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LITERATURE REVIEW OF GREEN PROCUREMENT POLICIES AND THEIR APPLICATIONS IN THE PHARMACEUTICAL INDUSTRY

Amani, Farnaz [(1)]; Bastante-Ceca, Mª José [(2)]; González-Cruz, Mª Carmen [(2)]; Aragonés-Beltrán, Pablo [(2)]

[(1)] University of Science & Culture, [(2)] GIDDP, Universitat Politècnica de València

Logistics activities play a prominent role in activating manufacturers and distribution channels, and pharmacies. It is considered as a development area for the pharmaceutical sector. Green logistics can be used to minimize the negative impacts of these activities on the environment because of the competition among pharmaceutical companies, environmental laws, environmental awareness and high consumer sensitivity. The inventory management of medicines is different depending on their specific characteristics with other products. Medicines are among perishable items. If each of them expires, it can be used no longer and a cost is incured for its disposal. One of the most important things in the pharmaceutical industry is to study the risks and benefits of medicines with regard to human health, not the impact on the environment. In the pharmaceutical sector, all environmental information of drug manufacturers is confidential, due to competition between companies and strict laws of green claims.
This article examines the uses of green logistics in the pharmaceutical industry through a review of the published scientific literature.
The results and conclusions of this review will allows us to sort through articles and review different situations, to identify all the changes over time with the objective to find research gaps.

Keywords: green logistics; pharmaceutical industry; green procurement; ecological logistics

REVISIÓN BIBLOGRÁFICA DE LAS PRÁCTICAS DE COMPRA VERDE Y SU APLICACIÓN A LA INDUSTRIA FARMACÉUTICA

La logística desempeña un papel destacado en la activación entre fabricantes, canales de distribución, y farmacias. La logística ecológica se puede utilizar para minimizar los impactos negativos de estas actividades, debido a la competencia entre las empresas farmacéuticas, las leyes ambientales, la conciencia ambiental y la alta sensibilidad de los consumidores. La gestión del inventario de los medicamentos es diferente debido a sus características específicas diferentes de otros productos. Los medicamentos se encuentran entre los artículos perecederos. Si alguno de de ellos caduca, ya no se puede utilizar y se genera un coste de su eliminación. Uno de los aspectos más importantes de la industria farmacéutica consiste en analizar los riesgos y beneficios de los medicamentos respecto a la salud humana, no el impacto sobre el medio ambiente. En el sector farmacéutico, toda la información ambiental de los fabricantes de medicamentos es confidencial, debido a la competencia entre las empresas, y las leyes estrictas de reclamaciones ecológicas. Este artículo examina el empleo de la logística verde en la industria farmacéutica a través de una revisión de la literatura científica. Los resultados nos permitirán identificar la evolución a lo largo del tiempo, con el objetivo de encontrar lagunas de investigación.

Palabras clave: logística verde; industria farmacéutica; compra pública verde; logística ecológica

Correspondencia: María José Bastante Ceca mabasce1@dpi.upv.es

1. Introduction

One of the most important factors for survival in today's highly competitive environment is lower production costs. Choosing the right suppliers can significantly reduce purchasing costs and increase the competitiveness of the organization, as in most industries, the cost of raw materials and components constitutes a major part of the cost of the product. It takes. Today, selecting and evaluating suppliers is an important responsibility that should be taken into consideration by purchasing managers and the importance of selecting suppliers is high. Choosing suppliers is the most important responsibility for purchasing. There is now another concept called supply chain management, which has led researchers and lawyers to conclude that supply selection selection management is a factor that increases competition throughout the supply chain (Marangi, 2014).

2. Review of the general literature topic

Studies have recognized public procurement as one of the policy instruments most suitable for achieving environmental-sustainability (Crosbey et al, 2008. Lundberg et al, 2015). Green public procurement (GPP) has been practiced since the 1990s, but there is still a large, unrealized potential to use it in a more coordinated manner to reach sustainability objectives (Milios et al , 2017). Green procurement considers environmental issues through total cost of product ownership and product life cycle analysis (Correia et al, 2013. Lian, P.C.S et al, 2004).The concept of green procurement is used synonymously with terms such as environmentally responsible procurement (Bakir et al, 2013), sustainable procurement (Aktin et al, 2016), and eco procurement (Bolton, 2008). The focus of the specific task regarding green procurement differs based on organizations' objectives. For example, organizations may consider purchase of products made from recycled materials, inclusion of environmental criteria in green supplier selection (Igarashi, M et al, 2013). As "green public procurement" (GPP) is playing an increasingly important role in stimulating the demand for environmentally friendly products and services, there is a strongly emerging need to analyze which factors drive the inclusion of environmental criteria in public tenders (Testa, 2016). In the perishable materials industry, especially the pharmaceuticals, there is an undeniable role of supply-side demand along with cost targets. Designing an integrated supply chain to facilitate product delivery to customers in a timely manner facilitates this. The challenge begins when designers encounter drugs that are no longer usable after their expiration date. The important thing is to minimize error and disturbance so as to minimize the amount of unwanted shortage and create a consistent process (Mousazadeh et al, 2015). The quality of drug service delivery in pharmacies is an important challenge in pharmacy management. Pharmacies can provide medication separately. However, most pharmacy managers are physicians and have no expertise in managing inventory. As a result, it is another factor in increasing the cost of providing pharmaceutical services and reducing customer satisfaction (Khorasani et al, 2017). Properly controlling the inventory level at hand in order to obtain a system-wide acceptable level of service, determining the amount of ordering per order period, as well as determining the point of re-ordering in a multi-level and multi-location supply chain is very important and of course difficult. The complexity of this issue is even greater when it comes to inventory control planning for corruptible items. This complexity is often such that analytical models fail to provide a precise mathematical model for such problems (Dong et al, 2017).

Table 1: Research Trend Background Table on Suppliers and Corruptive Items Review

Researcher	Year	Goal				Considering the perishability of the product	Risk in decision making	Modeling*			Modeling method	Modeling type	Planning
		Product quality	Delivery time and accountability	Reduce the cost level	Increase interest rates			M	S	H			
Rahimi et al.	2017			X		X		X				Complex integer linear programming model	Single period
Mohammadi	2017		X		X	X		X				The problem of complex nonlinear integer programming	Single period
Vaezi et al.	2017			X		X		X				The problem of complex nonlinear integer programming	Single period
Tjik et al.	2017	X			X	X		X			Linear programming		Single period
Entezari	2015	X	X	X				X				LP-Metric	Periodic
Akbari et al.	2015			X		X			X		NPW		Single period
Mirpanahi	2015	X	X	X					X		Fuzzy multi criteria decision making technique		Single period
Afzalian	2014	X	X	X					X		Fuzzy multi criteria decision making technique		Single period
Khosroabadi	2014			X						X		Complex integer linear programming model	Single period
Khoshreza	2016		X			X			X			The problem of complex nonlinear integer programming	Single period
Ariannejad	2011		X					X			Fuzzy multi criteria decision making technique	LP-Metric	Periodic
Sadeghimoghadam et al.	2009			X		X			X			LP-Metric	Periodic
Torabi & Bastami	2018		X							X	Multi-purpose programming model	MINLP	Single period
Ghadimi	2018		X	X						X	Fuzzy multi criteria decision making technique	MINLP	Single period
Sapershen et al.	2018						X	X			Fuzzy multi criteria decision making technique		Single period
Lotra et al.	2017		X	X				X			Fuzzy multi criteria decision making technique		Single period
Ataran	2017	X		X				X				MINLP	Single period
Kin et al.	2014				X	X		X				LP-Metric	Periodic
Musazadeh	2015	X				X		X				Dual purpose linear model	Single period

*M: Math; S: Statistical; H: Hybrid

3. Papers collection and research methodology

The next step in the literature review is an important and sensitive step to limiting research and distinguishing it from other research. In this section, we will discuss articles focusing on Green public procurement (GPP) and discuss some of the more sensitive and general issues that are currently relevant to this topic. The necessary information was collected using the retrieval of books, theses, researches and studies of other researchers. To gather information on the theoretical foundations and literature of the subject research, from library sources, articles, required books from Latin and Persian books, theses and especially Latin journal articles from reputable databases such as Sciencedirect, IEEE and springer, Scopus, used. In this section, we will try to reach the goals of the paper mentioned in the previous sections and try to find other research gaps. Based on our review of the literature, analysis of articles that help us get to the conclusion, we provide the information we need to know and collect in the field. In this section of the article, we present all the steps used to examine the literature. It is worth noting, however, that a careful and well-organized review of the literature on the subject can help advance the development of research and can provide new study areas, new opportunities and useful information to other researchers for future research. We have restricted them to the collection of articles and references to the following that all limitations are identified in the remainder of the research. We have analyzed articles focused on the topic of Green public procurement (GPP) for the period 2010 to 2020. In this section, we cover all stages of reviewing the research literature. In the literature review, we reviewed articles on suppliers and the supply chain of perishable items and provide a summary of the articles in Table 1 in full detail. In the next section, we provide general information about GPP in Table 2. Selection and collection of articles is based on a structured approach, including articles on the application of GPP in the field of perishable items (pharmaceuticals) and articles on Green supply chain management (GSCM) practices and supply chain performance. We used the following keywords to collect articles: Green Public Procurement, Sustainable Public Procurement, Pharmaceutical Industry, Green Supply Chain Management, and Green Public Procurement. In addition to detailing the articles, we also look at the journals in which the GPP articles are published in the pharmaceutical industry. The total number of articles read was 345 articles, including theses, articles, chapters of books, and so on. We selected 60 articles that were fully standardized in the GPP field and 30 articles in GSCM fields. After describing the initial tables of the selected articles' specifications, we will go into more detail, examining and presenting the Green public procurement (GPP) applications and GSCM practices collected from all the articles. We have eliminated articles that were not in our field of study and which had nothing to do with our subject matter and there were some ambiguities. Our goal is set out in the questions at the beginning of the article, and we will move on to our goals, looking for gaps and providing solutions for further research, and this method has helped us to anchor the articles.

4. Validation of the research

According to Seuring and Muller (2008) the systematic review approach ensures the objectivity and validity of the research steps used. Generally, research started around 2000 with the Murray & Warner GPP topic and began to develop over time. But and in this research, we plan to show the charts of articles in this field from 2010 to 2020. And it should be noted that GPP is on its upward trajectory.

Figure 1: Screening methodology

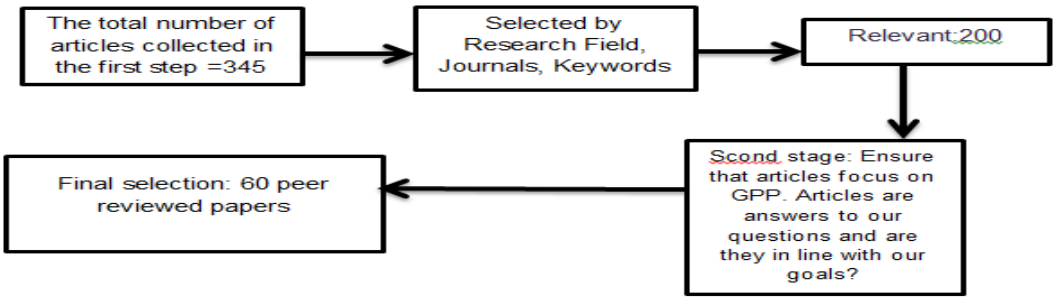

Table 2: Distribution of number of journal articles over the last 10years

JOURNAL	Nº	PERIOD
Journal of Public Procurement	1	2012
Environment, Development and Sustainability	1	2015
Environmental and Resource Economics	2	2015-2016
Ecological Economics	2	2010-2012
Energy	1	2011
Energy Policy	1	2014
Journal of Cleaner Production	30	2010-2019
Journal of Industrial Ecology	1	2010
Journal of Integrative Environmental Sciences	1	2012-2015
Natural Resources Forum	1	2010
Resources, Conservation and Recycling	2	2016-2018
Waste Management & Research	1	2012
Research in Social and Administrative Pharmacy	3	2013-2016
Omega	3	2012-2015
Transportation Research Part E	1	2018
Journal of Purchasing & Supply Management	3	2013-2016
Process Safety and Environmental Protection	2	2017-2018
European Journal of Operational Research	4	2014-2018

Table 2 lists the names of the journals used, along with their dates, and Table 3 provides further explanations of the articles, including countries and types of research.

Table 3: Further explanations of the articles

NO	Author	Year	Research Location	Research method	Type of data
1	Ho et al.	2010	China, Korea, Thailand	Case studies	Mixed
2	Larsen & Hertwich	2010	Norway	Document analysis	Qualitative

3	Brammer & Walker	2011	UK	Surveys	Qualitative
4	Tarantini et al.	2011	Italy	Case studies	Qualitative
5	Lundberg & Marklund	2011	Sweden	Theory	Qualitative
6	Erridge & Hennigan	2012	Ireland	Surveys	Qualitative
7	Oruezabala & Rico	2012	France	Case studies	Qualitative
8	Melissen & Reinders	2012	Netherlands	Document analysis	Qualitative
9	Arvidsson & Stage	2012	Sweden	Case studies	Quantitative
10	Parikka-Alhola & Nissinen	2012	Europe	Case studies	Quantitative
11	Testa et al.	2012	Netherlands	Surveys	Quantitative
12	Walker & Brammer	2012	UK	Surveys	Quantitative
13	Rietbergen & Blok	2013	Sweden	Document analysis	Quantitative
14	Correia et al.	2013	China	Theory	Qualitative
15	Bratt et al.	2013	Sweden	Case studies	Qualitative
16	Zhu et al.	2013	De, Se, Dk, Ch, Hu	Surveys	Qualitative
17	Lundberg & Marklund	2013	Denmark	Theory	Qualitative
18	Guenther et al.	2013	Italy	Case studies/Surveys	Mixed
19	Mosgaard et al.	2013	Italy	Surveys	Mixed
20	Testa et al.	2014	Italy	Surveys	Quantitative
21	Rizzi et al.	2014	Malaysia	Case studies	Qualitative
22	Annunziata et al.	2014	USA	Document analysis	Quantitative
23	McMurray et al.	2014	Netherlands	Surveys	Quantitative

24	Simcoe & Toffel	2014	Europe	Document analysis	Quantitative
25	Rietbergen et al.	2014	Netherlands	Exploratory research design	Mixed
26	Nikolaou et al.	2015	Europe	Surveys	Quantitative
27	Testa et al.	2015	Italy	Content Analysis	Mixed
28	Lundberg et al.	2015	Sweden	Document analysis	Quantitative
29	Hall et al.	2015	Sweden	Surveys	Quantitative
30	Igarashi et al.	2015	Norway	Document analysis	Mixed
31	Tsai	2015	Taiwan	Document analysis	Mixed
32	Lundberg et al.	2015	Sweden	Theory	Qualitative
33	Grandia	2015	Netherlands	Case studies	Qualitative
34	Grandia et al.	2015	Netherlands	Surveys	Quantitative
35	Uttam & Roos	2015	Sweden	Case studies	Mixed
36	Alvarez & Rubicon	2015	Spain	Case studies	Qualitative
37	Butt et al.	2016	Namibia	Case studies	Qualitative
38	Smith et al.	2016	Se, It, Dk, At, UK	Case studies	Qualitative
39	Cerutti et al.	2015	Italy	Case studies	Mixed
40	Grandia	2016	Denmark	Surveys	Mixed
41	Wong et al.	2016	Hong Kong	Surveys	Mixed
42	Pacheco-Blanco & Bastante-Ceca	2017	Spain	Case studies	Mixed
43	Rainville	2016	Us	Review	Qualitative
44	Xu et al.	2016	China	Case studies	Quantitative
45	Witjes & Lozano	2016	China	Theory	Qualitative

46	Yu Xie et al.	2019	China	Document analysis	Mixed
47	Ming et al.	2017	China	Case studies	Mixed
48	Kee-hung La et al.	2012	China	Document analysis	Mixed
49	Ruoqi Geng et al.	2016	China	Review	Quantitative
50	Junqi Liu et al.	2019	China	Document analysis	Quantitative
51	Testa et al.	2016	Several Europe	Case studies	Mixed
52	Arslan et al.	2015	China	Theory	Qualitative
53	Kamrul Ahsan et al.	2017	Australian	Document analysis	Mixed
54	Sergio et al.	2015	Denmark	Document analysis	Mixed
55	Junqi Liu et al.	2019	China	Document analysis	Mixed
56	Sujak Bakir et al.	2018	Singapore	Document analysis	Mixed
57	Magnus Sparrevik et al.	2018	Norway	Case studies	Quantitative
59	Wenjuan Cheng et al.	2018	China	Case studies	Quantitative
60	Yaxing Wang	2019	China	Surveys	Quantitative

According to research in the Journal of Cleaner Production most GPP articles have been published and far more journals have been published. In addition to the supplementary information, we should note that according to Table 3, we can find out what research method was used in each article. For example, you may find that most articles have obtained results through questionnaires or interviews, or other articles have used past master study or analysis or a series of articles from both types of models. And we have examined the bidding documents as well. In general, GPP literature is geographically limited. And most of the statistics are from European countries and China. But Asian countries and the United States and other countries with less research can be useful for expanding this type of research in these areas, and can help further researchers themselves.

4.1. Review of selected articles in the GPP and GSCM discussion

In this section we will review the literature on articles. We review articles on GPP that align with our core focus and purpose of research. Generally, we examine the application of GPP in the pharmaceutical industry and examine the policies and regulations of GPP and GSCM practices, how GPP works and its environmental aspects, and the overall impact of GPP. After thoroughly reviewing our articles, we will categorize them.

4.2. Investigate the consequences and policies and regulations of GPP

In reviewing their articles and cases, as well as investigating specific industries such as pharmaceuticals, we find that national policies are also considered. Overall, we have found that GPP is highly acclaimed in most countries of the world. Inclusion of GPP would also stimulate the innovation capabilities of firms. According to Porter's theory, GPP could represent a “properly designed” environmental policy instrument able to conjugate environmental benefits and competitive improvement in the firm's performance and Or examining countries 'purchasing practices and, in addition, determining governments' green purchasing strategies and examining the extent to which government involvement in green procurement is effective (Testa et al., 2015).

4.3. GPP Conversion Issues

Research suggests that GPP must overcome important issues such as: environmental awareness, organizational goals and structure, and financial issues. It is true that GPP practices vary across governments and regions, but financial constraints are always a major obstacle to green resource provision. Because green products are environmentally expensive and have budget constraints. Especially in times of economic crisis, the development of GPP practices is not allowed (Brammer et al, 2011). At the government level another obstacle is the lack of awareness of the GPP. Because this can have an impact on the use of GPP practices (Testa et al., 2012).

4.4. Characteristics of environmental aspects in setting GPP policies and practices

Getting to know the environmental impacts of goods and services purchased helps organizations become greener (Mosgaard et al., 2013). Unfortunately, it should be noted that the environmental criteria of public tenders require technical expertise and technical knowledge. Most of the time we are faced with a shortage of supply and sales staff. And the lack of complete information is a common obstacle in the GPP process (Zhu et al., 2013).

4.5. Effectiveness of GPP

The effectiveness of GPP as an environmental policy tool to reduce environmental impact and achieve environmental objectives is challenged by (Lundberg et al., 2015). Logistics activities play prominent role in enabling manufacturers, distribution channels, and pharmacies to work in harmony. In addition, reasons such as the need for quick response, short shelf life of pharmaceutical products, recalls, counterfeit products, and the necessity to take some measures to protect integrity and efficacy of products make logistics more important in the pharmaceutical sector (Shao et al., 2006. Khan et al., 2009). Accordingly, nowadays these activities have become increasingly striking in the pharmaceutical industry and seen as a development area for this sector (Friemann et al., 2016).As well as in other sectors, in the

pharmaceutical sector, green practices are beginning to be more attracting particularly in decreasing costs and increasing image of companies, too (Lundberg et al.,2015). Following the GPP review, we examine the relationship between GSCM practices and the supply chain in the pharmaceutical industry.

5. The relationship between GSCM practices and the supply chain in the pharmaceutical industry

The aim of GSCM is to reduced costs and resource consumption, decreased environmental pollution through green production, improved market share, stronger brand image, and increased economic performance by improving environmental and social performance (Dawei et al., 2015). The point is, Green supply chain management (GSCM) performance evaluation is not only very important but also very effective for implementation. One of the most important issues in the pharmaceutical industry all the time is the hygienic waste and recyclables of the organizations and the waste disposal of potentially corrosive and harmful items to the environment. It can be noted that this issue is important in all industries and can be an important factor in itself and can sometimes directly or indirectly affect the supply chain and other processes (Laari et al., 2016).

Table 4: Summary of the articles studied in the field of GSCM

Nº	AUTHOR	YEAR	RESEARCH METHOD
1	Wu et al.	2010	Survey
2	Zhu et al.	2010	Survey
3	Azevedo et al.	2011	Case study
4	Duarte et al.	2011	Conceptual model and Balanced Scorecard
5	Stefanelli et al.	2014	Survey
6	Yang et al.	2013	Survey
7	Wang & Chan	2013	A hierarchical fuzzy TOPSIS approach
8	Bjorklund et al.	2012	Case study
9	Chan et al.	2012	Survey
10	Lin et al.	2011	Fuzzy set theory, DEMATEL Method
11	Giovanni & Vinzi	2012	Survey
12	Green et al.	2012	Survey
13	Zhu et al.	2013	Survey

14	Diabat et al.	2013	Fuzzy multi-criteria decision making method
15	Lin	2013	Fuzzy set theory and DEMATEL method
16	Dubey et al.	2015	Survey
17	Pourjavad & Shahin	2018	Fuzzy inference system (FIS)
18	Mumtaz et al.	2018	Survey
19	Sharma et al.	2017	Survey, AHP
20	Jabbour et al.	2015	Case study
21	Diab et al.	2015	Survey
22	Tyagi et al.	2015	Fuzzy TOPSIS approach
23	Chuang	2014	Six Sigma approach with DMAIC
24	Lin et al.	2014	Case study, the fuzzy set theory to determine linguistic preferences, ISM
25	Mangla et al.	2014	DEMATEL Method
26	Kusi-Sarpong et al.	2016	Survey
27	Khaksar et al.	2016	Survey
28	Zhang & Yang	2016	Survey
29	Yu et al.	2017	Survey
30	Zhu et al.	2017	Survey

6. Conclusions and future research

Green supply chain management (GSCM) can increase utilization of resources, minimize consumption of resources and improve corporate image by enhancing its operational performance without sacrificing the compatibility among suppliers, customers, society and environment (Kazancoglu et al,2018) For managers, it could be discussed that the holistic framework helps companies ensure more environmentally-conscious in the supply chain activities, more responsible by reducing the wastes, and protecting the quality of the products, and more sensitive by conserving the natural resources (Jabbour et al, 2015). In this study, we examined the important factors in the field of GPP and its effectiveness and examined the relationship between Green supply chain management (GSCM) practices and found that the Green supply chain management (GSCM) criteria are very important and important. They are

rarely discussed in the pharmaceutical industry. So it can be a good field for future researchers and articles. Most articles address some of the criteria, while addressing each of the major criteria and sub-criteria, and providing a comprehensive framework and a Green supply chain management (GSCM) fabric in the pharmaceutical industry. Most articles have provided criteria such as environmental, economic, logistical, etc., but in our opinion the pharmaceutical industry needs more comprehensive criteria. If a well-organized framework is in place, GSCM's performance evaluation in the pharmaceutical industry, which is a very important industry, can be done well. This is how it can cover all actions across the supply chain. And in future research, in addition to other suggestions, other Green supply chain management (GSCM) performance evaluation methods can be found and used. Note that the environmental requirements associated with procurement increase the difficulty. These requirements reduce the offers. While environmental standards relate to the product being manufactured and organized (e.g. the pharmaceutical industry) and the requirements and standards stand up to them. And organizations can succeed in meeting all the rules and requirements from the very beginning. Implementing GPP is not a simple task, as it needs to incorporate and adapt to appropriate and available environmental tools that are already in force to achieve the objectives' final target (Parikka-Alhola et al, 2012). But from 2010 onwards or even before, a concept called politics has always been associated with this topic. And in addition to politics, the energy debate has also been a topic of discussion. We have seen this in research and in our review articles, and all of these concepts are very important in the pharmaceutical industry. The topics in the articles are no longer general and they deal with the concepts in detail and examine each one. Each course has its own specific concepts. Especially before 2013, the cases mentioned above have been investigated. But according to surveys, from 2013 onwards, more attention has been paid to influencers. In general, most articles discuss much of the GPP's policy and design. And other GPP articles examine the qualitative approach and analysis of governments in the GPP sector. Research is attempting to identify barriers and opportunities for GPP uptake and has continued to evaluate green public procurement. Concerning environmental considerations, research indicates that GPP is underway, but studies are scarce and inadequate. The relevance of the innovation impact of GPP is confirmed by very recent contributions, where specific aspects related to the drivers of the GPP-innovation links are scrutinized. However, more research is indeed needed in this specific realm. GPP as an effective and efficient environmental policy tool. The effects of GPP policy in the near future are barely present in existing evidence. Indeed, the effectiveness and impacts of GPP are not well addressed by the empirical literature and cannot be found in many theoretical analyses (Cheng et al, 2018).

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