific, and concise were kept;
- In order to minimize socially desirable, lenient, acquiescent, and consistent bias, all respondents were guaranteed anonymity.

4.2. Estimation Methodology

Having defined the theoretical model, we propose the following equation to the test our proposition

$$GPP = \alpha_0 + \beta_1 AWARENESS + \beta_2 POPULATION + \beta_3 ISO14001 + \beta_4 EXTERNAL-ASSIST. + \beta_5 REGION + \varepsilon \quad (1)$$

Several methods were used in the past to measure the state and progress in GPP such as questionnaires (e.g. Ochoa and Erdmenger, 2003) and interviews (Michelsen and de Boer, 2009) and tender analysis (Bouwer et al., 2006; Nissinen et al., 2009).

Each method showed some advantages, but also some important limitations. Kippo-Edlund et al. (2005) reviewed several questionnaire studies and found that the response rate had been low in all of them. In addition, such studies obviously give insight mostly to the practice of “green” purchasers (e.g. Ochoa and Erdmenger, 2003). Telephone interviews, on the other hand, can reach a good response rate, but the information gained is still based on the assessment by the purchaser (Nissinen et al., 2009). Finally, tenders analysis could be strongly influenced by researchers' interpretation if a rigorous method of analysis misses.

Starting from these considerations, we measured the level of GPP in public administrations in two ways, in order to guarantee a high

Table 2
Sample's details.

Region	Public authority	Number	No. of public authorities in the region	%	Population	Regional population	%
Emilia Romagna	Municipality	46	348	13.2	1.581.432	4395.569	36
	Province	7	9	77.8	3.018.210		68.7
Lazio	Municipality	36	378	9.52	3.400.238	5681.868	59.8
	Province	2	5	40	4.472.823		78.7
Liguria	Municipality	48	235	20.4	208.829	1615.986	3.67
	Province	2	4	50	510.921		31.62

robustness of our results. Firstly, by means of interviews, we asked if public administration has published a green tender in the last year; secondly we asked how many green tenders were published in the last year. In order to avoid misunderstanding on the concept of green tender, a methodological annex was sent to the interviewees where, according to European guidelines, examples of green criteria at the different stages of the tender were included.²

Additionally, to test the validity of answers, we asked to interview public authorities to send us some example of green tenders that they have considered to answer to the questionnaire, in order to verify the presence of environmental criteria according to the European criteria. Just in few cases (less than 3%) a “false” green tender was found.

Having two different measures for the dependent variables, we used two statistical tools for testing our propositions: a logistic model and an ordered probit model.

To measure the *level of awareness on GPP toolkit and regulations* we used the answers to the following question: *Which of the following regulations and toolkit on public green consumption, the Public Administration have used in own purchasing process?* Assigning a value 1 to each set of regulation marked by a respondent, an index varying from 0 to 6 was created by the sum of each answer (see Table 3 for details).

To measure the size of public administration (Population) we used a categorical variable that assign 1 of the governed population if less than 5000 and 3 if it is more than 15 000. The answer to this question was checked by means of the official site of Statistical National Institute (ISTAT) that each year publish data on resident population in each municipality and province.

The variable measuring external assistance was created using the answer to the following question: *Regarding the following product categories, was the purchasing process carried out in a centralized manner or by the support of external experts?* Assigning a value 1 to each product category marked by a respondent, an index varying from 0 to 7 was created by the sum of each answer.

In addition, we considered the adoption of an environmental management system certified ISO 14001 as an explanatory variable checking this information on the official website of the Italian Accreditation Body—Accredia.

Finally, in order to capture the effect of external context and its possible implications on the public authorities' decision-making we also consider their geographical location.

Table 4 provides descriptive statistics for the study's variables.

Since the variable “Population” is correlated to the adoption of a certified EMS according to ISO 14001 standard and to the use of external experts in purchasing function, a multicollinearity problem could affect the reliability of some coefficients estimation. For this reason, to test our hypotheses, we split these three variables in two equations (in the first equation we estimate the effect of population on GPP; in the second one we estimate the effect of ISO 14001 and external assistance, see Table 4 for details).

5. Results

The most significant outcome of our model is that the awareness on GPP initiatives and tools is highly significant in determining both the choice to adopt GPP and the number of tenders that are adopted with the inclusion of environmental criteria (See Table 4). The more a public administration is informed and acquires competence and know-how in developing GPP practices, the more it is eager to experiment these new procedures and introduce greener criteria in the tenders.

² Examples on the following product/service/ works categories: copying and graphic paper; cleaning products and services, office it equipment, construction; transport, furniture; electricity; food and catering services; textiles; gardening products and services; thermal insulation; hard floor-coverings; wall panels; combine heat and power (CHP; road construction and traffic signs). The information included was collected on the European Commission GPP web site: http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

Table 3
Sectoral laws and toolkit used for measuring awareness on GPP regulation.

European	European guideline on GPP—communication from the Commission to the European Parliament, Public procurement for a better environment COM(2008) 400
National	Legislative decree no. 163/06 code of public tender National action plan on GPP and related decrees (Ministry of Environment Decree 11 April 2008) Ministerial decree no. 203/2003 (circolare 4 August 2004, plastic sector; circolare 22 March 2005, soil sector; circolare 8 June 2004, textile sector; circolare 3 December 2004 paper sector) Legislative decree no. 195/2005 on energetic efficiency of buildings
Regional	Regional laws different for each region

Table 4
Descriptive statistics.

	Mean	Standard deviation	Minimum	Maximum	No. of cases
GPP	0.426	0.496	0	1	143
GPP—green tender	0.895	1.590	0	11	143
Awareness	2.566	1.684	0	6	143
Population	1.986	0.813	1	3	143
ISO 14001	0.356	0.480	0	1	143
External assistance	0.440	1.208	0	7	143

This is a confirmation of a great bulk of anecdotal evidence showing that the information campaign, sensitization on GPP opportunities and training courses for purchasers are actually increasing the capability of public bodies to adopt and effectively “use” environmental criteria in their purchasing strategies and decisions (Iraldo et al., 2007). About the several stages of a “tendering process” where the environmental criteria can be included, 54% of the public authorities³ declare that environmental criteria are mainly included in technical specifications, 35% of them declare that green criteria are principally included in assessing the technical expertise of competitors, 23% of them in choosing the award criteria and 10% generally use environmental criteria in the execution of supply or service contract.

Another confirmation to many empirical cases comes from Eq. (1) (Michelsen and de Boer, 2009). It is rather clear that, based on the results of our model, population as a proxy of the municipality (or province) dimension is a significant variable to explain the policies focused on “greening public procurement”. This is certainly caused by, on the one hand, the larger availability of economic resources to be spent in public procurement by the larger administrations, that makes it easier to focus on more sustainable products and services and to overcome the problem of adopting a selection criterion based on the “most economically advantageous tender”. On the other hand, the larger administrations usually spend their budget on a wider set of products and services, offering much more possibilities to develop a green purchasing strategy at the operational level.

Strictly linked to the issue of resources is the choice (or possibility) for much public administrations to rely on external assistance to include environmental criteria in the public tenders. This variable positively affects the probability of implementing GPP practices. This is quite obvious if one thinks of the role that external assistance can play in developing such initiatives. An external consultant, for example, can be a valuable support in identifying the juridical boundaries of the tender, choosing the correct and most appropriate modalities to include environmental criteria and specifying the most effective and proper requirements in

³ Note that only 40 interviewees provided this information concerning the phase of the purchasing process in which the environmental criteria are included.

order to guide the tendering procedure towards the desired product or service environmental performance, by articulating the corresponding criteria under the technical point of view.

What is rather surprisingly emerging from our model is that ISO 14001 certification is slightly significant in the two equations: the choice to develop GPP initiative and the number of tenders that a public administrations sets up to pursue GPP objectives.

ISO 14001 standard requires that an organization manages its “indirect” environmental aspects and tries to continually improve the environmental performance linked to them. As mentioned above, the environmental performance of suppliers and products purchased by a public authority represents a key aspect, which can be strongly influenced by the public organizations by their purchasing decisions and actions. For this reason, we could expect that the adoption of an ISO14001 certified EMS could significantly support the PA to set up and implement a GPP strategy. On the contrary, our results show that this link is not so evident and this is counterfactual to many case-studies and other anecdotal evidence, that normally find in an EMS a very effective way to stimulate the adoption of GPP and a very strong methodological ground on which to build a GPP-oriented strategy, as part of an EMS indirect environmental aspects management and improvement (Swanson et al., 2005; Von Malmberg, 2003).

Finally, with respect to the potential effect of the regional location, we found that public authorities of the Lazio region (center of Italy) are less likely to develop GPP initiatives compared to the public authorities located in the Emilia Romagna region (north of Italy) (Table 5).

6. Discussion and Conclusions

The results emerging from our model show a straightforward way to be followed for future development of GPP procedures. The suggestions deriving from the analysed results are a clear signal for both the policy maker and the managers of the public organizations that might be interested by and in GPP.

First of all, a primary managerial implication of our model refers to the strong need for a public administration that intends to develop a GPP-oriented strategy to strongly rely on awareness, competence and know-how of its personnel involved in the purchasing activities at different levels.

Our results clearly emphasise the need for an organization to implement an effective awareness-raising action on its human resources, both by means of spreading information on GPP tools and opportunities and by intensively training the key-personnel on how to set up a tendering procedure, define the requirements, qualify the suppliers, identify the best offer for “sustainable value for money”, etc. According to Nissinen et al. (2009) we should point out that these kinds of actions are often difficult to design, plan and implement because they are strongly interdisciplinary. In order to develop an effective “green tender”, a public administration needs to be trained on technical aspects (i.e. environmental criteria for a product category and their application), legal

aspects (i.e. how to define the contents and express them in the call for tender) and economic aspects (i.e. how to evaluate the “environmental value” of the offer and integrate it in the monetisation of the price). This provides a suggestion also at the policy level: it is undisputable that, rather than drafting guidelines or developing “toolboxes” ready-to-use on GPP, the EU, national and regional governments should focus on how to raise the level of awareness and the know-how within the public administrations that could adopt a GPP-oriented strategy (Bouwer et al., 2006)

Another relevant issue to be discussed regards the dimension of public administrations adopting GPP. What has been acknowledged on empirical bases in the last years is undoubtedly true: smaller authorities and government do face higher barriers in developing GPP initiatives (Michelsen and de Boer, 2009). This is very trivial to be sketched out by a statistical model, but not so simple to solve as an organizational problem. Is it only a question of economic resources? If this had been the main barrier, probably many of the pilot projects and support and funding actions carried out by several Member States and Regions in the most recent years would have solved it. It does not seem that this is the situation, though.

What is probably missing, in small public organizations, is also the capability to define, within the organization, the proper responsibilities, roles and functions to deal with the GPP challenge. Very lean organizational structures do not allow for specialised personnel or full-time managers dealing with GPP, that can have the time and the opportunities to get trained, accrue information and stimuli, develop *ad hoc* competences and skills that are crucial to tackle the GPP implementation process (Rüdenauer et al., 2007). If one wants to get a non-trivial suggestion from our results relating to dimension, this could be read as a clear recommendation to start conceiving, designing and implementing organizational solutions and new functional models that can enable small public administration to develop high-profile, interdisciplinary and technically problematic knowledge.

A last indication comes from our results with regard to EMSs as potential leverages to prompt the development of GPP initiatives and to sustain this process thanks to a “strong” organizational and managerial framework: the environmental management system. It is commonly believed that the implementation of an EMS prepares GPP insofar as it imposes the adoption of procedures and criteria to identify and select suppliers on the basis of their environmental performance (Emilsson and Hjelm, 2007). Moreover, both EMAS and ISO 14001 place particular emphasis on the so-called “indirect environmental aspects”, among which the suppliers’ behaviour and the ways to stimulate their improvement assumes a predominant role (Ridolfi et al., 2008). On these bases, one would expect a very significant relation between ISO and GPP stemming from our model. This is not the case, and there could be several reasons explaining this outcome.

First of all, there is increasing evidence that EMSs are applied by public administrations by focusing mostly on “direct environmental aspects” and, therefore, undermining the importance of the “indirect”

Table 5
Results of regression measuring the determinant of GPP.

	GPP				No. of green tender			
	(1)		(2)		(1)		(2)	
	Coefficient	z	Coefficient	z	Coefficient	z	Coefficient	z
GPP awareness	0.24	2.10**	0.22	1.99**	0.18	2.97***	0.19	3.07***
Population	0.57	1.99**			0.42	2.62***		
ISO 14001			0.90	1.93*			0.45	1.79*
External assistance			0.32	1.99**			0.12	1.98**
Lazio region	−0.92	−1.93*	−0.52	−1.03	−0.53	−2.05**	−0.29	−1.06
Liguria region	0.75	0.15	−0.65	−1.21	−0.01	0.99	−0.51	−1.79*
Constant	−1.87	−2.59**			−0.47	−1.98**		
No. of observations			143		143		143	
LR chi ²	17.69***		18.83***		28.64***		22.97***	
Pseudo R-square	0.090		0.096		0.080		0.064	

ones (Von Malmborg, 2003). This is due to a lack of knowledge and operational support tools for the interpretation and methodological approach to the “indirect aspects” that is preventing many environmental managers within public administrations to correctly tackle this issue.

Secondly, GPP and voluntary certifications (e.g. ISO 14001 or EMAS) are often considered by public organizations (e.g. local government) as two different ways of proving the environmental commitment to the stakeholders (e.g. the electorate). This implies that the scarce economic resources are invested in pursuing one of these two objectives, neglecting the synergies between them and aiming at obtaining short-run results to be spent in terms of consensus-building towards the stakeholders (Günther and Scheibe, 2006).

There are also some limitations to our study that should be stressed. First, we use self-reported data collected by a questionnaire. A tenders' analysis for checking the use of environmental criteria defined by European commission should be carried out even if a systematic collection of tender allowing an extraction of a representative sample still misses. Moreover, we have investigated use of environmental criteria in tenders but no information was collected on the role that these criteria had in the assignment of contract. We strongly suggest, therefore, that future research focuses on what are the stages of the purchasing processes in which environmental criteria are included and, especially, whether and to what extent these criteria were determinant to select the contractor.

As mentioned above, the legal framework provides details on how environmental criteria are included for about 18 product categories. Hence, scholars and practitioners should (i) analyze if there are differences in GPP implementation among the product categories and for which of them public authorities have encountered higher obstacles and drawbacks; (ii) investigate the different application and effects of different kind of environmental criteria such as performance and functional criteria and (iii) investigate the potential synergies among the available European environmental policy instruments, including GPP, Ecolabel, EMAS and the product environmental footprint, with a truly interdisciplinary approach, in order to point out their strengths and weaknesses and to identify the margins for improving these synergies.

Finally, more research is needed to understand the effect of green public procurement on economic systems. In detail, it would be very notable to analyze if GPP is able to steer firms and supply chains into greener development path promoting resource saving and green innovation.

Acknowledgments

The surveys were financed by the European Commission “Life plus” funding programme. In particular, our research work was funded by ERVET, a partner in PROMISE. Moreover, the authors thank all the partners of the Life PROMISE project for the collection of data and the support provided in interpreting them.

References

- Bolton, P., 2006. Government procurement as a policy tool in South Africa. *Journal of Public Procurement* 6, 193–217.
- Bolton, P., 2008. Protecting the environment through public procurement: the case of South Africa. *Natural Resources Forum* 32, 1–10.
- Bouwer, M., Jonk, M., Berman, T., Bersani, R., Lusser, H., Nappa, V., Nissinen, A., Parikka, K., Szupping, P., Viganò, C., 2006. Green public procurement in Europe 2006—conclusions and recommendations. Virage Milieu & Management bv, Korte Spaarne 31, 2011 A Haarlem, the Netherlands. Available form, http://ec.europa.eu/environment/gpp/pdf/take_5.pdf [Visited November 26, 2010].
- Daddi, T., Testa, F., Iraldo, F., 2010. A cluster-based approach as an effective way to implement the Environmental Compliance Assistance Programme: evidence from some good practices. *Local Environment* 15 (1), 73–82.
- Edler, J., Georgioli, L., 2007. Public procurement and innovation—resurrecting the demand side. *Research Policy* 36, 949–963.
- Emilsson, S., Hjelm, O., 2007. Managing indirect environmental impact within local authorities' standardised environmental management systems. *Local Environment* 12, 73–86.
- European Commission, 2001a. Commission Interpretative Communication on the Community law applicable to public procurement and the possibilities for integrating environmental considerations into public procurement. COM(2001) 274 final, Brussels.
- European Commission, 2001b. Green Paper on Integrated Product Policy COM(2001) 68 final. Brussels.
- European Commission, 2004a. Directive 2004/18/EC - Directive of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (2004/18/EC). *Official Journal of the European Union* 114–240 (30.4.2004).
- European Commission, 2004b. Buying green! A handbook on environmental public procurement. Available at, http://ec.europa.eu/environment/gpp/pdf/buying_green_handbook_en.pdf [Visited May 12, 2011].
- European Commission, 2007. Guide on dealing with innovative solutions in public procurement –10 elements of good practice, Luxembourg: SEC(2007) 280, Brussels.
- European Commission, 2008a. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the sustainable consumption and production and sustainable industrial policy action plan. COM(2008) 397/3, Brussels.
- European Commission, 2008b. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions Brussels, Public procurement for a better environment, COM(2008) 400/2, Brussels.
- European Commission, 2009. Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a community eco-management and audit scheme (EMAS), Brussels.
- European Commission, 2010. Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel, Brussels.
- European Parliament, 2002. Decision of the European Parliament and of the Council laying down the Sixth Community Environment Action Programme (1600/2002/EC) *Official Journal of the European Union* 1–15 (10.9.2002).
- Günther, E., Scheibe, L., 2006. The hurdle analysis. A self-evaluation tool for municipalities to identify, analyse and overcome hurdles to green procurement. *Corporate Social Responsibility and Environmental Management* 13, 61–77.
- Hall, M., Purchase, D., 2006. Building or bodging? Attitudes to sustainability in UK public sector housing construction development. *Sustainable Development* 14, 205–218.
- Ho, L.W.P., Dickinson, N.M., Chan, G.Y.S., 2010. Green procurement in the Asian public sector and the Hong Kong private sector. *Natural Resources Forum* 34, 24–38.
- International Standard Organization, 2004. ISO 14001: environmental management systems—specification with guidance for use. International Standard Organization.
- Iraldo, F., Testa, F., 2007. Il Green Public Procurement: le novità normative e le esperienze in Italia e in Europa sul tema degli acquisti verdi. *Largo Consumo* 12, 32–39.
- Iraldo, F., Melis, M., Testa, F., 2007. L'attuale sviluppo del Green Public Procurement. *Economia delle Fonti di Energia e dell'Ambiente* 1, 5–19.
- Iraldo, F., Testa, F., Ricotta, S., 2008. Il GPP in Italia: l'emaneazione del Piano Nazionale degli Acquisti Verdi. *Inquinamento* 3, 56–62.
- Iraldo, F., Testa, F., Frey, M., 2009. Is an environmental management system able to influence environmental and competitive? The case of the eco-management and audit scheme (EMAS) in the European Union. *Journal of Cleaner Production* 17, 1444–1452.
- Kippo-Edlund, P., Hauta-Heikkilä, H., Miettinen, H., Nissinen, A., 2005. Measuring the environmental soundness of public procurement in Nordic countries. *TemaNord* 2005, vol. 505. Nordic Council of Ministers, Copenhagen. Available at, http://www.norden.org/da/publikationer/publikationer/2005-505/at_download/publicationfile [Visited December 18, 2010].
- Li, L., Geiser, K., 2005. Environmentally responsible public procurement (ERPP) and its implications for integrated product policy (IPP). *Journal of Cleaner Production* 13, 705–715.
- Lozano, M., Vallés, J., 2007. An analysis of the implementation of an environmental management system in a local public administration. *Journal of Environmental Management* 82 (4), 495–511.
- Marron, D., 2003. Greener public purchasing as an environmental policy instrument OECD. *Journal on Budgeting* 3, 71–105.
- Mathisen, T.A., Solvoll, G., 2008. Competitive tendering and structural changes: an example from the bus industry. *Transport Policy* 15, 1–11.
- Michelsen, O., de Boer, L., 2009. Green procurement in Norway; a survey of practices at the municipal and county level. *Journal of Environmental Management* 91, 160–167.
- Murray, J.G., 2000. Effects of a green purchasing strategy: the case of Belfast City Council. *Supply Chain Management: An International Journal* 5, 37–4.
- Nissinen, A., Parikka-Alholaa, K., Ritab, H., 2009. Environmental criteria in the public purchases above the EU threshold values by three Nordic countries: 2003 and 2005. *Ecological Economics* 68, 1838–1849.
- Norén, H., von Malmborg, F., 2004. Are standardised EMSs useful in local authorities? A study of how a tool from the private sector is used in the public sector. *Business Strategy and the Environment* 13, 187–197.
- Ochoa, A., Erdmenger, C., 2003. Study contract to survey the state of play of green public procurement in the European Union. Final report. ICLEI European Secretariat, Eco-Procurement Programme. Available at: ec.europa.eu/environment/gpp [Visited November 28, 2010].
- Parikka-Alholaa, K., 2008. Promoting environmentally sound furniture by green public procurement. *Ecological Economics* 68, 472–485.
- Parikka-Alholaa, K., Nissinen, A., Ekroos, A., 2007. Green award criteria in the most economically advantageous tender in public purchasing. In: Thai, K.V., Piga, G. (Eds.),

- Advancing Public Procurement: Practices, Innovation and Knowledge sharing. PrAcademic Press, Boca Raton, Florida, pp. 257–279.
- Preuss, L., 2007. Buying into our future: sustainable initiatives in local government procurement. *Business Strategy and the Environment* 16, 354–365.
- Ridolfi, R., Andreis, D., Panzieri, M., Ceccherini, F., 2008. The application of environmental certification to the province of Siena. *Journal of Environmental Management* 86, 390–395.
- Rüdenauer, I., Dross, M., Eberle, U., Gensch, C.O., Graulich, K., Hünecke, K., Koch, Y., Möller, M., Quack, D., Seebach, D., Zimmer, W., Hidson, M., Defranceschi, P., Tepper, P., 2007. Costs and benefits of green public- general recommendations procurement in Europe, Service contract number: DG ENV.G.2/SER/2006/0097r. Available from: ec.europa.eu/environment/gpp/ [Visited November 19, 2010].
- Swanson, M., Weissman, A., Davis, G., Socolof, M., Davis, K., 2005. Developing priorities for greener state government purchasing: a California case study. *Journal of Cleaner Production* 13, 669–677.
- Testa, F., Iraldo, F., Frey, M., 2011. The effect of environmental regulation on firms' competitive performance: the case of the building and construction sector in some EU regions. *Journal of Environmental Management* 92, 2136–2144.
- Tukker, A., Emmert, S., Charter, M., Vezzoli, C., Sto, E., Andersen, M.M., Geerken, T., Tischner, U., Lahlou, S., 2008. Fostering change to sustainable consumption and production: an evidence based view. *Journal of Cleaner Production* 16, 1218–1225.
- Von Malmborg, F., 2003. Environmental management systems: what is in it for local authorities? *Journal of Environmental Policy & Planning* 5, 3–21.
- Walker, H., Brammer, S., 2009. Sustainable procurement in the United Kingdom public sector. *Supply Chain Management: An International Journal* 14, 128–137.