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Sustainable Public Procurement: Research Trends and Gaps

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Abstract: During the period from 1998 to 2021 there are numerous Sustainable Public Procurement (SPP) discussion. Up to now, the number of research in SPP has increased more than eight times in the past 23 years. In recent years, the implementation of SPP is covering new sectors, and identifying new practices. The aim of this paper is to do an extensive and systematic literature review with the aim to provide qualitative viewpoint of outlining and identifying state-of-the-art research trends and gaps. The literature analyzed here comprises English language papers, which are focused on SPP. In this paper, the 23 years period of SPP discussion disaggregated into several periods of research time. Several findings in this research are: First, most of the articles discuss about the improvement of SPP. Second, SPP has been implemented in many sectors and construction sector is a major subject of discussion in SPP research. Third, most SPP research are in Europe. Finally, we describe conclusion and future research opportunity.

Keywords: Sustainable public procurement, Green public procurement, Socially responsible procurement, Low carbon procurement, Government green procurement, Gender-responsive public procurement, Literature review

Public procurement represents 15-30% of national GDP in global (UNEP 2012). Developed countries spend over 10% of their gross domestic product on public procurement (Zhu et al 2013). As such massive procurement volume, in the last decade, Sustainable Public Procurement (SPP) has become an increasingly used tool policy instrument that potentially play a role in changing unsustainable consumption and production. Tsai (2015) confirms that implementation GPP 2002-2012 in Taiwan from the green-mark products consumption and the renewable electricity purchase reduce CO2 emissions intensity and increase the renewable electricity purchased.

SPP is implemented in different places in different regions. The term Sustainable Public Procurement (SPP) has been broader to Green Public Procurement (GPP), Socially Responsible Public Procurement (SRPP). During the period from 1998 to 2021 there are abundant SPP discussion. Appoloni (2014) states that the research in SPP/GPP is growing fast in terms of number of articles published and the variety of the journals in which this topic is discussed. The 23 years period of SPP discussion will be reviewed to answer these two research questions: What are the research trends in SPP field in the last 23 years and research gaps in the SPP field in the last 23 years? In this research 145 English papers from 1998 up to 2021 were retrieved based on a keyword search on Scopus. The keywords were selected and limited to green or sustainable procurement terminologies include sustainable public procurement, green public procurement, socially responsible procurement, low carbon procurement. All the selected articles specifically focus on the research questions.

MATERIAL AND METHODS

A thorough content analysis has been used to identify the essential part for grouping the paper selected in this research. There are three major paper groups resulted from the content analysis, first is topic of discussion, second, procurement sector and the third is the geographic location of the research. The three groups are chosen because in the last literature and critical reviews of SPP (Appolloni 2014, Cheng 2017, Sönnichsen 2020, Kundu 2020) has already focus on research method (survey, case studies, theory etc.), type of data (qualitative, quantitative, mixed), impact factor of the papers, area/journal of publication, frequency of government functions, level of government studied by articles, frequency of country studied in the literature.

In order to extent the research in SPP, this article focus to subject areas that has not been discussed in the previous literature reviews. There are eleven major grouping on topic discussion selected based on content analysis with respect to SPP which: literature review, driver of implementation, Improvement of implementation, Criticism, Barrier of implementation, Environmental and/or Social Criteria or Indicators, Standard, Low Carbon Procurement, Importance of implementation, SPP Model, Gender-responsive Procurement. In public procurement sector there are ten

sectors identified from the articles. They are transportation services, public health, building and construction, food/catering sector, public university, furniture, waste management, information technology, agriculture, paper, and stationery for geographic location there were five continents as research location in the articles, they are: Africa, Asia, Europe, Australia, and America.

Discussion of SPP/GPP started in 1998 by the concept of lean supply chain for government. Erridge (1998a) and Erridge (1998b) and Murray (1999) has described the concept of lean supply model which include green purchasing that can support development of local economic and environmental sustainability (Table 1). Murray (2000) and Warner (2001) describes the importance of implementation of the green purchasing concept by local government in UK. After 14 years of discussion, start in 2012, there is a criticism of SPP which mainly focus on effectiveness of SPP in supporting Sustainable Development and reducing environment degradation (Lundberg, 2012). The majority of the articles discuss about the improvement of SPP. The number of this topic of discussion increase and reach its top on the last five years with 22 publications. In the latest review by Cheng (2017), the focus of SPP discussion is mainly on the specific impacts of SPP implementation, while discussions about the effectiveness SPP compared to other environmental policy tools is still rare. SPP has been implemented in many sectors (Table 2). Building and Construction is a major subject of discussion in SPP research while transportation, waste management and IT is the minor subject discussed in SPP articles. Most SPP/GPP research are in Europe while articles about SPP in Australia is least one (Table 3).

RESULTS AND DISCUSSION

Procurement of goods and services that have a large value will also require large natural resources, which can directly or indirectly affect natural sustainability, environmental pollution, biodiversity, and climate change. This effect on nature is not only seen from the significant use of raw materials, but also the emissions resulting from the procurement of goods/services from the production process, transportation, up to the use stage. Issues that occur in the world such as natural resource limitations, food scarcity, population growth is likely to make SPP a global demand to be implemented soon. By 2015, countries in the world incorporated in the United Nations have agreed to implement Sustainable Development Goals (SDG) with 169 targets must be achieved in 15 years (2030). One of the indicators in the target SDG is the goal number 12 is "responsible production and consumption pattern". More specifically on goal 12.7 with the target of "promoting sustainable Government Procurement of Goods/Sustainable Public Procurement, in accordance with national policies and priorities ". In the last decade, Sustainable Public Procurement (SPP) has become an increasingly used tool policy instrument that potentially play a role in changing unsustainable consumption and production. As the extent implementation of SPP in many regions the research for SPP will the extent as well.

In the early discussion of SPP improvement several tools were proposed to ease local authorities implementing SPP (Swanson, 2003; Günther, 2006). Hochschorner (2006) proposed the use Life Cycle Assessment (LCA) as tool that can give guidance for environmentally preferable production and that considers the whole life cycle of the product. In the period of 2008-2012, researchers continue to discuss calculation tool to determine the most economically advantageous tender by life cycle assessment and or the environmental cost calculation method (Lundberg 2011, Larsen 2010, Alhola 2012, Arvidsom 2012). Preuss (2009) and Walker (2012) proposed several ways to improve the implementation of SPP by working with SMEs, contracting with voluntary organization on the social side or including sustainability criteria in contracts such as replacing hazardous materials in products and services on the environmental side. Testa (2012) shows the level of awareness of the existing tools for supporting SPP have a positive and significant effect on the probability to adopt SPP. In the period of 2013-2018, Cerutti (2017) proposed applying a simplified life cycle approach in the assessment of procurement policies. This approach allows the assessment of procurement policies in the catering service that considers all the stages of the process.

Grandia (2015a, 2015b, 2016), Guenther (2013) and Roman (2016) proposed organizational and leadership change to support SPP. The studies show that the degree of sustainable procurement behavior varies across the population of procurers. The change agents are one part of the process to implement SPP, they are important and play a vital role to present and help key actors enact SPP desired behavior. Uttam (2015) mentioned competitive dialogue procedure that allows the contracting authority to embrace discussions with shortlisted contractors regarding the authority's requirements. In the dialogue sessions between procurers and contractors, SPP should be discussed to ensure consistency of the weight for social, economic, and environmental considerations and respective preferences. Witjes (2016) and Wong (2016) concluded that client requirements in tendering as important factor to enhance SPP. This study shows that the government should take a

Table 1. Distribution of topic of discussion in SPP articles

Topic of discussion	Number of articles / Author				
	1998-2002	2003-2007	2008-2012	2013-2017	2018-2021
Literature review	3 Erridge (1998a), Erridge(1998b), Murray (1999)			3 Appolloni (2014), Igarashi (2013), Cheng (2017)	2 Sönnichsen (2020), Kundu (2020)
Driver of implementation		1 Thomson (2007)		2 Agyepong (2016), Alvarez (2015)	9 Haddadi (2021), Liu (2021), Aldenius (2021), Ciumara (2021), Wang (2020), Leal (2020), Raj (2020), Etse (2021b), Bakir (2018)
Improvement of implementation		4 Swanson (2003), Günther (2006), Hochschorner (2006)	8 Alholla (2012), Arvidsson (2012), Larsen (2010), Lundberg (2011), Preuss (2009), Tarantini (2011), Testa (2012), Walker (2012).	19 Butt (2015), Cerutti (2016), Cerutti (2017), Aldenius (2017), Grandia (2015), Grandia (2016), Gunther (2013), Igarashi (2013), Igarashi (2015), Pacheco-Blanco (2016), Roman (2016), Testa (2014), Trindade (2017), Uttam (2015), Wong (2016), Akenroye (2013)	22 Wang (2018), Grzyl (2018), Liu (2018), Giacomo (2018), Ma (2021), Hamdan (2021), Badell (2021), Miyamoto (2020), Al Nuaimi (2020), Grandia (2020), Stritch (2020), Lindström (2020), Lăzăroiu (2020), Grandia (2019), Fuentes-Bargues (2019), Liu (2019a), De Giacomo (2019), Liu (2019b), Iannone (2019), Etse (2021a), Rosell (2021), Alhola (2019)
Criticism o			1 Lundberg (2012)	4 Burchard-Dziubinska (2017), Lundberg (2015a ,2015b, Lundberg 2017), Nikolau (2017).	3 Džupka (2020), Burghardt (2021), Halonen(2021)
Barrier of implementation	1 Warner (2001)	6 Faith-Ell (2005), Van Asselt (2006), Bouwer (2006), Faith-Ell (2006), Steurer (2007), Walker (2007)	7 Brammer (2011), Erridge (2012), Melissen (2012), Nash (2009), Oruezabala (2012), Walker (2009), Geng(2008)	6 Ahsan (2017), Testa (2015), Rizzi (2014), Schwerin (2013), Zhu (2013), Aragão (2017)	8 Lindfors (2021), Bucea-Manea-ţoniş (2021), Vejaratnam (2020), Adjei-Bamfo (2019), Tawfik Alqadami (2020), Da Costa (2019), Plaček (2021)
Environmental and/or Social criteria and indicators				4 Bratt (2013), Neto (2017), Rainville (2016), Testa (2015), Fuentes-Bargues (2018)	4 Soto (2020), Braulio-Gonzalo (2020), Welz (2020), Knebel (2021)
Standard				5 Smith (2015), Rainville (2016), Chiarini (2017), Witjes (2016), Ahsan (2017)	
Low carbon procurement				2 Correia (2013), Rietbergen (2013)	2 Kadefors (2019,2021),
Importance of implementation	2 Murray (2000), Warner (2001)	2 Li (2004), McRudden (2004), Preuss (2007)	7 Bala (2008), Bolton (2008), Erridge (2012), Ho (2010), Lacroix (2010), Nissinen (2009), UN (2008)	6 Diófási (2014), Simcoe (2014), Annunziata, (2014), Tsai (2015), Campbell (2017), Prier (2016)	2 Schebesta (2018), Bidin (2019)
SPP model				1 Xin (2016)	1 Timm (2021)
Gender-responsive public procurement					1 Orser et.all (2021)

proactive role in pushing SPP adoption and establish a green material market to promote the SPP by lowering material costs. It is also important to get active engagement of suppliers to provide the performance of construction materials.

Trindade (2017) proposes a new tool-the SPP Toolbox-for guiding public organizations as they re-think the procurement process. This toolbox integrates insights from Green Public Procurement (GPP), Sustainable Public Procurement (SPP) and Public Procurement of Innovation (PPI) objectives and practices, in the context of the emergence of socio-technical transitions. The toolbox allowing flexibility in terms of goals, promoting an increasing complexity of institutionalized practices and skills-from GPP to SPP and then from SPP to PPI, organized in a framework fully integrated into the organizational strategy.

Wang (2018), Etse (2021) and Badell (2021) discuss how government institutions adopt SPP in various ways. Wang (2018) proposes four strategies to implement SPP: establishing a database for small and medium enterprises, developing a grade system and the post-evaluation system, formulating detailed implementation methods for high-tech products (services), and carrying out classification management for imported products. Etse (2021) and Badell (2021) mention that sustainable procurement practices are different from one organization to another organization depends on the regulation and organizational leadership. Miyamoto (2020) reveals that the presence of a GPP is associated with higher implementation and measurement rates of green purchasing. The study shows that green purchasing is advanced in items such as paper or stationery because: Eco labels are available and used. Moreover, it is easy to purchase these items in bulk. However, on contrary, green purchasing is not so common in items such as air conditioners or public works. This due to these items are often tailored, and it is difficult to determine the ecofriendly level.

Alhola (2019) proposes a new term of Circular Public Procurement (CPP) which is defined as: a procurement of competitively priced products, services, or systems that lead to extended life spans, value retention, and/or remarkably improved and no risky cycling of biological or technical materials, making use of and supporting the circular business models and related networks. While SPP and GPP are product or technology-oriented and focus on the tendering process, CPP could go beyond this and pay attention to the complex network of supply chains and other stakeholders. In CPP, the main object of the negotiations between supplier and procurer switches from product orientation to product-service system and from price per product unit to price per delivered service. Alnuaimi (2020) in his research concludes that there is a need for standard practices handbook for SP to be used by public organizations to provide public procurers a clear method for conducting a proper cost–benefit analysis to evaluate and decide on sustainable purchases. The research trends in improvement of SPP mainly focus on creating or implementing tool/procedure for helping implementation of SPP.

In the two decades of implementation of SPP, some researchers reveal that there are still many barriers in implementing SPP (Table 1). Latest from Lindfors (2021) states one barrier of SPP implementation previously identified in literature is related to that the lack of accessible and easy to use tools that help standardize the development of criteria in green tenders. Alqadami (2020) reveals that some challenges in implementing SPP are the higher upfront cost associated with eco-products and services, gap existence between policy formulation and actual project

Table 2. Distribution of public procurement sector

Public procurement sector	Number of article	Articles
Transportation services	4	Lindfors (2021), Aldenius (2021), Aldenius (2014), Parikka-Alhola (2012)
Public health	3	Ahsan (2017), Diófási (2013), Oruezabala (2012), Etse(2021a)
Building and construction	13	Kadefors (2021), Timm (2021), Bidin (2019), Annunziata (2014), Uttam (2015), Wong (2016), Alvarez (2015), Rizzi (2014), Tarantini (2011), Faith-Ell (2005), Faith-Ell (2006), Soto (2020), Tawfik Alqadami (2020), Alqadami (2020), Kadefors (2019)
Food/Catering sector	6	Cerutti (2016), Cerutti (2017), Smith (2015), Neto (2017), Schebesta (2018), Lindström (2020)
Public university	4	Pacheco-Blanco (2016), Bala (2008), Aragão (2017), Fuentes-Bargues (2018)
Furniture	2	Parikka-Alhola (2008), Braulio-Gonzalo (2020)
Waste management	1	Arvidssson (2012)
Information technology	2	Li (2004), Welz (2020)
Agriculture	1	Bucea-Manea-ţoniş (2021)
Paper and stationery	1	Miyamoto (2020)

delivery, lack of legislation to introduce mandatory influence for green adoption. Placek (2021) have found that the decision-making procurers is affected by the trade-off between stewardship and administrative compliance, which turn out to be mutually conflicting goals. On the one hand, many public procurers do possess a stewardship motivation that shapes their positive attitude to GPP. On the other hand, they are painfully aware of, and seek to forestall, administrative risks and complications attendant on the conscientious, i.e., non-perfunctory, implementation of GPP. Bucea-Manea-ţoniş (2021) states that the lack of specific legislation, policies, and procedures in each main area of public procurement interest in one major barrier in implementing SPP. Based on the discussion, it can be concluded that the barriers of SPP mainly in regulation, cost, lack of standard and criteria, and motivation of procurers.

Up to now, the research of SPP has been focused on building and construction sector. Annunziata (2014) discussed the importance of energy efficiency in public buildings. Uttam (2015) discuss a new procedure in SPP in construction of a bridge, tunnel, underpass and pedestrian and bike path. Wong (2016) provide the factors that are important in enhancing green procurement building developments. Alvarez (2005) discuss about carbon footprint in Green Public Procurement can act as a strong stimulus for eco-innovation in construction services sector. Rizzi (2014) discuss factors that hamper GPP opportunities for Small and Medium Enterprises in road construction. Tarantini (2011) discuss about LCA that allowed identifying the main impacts and the critical processes of the window life cycle. Faith-Ell (2005, 2006) discuss about application of environmental requirements in road maintenance contracts. As can be seen from the literature that the research of SPP in construction sector has been last for 16 years (2005-2021). As the implementation of SDG until 2030 there will more construction sector involve in the SPP.

Finally, the research distribution of SPP spread over all continents and most of the research about SPP is in Europe

Table 3. Distribution of research location

Continent	Number of article	Country
Africa	7	South Africa: Agyepong (2016), Bolton (2008) Morocco: Haddadi (2021) Ghana: Adjei-Bamfo (2019), Etse (2021a), Etse (2021b) Nigeria: Akenroye (2013)
Asia	22	Malaysia: McMurray (2014), Bidin (2019), Tawfik Alqadami (2020), Alqadami (2020) China: Liu (2021), Ma (2021), Liu (2018), Wang (2020), Wang (2018), Wong (2016), Xu (2016), Zhu (2013), Schwerin (2013), Ho (2010), Liu (2019a), Liu (2019b), Geng(2008) Japan: Miyamoto (2020) UAE: Al Nuaimi (2020) Taiwan: Tsai (2015) Korea: Campbell (2017) Singapore: Bakir (2018)
Europe	50	Sweden: Aldenius (2021), Lindfors (2021), Lundberg (2015), Uttam (2015), Aldenius (2014), Bratt (2013), Arvidsson (2012), Nissinen (2009), Varnas (2009), Parikka-Alhola (2008), Faith-Ell (2006), Faith-Ell (2005), Lindström (2020) Norway: Hamdan (2021), Lundberg (2013), Larsen (2010), Michelsen (2009) Spain: Pacheco-Blanco (2016), Bala (2008), Soto (2020), Fuentes-Bargues (2019) UK: Preuss (2009), Walker (2009), Murray (2000), Preuss (2007), Walker (2007), Erridge (1998), Murray (1999), Murray (2000) French: Oruezabala (2012) Netherland: Rietbirgen (2013), Melissen (2012) Ireland: Erridge (2012) Italy: Annunziata (2014), Testa (2012), Tarantini (2011) Greece: Nikolaou (2017), Lacroix (2010) Finland: Nissinen (2009), Parikka-Alhola (2008) Denmark: Nissinen (2009) Romania: Bucea-Manea-ţoniş (2021), Ciumara (2020) Belgium: Grandia (2020) Switzerland: Welz (2020), Knebel (2021) Czech: Plaček (2021) Central Europe: Džupka (2020) EU: Badell (2021), Schebesta (2018), Van Asselt (2011), Steurer (2007), Bouwer (2006), Rosell (2021), Burghardt (2021)
Australia	1	Australia: Ahsan (2017)
America	9	USA: Stritch (2020), Simcoe (2014), Li (2004), Swanson (2003), Prier (2016) Canada: Orser et.all (2021) Mexico: Leal (2020) Brazil: Aragão (2017), Da Costa (2019)

where most of its countries is developed countries. Public authorities are major consumers in Europe: they spend approximately 1.8 trillion euros annually, representing around 14 per cent of the EU's gross domestic product. In Europe Union (EU) there has been a regulation to conduct SPP although this regulation is a voluntary not an obligatory instrument. Rosell (2021) and Lindström (2020) confirms that developed countries and a larger government size impact positively on GPP. However, after 23 years of implementation of SPP in Europe, Lundberg (2018) has found that GPP is neither a cost-effective nor an objectively effective environmental policy instrument especially in Sweden as this country is considered as one of major countries that implement SPP (Bouwer, 2006). Latest critical review by Halonen (2021) also questioning the effectiveness SPP compared to other environmental policy tools in Europe. The topics discussed in the developing countries are about driver of implementation of SPP (Bakir 2018), improvement of SPP implementation (Wang 2018, Liu 2018, Al Nuaimi 2020, Miyamoto 2020) and barriers of SPP implementation (Tawfik Alqadami 2020, Alqadami 2020) and there is no criticism of SPP (Table 3).

This study has identified several SPP research gaps. These are several research gaps that can be defined from the selected 145 reviewed articles: First, to define whether SPP is a good or effective tool for sustainable development there is a need for quantitative research comparing the effectiveness of SPP to others policy (tax for example) in handling environmental issues. Second, since ISO 24000:2017 Sustainable Procurement-Guidance has been published in April 2017, there are opportunities to do research in implementing this guidance in public procurement. Whether this guidance fits for public procurement is still an open question to be answered. Studies of SPP criteria and indicators is very limited while the SPP criteria and indicators are important in optimizing the application of SPP. The indicator is one of the tools to be able to evaluate and monitor the implementation of the principle of sustainability. Indicators can be used as a guide in planning, the selection process, and the performance measures for implementing sustainable procurement. The implementation of the SPP concept requires indicators to assess its effectiveness, in the sense of knowing whether an activity of SPP can be said to be sustainable or unsustainable or to know how sustainable is the SPP process compared to others? Criteria and indicator for implementing SPP is very important to do measurement how sustain a procurement is so it can be compared to other procurement. Another challenge that makes indicators so important is there is a need to differentiate between the companies that only produce nice documents in and those that perform well. Thus, a standard criteria and indicator for SPP is important to standardize future research results in many regions so they can be compared to others. Jatav (2021) in his study of SDGs performance mentioned that different measurement method will have different result and can lead to different conclusions although the indicators use to gauge has been standardize. Therefore, there is a need to standardize the method for measuring SPP.

Construction sector takes a significant portion of public procurement (Mungiu-Pippidi, 2015). As a result of this significant investment, the procurement process has the potential to deliver very significant payoffs for the community and has the potential impact to the environment. Yet, up to now, there is a limited amount of research discussing criteria and indicators for SPP in construction sector. Varnas (2009) mentions the three different steps in the construction process have been suggested for applying environmental criteria: in the preliminary design/architectural competition; in the tendering for the construction contract; and in the tendering for the building services. There is a need to have a standard criteria and indicators for each step to implement GPP. Therefore, there is a significant need to do research in criteria and indicators for SPP in construction sector and method for measuring SPP performance.

CONCLUSIONS

In the last 23 years SPP has been a growing research subject. SPP in some articles is believed as tool for environment while some argues that SPP is not an effective tool for environment. Beside these two contrary arguments, most of researchers in the last decades put their effort to improve SPP and prove the effectiveness of SPP therefore researcher mainly discuss SPP in the context of importance of implementation. Our findings show that most of the articles discuss about SPP in Europe Union. As the implementation of SDG until 2030, the discussion of SPP will spread across many regions. This opens opportunity for future research of implementing SPP. Finally, creating a standardize criteria and indicator for SPP and a method for evaluating SPP performance are also challenging research areas that need to be solved near the future.

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