



Assessing the implementation of sustainable public procurement using quantitative text-analysis tools: A large-scale analysis of Belgian public procurement notices

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ABSTRACT

Public organizations are using sustainable public procurement (SPP) as a policy tool to address societal and environmental issues. Having a policy on SPP however does not guarantee implementation. Several barriers have for example been identified that prevent public procurers from implementing SPP in their procurement projects, such as financial constraints, lack of knowledge or motivation. The question therefore arises how much SPP public organizations actually implement in their procurement projects. However, existing studies often focus on the environmental part of SPP and often rely on using interviews or surveys to assess the perceived degree of SPP (which have been accused of being subject to social desirability bias and low response rates). Little is therefore known about what SPP is in practice, and how frequently it is implemented. In this study, we therefore provide a detailed operationalization of SPP that encompasses the full concept. We subsequently assess the implementation of SPP in practice using text mining techniques to analyse over 140.000 Belgian public procurement notices that were published between 2011 and 2016. The research shows that in more than 70% of the notices (with an annex) SPP is implemented, but there appears to be a downward trend. It seems that SPP is implemented less over time, rather than more. Environmentally friendly procurement was, relative to other types of SPP, prevalent over time and across regions. For SPP to live up to its potential there are thus still barriers to be overcome.

1. Introduction

In the European Union, the general government expenditure on works, goods, and services (excluding utilities and some concessions) was approximately 13.3% of the GDP of 2017 (DG GROW, 05 November 2019). As such the procurement or the process of acquiring goods, services and works through a public contract is a key economic activity of public organizations (Brammer and Walker, 2011; Grandia, 2015a; Kiiver and Kodym, 2014; Uyarra and Flanagan, 2010). Because of its sheer size, public procurement has the potential of being a very powerful policy tool to tackle societal and environmental issues (Grandia and Meehan, 2017), such as the decrease of long-term unemployment, improvement of working conditions, and prevention of climate change (Grandia, 2017; Preuss, 2009). Indeed, many governments and public organizations have developed policies on sustainable public procurement (SPP). SPP embodies a concern for social, economic, and environmental aspects of procurement decisions (Brammer and Walker, 2011). Although an increasing amount of public

organizations now have sustainable public procurement policies, this does not guarantee a successful implementation of SPP in practice (Hoejmose and Adrien-Kirby, 2012). Several barriers have for example been identified that prevent public procurers from implementing SPP in their procurements, such as financial strains, lack of knowledge or motivation (Grandia, 2015a). The question therefore arises how much SPP public organizations actually implement in their procurement projects.

While various studies have investigated SPP (Cheng et al., 2018), these studies have three important limitations. First, the majority of studies into SPP focus on environmental elements of SPP (commonly referred to as green public procurement), while the social elements appear to receive fewer attention (Grandia, 2017; Seuring and Müller, 2008; Witjes and Lozano, 2016). This narrow research focus is problematic, as a recent study shows that the various elements of SPP are indeed distinct and patterns in the implementation cannot be generalized to each other (Grandia and Voncken, 2019). Second, the extant literature focuses on the identification of barriers and opportunities for

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SPP and policy-design issues (Cheng et al., 2018) rather than assessing the implementation of SPP. Third, the majority of studies on SPP that do attempt to assess the implementation of SPP are based on questionnaires or interviews in which respondents are asked to report their own or their organization's SPP (e.g. Grandia et al., 2015; Renda et al., 2012; Testa et al., 2016; Walker and Brammer, 2009). Given the positive connotation of SPP, using self-report measures to assess SPP are very prone to a social desirability bias (Walker et al., 2012). Moreover, these studies often suffer from low-response rates. The response rate of the 2012 EU report on the implementation of SPP in the EU27 (i.e. Renda et al., 2012) was for example a mere 4%. Such low response rates, combined with the expected social desirability bias, are cause for concern (Walker et al., 2012). Due to these limitations, the extent to which SPP is implemented in practice and the nature of the implementation and patterns therein are unclear.

This research attempts to fill this gap by answering the following three research questions: 1) how can SPP in practice be operationalized to better cover the full concept of SPP, 2) what is the actual implementation of SPP in practice 3) what kind of patterns can we identify therein? To answer the first research question, we adopted an exploratory approach and operationalized SPP in practice via a combination of document study and focus groups. To answer the second and third research questions and assess the actual implementation of SPP while avoiding the limitations of previous studies we analysed over 140.000 public procurement notices that were published by Belgian public organizations on the Belgian E-procurement platform between 2011 and 2016 for the implementation of SPP using text mining techniques. Text mining is an objective but (in this field) relatively new research method that can be used to explore large sets of documents for the presence of specific codes (Kobayashi et al., 2018). It therefore allows us to automatically assess the implementation of SPP in a large number of procurement notices and identify patterns therein. Belgium was identified as one of the SPP forerunners in the EU by Renda et al. (2012) and is therefore considered a good case to test the usefulness of this new research method for assessing the actual implementation of SPP.

In the next section, sustainable public procurement will be introduced, followed by a presentation of the methodology, operationalization of SPP and the development of the codebook and the presentation of the findings. The paper ends with a discussion of the findings, the limitations of study and a conclusion in which the research questions are answered.

2. Sustainable public procurement

A wide range of terms are being used to refer to sustainable developments in the context of procurement (Amann et al., 2014), such as green public procurement (Cheng et al., 2018; Palmujoki et al., 2010; Tarantini et al., 2011), sustainable public procurement (Bernal et al., 2019; Flynn et al., 2013; Grandia, 2016; Melissen and Reinders, 2012; Oruezabala and Rico, 2012), green purchasing (Green et al., 1998; Murray, 2000), sustainable supply chain management (Amann et al., 2014; Carter and Rogers, 2008; Gold et al., 2010; Grosvold et al., 2014), environmentally friendly supply chain management (Walker et al., 2008), environmentally responsible public procurement (Li and Geiser, 2005), green procurement behaviour (Yang et al., 2019) and sustainable procurement behaviour (Grandia et al., 2015; Grandia, 2016). Due to the large number of terms it is not always clear what they mean in practice or even in academia. As a result, some of these terms describe similar phenomena with different terms (e.g. green public procurement and environmentally friendly procurement) that sometimes overlap (e.g. sustainable public procurement and sustainable supply chain management). A clear or detailed operationalization is frequently missing, resulting in confusion and the use of different terms for the same phenomenon, making it difficult to paint an overall picture of sustainability in the context of procurement. For example, in their

review article Sönnichsen and Clement (2020) attempted to provide an overview of the state of the art in green and sustainable public procurement by combining insights from green, sustainable and circular public procurement. However, although it can be argued that circular elements are being realized via sustainable or green public procurement and the concepts are thus related (Alhola et al., 2019), this does not mean they are conceptually the same. Moreover, a recent study showed not only that these concepts are indeed distinct, but also that the different SPP categories have different antecedents and that what drives green public procurement therefore does not necessarily work for circular economy (Grandia and Voncken, 2019). To understand the implementation of SPP it is therefore necessary to distinguish between SPP and the subcategories and ensure a clear operationalization. In this study we specifically examine the implementation of SPP, which we do consider to be part of the broader concept of sustainable supply chain management (Amann et al., 2014), as public procurement is one of the ways in which supply chains can be made more sustainable.

SPP is defined by Walker et al. (2012) as the pursuit of sustainable development objectives through the purchasing and supply process, thereby focusing on the policy tool aspects of SPP, and leaving the definition of sustainability open. Meehan and Bryde (2011) describe SPP as “the acquisition of goods and services in a way that ensures that there is the least impact on society and the environment throughout the full life cycle of the product”. Their definition largely overlaps with the European Commission's (07/08/2019) definition of SPP as “a process by which public authorities seek to achieve the appropriate balance between the three pillars of sustainable development - economic, social and environmental - when procuring goods, services or works at all stages of the project”. The European Commission's definition thus includes the triple bottom line dimensions often referred to as the three P's: People (social), Planet (environmental) and Profit (economic). If we follow this definition sustainable procurement should therefore encompass both economic, social and environmental aspects. This umbrella definition however does not help us understand what we mean by social or environmental sustainable procurement (McCrudden, 2004). For example, Uttam and Roos (2015) questioned what is meant if we talk about social procurement: international labour standards, abolishing child and slave labour, increasing health and safety at work, or the ethical procurement of raw materials? To be able to provide an overview of the implementation of SPP a more detailed definition and operationalization of SPP and its subcategories is therefore needed as we currently have too little insight into the degree to which SPP has been implemented in practice. Most studies on SPP focus on environmental rather than social procurement, with the exception of more specific studies on public food procurement that did focus on social rather than environmental procurement (Stefani et al., 2017). Studies that focus on only one aspect of SPP therefore do not provide any insight into the degree of SPP in the broad sense, or in the difference between the different categories (e.g. is there more environmental SPP implemented than social SPP?). Moreover, existing studies often focus on policy design issues or the identification of factors that drive or hinder implementation, such as top management initiatives and economic uncertainty (Giunipero et al., 2012), affective commitment to change (Grandia et al., 2014), collaboration between procurer and supplier (Witjes and Lozano, 2016), costs (Walker and Brammer, 2009), the presence of a change agent (Grandia, 2015b), the potential of e-procurement (Adjei-Bamfo et al., 2019), or the procurement procedure used (Uttam and Roos, 2015). Other papers focus on the way public organizations or procedures could increase the implementation of SPP, for example via designing a hurdle analysis tool that municipalities can use (Günther and Scheibe, 2006), or the identification of six possible strategies for including social considerations into public tenders (Bernal et al., 2019). Most existing studies into SPP report the perceived degree of SPP that is implemented in practice, measured via interviews or surveys, rather than the actual degree of SPP. As such there is great variation in the reported degree of SPP (or specific subcategories) in

existing studies, both regarding SPP in general as well as between organizations and countries (e.g. [Brammer and Walker, 2011](#); [Grandia et al., 2015](#); [Renda et al., 2012](#); [Testa et al., 2012](#)). The fact that most studies use a different operationalization and conceptualization of SPP (or a subcategory) makes it impossible to provide an overview of how much SPP (or of a subcategory) is implemented and what patterns appear therein. The lack of longitudinal studies exacerbates this, as there is not overview of the development of SPP over the years. This paper attempts to fill that gap and provide a stable foundation for future research into the implementation of SPP by providing a detailed operationalization of SPP and its subcategories. The aforementioned definitions of SPP and studies are as a starting point for this. We will subsequently use text-mining techniques to analyse public procurement notices and measure the actual degree of implemented SPP (including all subcategories) over the years and identify patterns therein. In the next section, the methodology behind the research is discussed in-depth.

3. Methodology

3.1. Research strategy

To provide an overview of the actual implementation of SPP and its subcategories and identify patterns therein we wanted to analyse over 140.000 public procurement notices that were published between 2011 and 2016 using text-mining techniques. We opted to do a longitudinal study as it would allow us to identify patterns in the implementation of SPP over time (e.g. upward or downward trends). By analysing the content of the procurement notices and searching them for the presence of SPP we can report the actual implementation of SPP in Belgium, rather than the perceived implementation of SPP.

Due to the sheer number of procurement notices, it was not feasible to use conventional and manual coding techniques, such as axial or thematic coding. We therefore opted to use a computer-assisted text mining strategy to identify SPP in the procurement notices. Text mining is an objective research method that is not (yet) commonly used in organizational studies ([Kobayashi et al., 2018](#)). Computer assisted text-mining offers the option of examining a large set of documents for the presence of specific codes. However, to detect the presence of SPP in the procurement notices a detailed operationalization and the development of an extensive codebook referring to (the subcategories of) SPP was necessary.

3.2. Operationalizing SPP & development of the codebook

An extensive document study laid the foundation for the codebook. A snowballing procedure was used to identify all relevant documents and websites. A civil servant from the Federal Institute for Sustainable Development (FIDO) from the Belgian Government provided a nine-page long list of relevant legislation, policy documents, policy letters, white papers, and websites as a start for the snowballing procedure. Every item on the list was studied, as well as documents or websites referred on them, which were subsequently studied for additional relevant documents or websites. This snowballing procedure was continued until no new relevant documents or websites were identified. The definition by [Meehan and Bryde \(2011\)](#) of sustainable procurement and the abstract concept of the three P's served as a rough framework to start the operationalization of SPP. Based on this the sustainable procurement practices from the documents different types or indicators of SPP were written down in an extensive excel file by the first author and subsequently grouped together in categories (e.g. social and environmental). Through various iterative steps the sub-categories were then refined into sub-subcategories, and subsequently into a codebook where each sub-subcategory contained codes indicating the presence of the specific sub-subcategory. For example, solar panel is a code indicating sub-subcategory solar energy, which is part of sub-category sustainable

energy generation, which is part of environmentally friendly procurement. Throughout the process public procurement notices, documents, and websites (including online dictionaries) were consulted to identify synonyms (e.g. solar panel and solar collector), alternative spellings, word breaks (e.g., 'fairtrade' 'fair trade', and 'fair-trade'), and orthography. The first author operationalized SPP and categorized the codes. Via an iterative process the second author and a focus group independently checked the work by the first author. The focus group consisted of civil servants from various Belgian public organizations that were experts in the field of sustainable public procurement. The focus group and the second author checked and refined the operationalization and categorization of SPP in various rounds until no additional codes or alterations were suggested.

To be able to also identify conjugations of the codes in the procurement notices, the codes in the codebook were converted in search terms that contain the word root rather than the complete word.¹ Belgium has multiple official languages (Dutch, French and German), the procurement notices were therefore also written in multiple languages. The codebook was therefore also developed in multiple languages. As only a small minority of Belgian citizens speaks German, and we did not come across any notices that were solely written in German, the codebook was written in Dutch and French, and not in German. A bilingual (Dutch and French) native speaker translated the Dutch version into French, which was checked by the Focus group (that contained civil servants from both the Dutch and French speaking parts of Belgium). The final operationalization of SPP and codebook encompass seven main categories that will be discussed in more detail below.

The first category is 'environmentally friendly public procurement', often referred to as green public procurement. This is the most well-known category of SPP, and sometimes considered synonymous to SPP. It encompasses technologies, processes, systems or materials that can be prescribed to help lower the environmental impact of goods, services and works (e.g. solar energy, recycling or rainwater systems, organic food), or should be avoided (e.g. deforestation or carbon emissions). The second category is 'circular economy', which is a more recently developed category of SPP, combining Planet and Profit. Circular economy encompasses an economic system focused on closing the lifecycle loop of products, by reusing and recycling materials. This approach is opposed to the current linear system where materials are destroyed as garbage at the end of their lifecycle ([FIDO, 2019](#)). The third category of SPP 'Social Return On Investment' focuses on 'People'; it involves easing citizens' access to the labour market, specifically for underprivileged, long-term unemployed or disabled citizens. The fourth SPP category 'Ethical Trade' focuses on ensuring that people throughout the international supply chain are treated in an ethical manner, addressing topics such as child labour, human rights, fair wages, and decent working conditions. The fifth category 'Local and SME-oriented public procurement' is a more profit oriented, category of SPP and aims to create more opportunities for local or small- and medium sized firms to partake in public procurement. The sixth SPP category 'Innovation-oriented public procurement' encompasses all three P's. It focuses on using public procurement to drive the development of innovations. The seventh and final category comprises the increasing list of labels (or certificates and standards) that help public procurers determine if a good or service meets specific sustainability criteria, such as the FSC label for sustainable wood or the Goodweave label for ethical trade, as such it encompasses both people and planet.

The seven main categories of SPP were further operationalized into subcategories and sub-subcategories. For example, SPP main category 'environmentally friendly public procurement' encompasses, amongst

¹ For example, 'zonnepan' was the search term for 'zonnepaneel' (Dutch translation of solar panel). This meant that the software would be able to identify both 'zonnepaneel' (singular) and 'zonnepanelen' (plural) using the same search term.

others, subcategories 'green energy generation', 'energy conservation', 'pollution', and 'transport'. In turn subcategory 'green energy generation' encompasses, amongst others, 'solar energy', 'wind energy', 'biomass', and 'CHP', whereas as subcategory 'pollution' encompasses, amongst others, 'air pollution', 'noise pollution', and 'light pollution'. A detailed overview of all the main categories, subcategories, and sub-subcategories can be found in the appendix.

3.3. Sample

In January 2017 the researchers received a dataset from the Federal Institute for Sustainable Development (FIDO) containing the (145.186) public procurement notices or contract award notices that had been published on the Belgian E-procurement platform between 2011 and January 2017. The public procurement notices were downloaded onto the hard drive from the E-procurement platform by the civil servants that are responsible for the maintenance and hosting of the E-procurement platform. The authors were given permission by the Belgian Federal Government to use the data for a scientific study and publish the results.

Given Belgium's three official languages, notices were written in these languages too. Each notice was in a separate file that contained at least one .xml file with basic information, and sometimes appendices in other file formats. The 331 folders that contained contract award notices were removed from the dataset, as they merely reported who was awarded a contract, and did not provide details about the contract itself. We opted to analyse the period for which data was available for a full year. As there was no complete data for 2017 and no data from before 2011, the studied timeframe is 2011–2016. The 106 folders that contained public procurement notices from 2017 were removed from the dataset too, as they were only for January of that year. The final dataset thus contained a total of 144,749 unique folders containing 144,749 unique public procurement notices published between 2011 and 2016.

3.4. Data analysis

The public procurement notices were indexed using [Elasticsearch \(2017\)](#). Elasticsearch is an open-source software program often used by software companies to build search engines but can also be used in scientific projects such as ours to analyse large data sets efficiently. A pilot study showed that the XML files only contained basic information about the government contract, such as the year of publication, post-code, or CPV code²; but no specific information about the content of the government contract (e.g. technical specifications or award criteria). Most information was "hidden" in attachments that various public procurement notices included. Therefore, all appendices in a searchable format (i.e. .doc, .docx, xls, xlsx, and .pdf) were also indexed by Elasticsearch. After the files were all indexed, specific search queries that included the terms from our codebook were run to search through the files to investigate attention for sustainability in the procurement notices. In order to validate our findings, the Belgian Federal Government organized a conference for circa 25 Belgian and Dutch SPP experts and practitioners. During the conference the attendees confirmed and validated our findings. results of the research are presented in the next section.

² The common procurement vocabulary (CPV) is a single classification system for public procurement that standardizes the references used by contracting authorities and entities to describe procurement contracts. It is based on a tree structure comprising codes of up to 9 digits (an 8 digit code plus a check digit) associated with a wording that describes the category of supplies, works or services forming the subject of the contract" (e.g. frozen vegetables, banking services or construction work) (SIMAP, 2019).

4. Results

4.1. The implementation of SPP

In 23% of all 144,749 files of public procurement at least one category of SPP was implemented ([Table 1](#)). This means that at least one code (for example solar panel) from the codebook was identified in a procurement notice. This is not a very high score and means that in the majority of procurement notices there is no SPP at all. This result is in contrast to what we expected based on the self-reported data on SPP (e.g. [Renda et al., 2012](#)) and could indicate that the social desirability bias might indeed have resulted in an overestimation of the implementation of SPP. However, only 20% of the notices had an annex (such as a formal specification or plan). If we compare the implementation of SPP in procurement notices with and without an annex, it becomes clear that in 70% of the notices with annexes there was SPP versus a mere 12% of the notices without annexes. This means that in the vast majority of notices with an annex at least one category of SPP was implemented. The low score for overall SPP implementation in all files therefore might be due to the lack of appendix, rather than lack of SPP implementation, we therefore have to be cautious in the interpretation of the results.

Environmentally friendly procurement is the most frequently implemented category of SPP with 26,271 notices implementing it. It is implemented more than twice as often as the runners up (ethical trade: 11,362 notices and social procurement: 11,335 notices) ([Table 2](#)). Innovation-oriented public procurement was implemented in only 1% of all procurement notices. As one notice can contain multiple categories of SPP, the total of [Table 2](#) is higher than the total of [Table 1](#).

If we zoom in at the level of the sub-subcategories ([Table 3](#)) it becomes apparent that environmental friendliness in general³ and waste are the most frequently identified SPP subcategories. Although there is a clear prevalence of environmental sub-categories, it is interesting to see that certain environmental sub-categories that are often at the heart of discussions about sustainability, such as sustainable energy generation (e.g. solar and wind energy), energy consumption and environmental pollution are still implemented less often than social categories 'labour participation', 'distance from the labour market' and 'fair working conditions'. Some categories score so remarkably low (e.g. local or regional products), that it appears that they are hardly implemented in practice.

In many notices more than one category of SPP was implemented (see [Table 4](#)). Specifically, each notice implemented on average 4.21 different sub-subcategories of SPP. There was no notice that implemented more than 55 different (of the total of 88) sub-subcategories. More categories do however not necessarily mean that a procurement project is more sustainable, it merely shows that a wider variety of sub-categories of SPP are implemented in the procurement notice. Fewer categories can for example mean that they have chosen to focus on one category of SPP and implement that in a challenging manner (e.g. a building must be powered solely by solar panels), rather than implement a little of a lot of categories (e.g. optional solar panels, optional recycling, optional use of sustainable modes of transportation). It does however show that if SPP is identified in a notice, then usually it involves more than one sub-subcategory of SPP.

4.2. Patterns in the implementation of SPP

In this section, we discuss to what extent patterns can be identified in the implementation of SPP. As the previous analysis showed that the notices with annex(es) paid considerably more attention to SPP than

³ The subcategory 'environmentally friendly' contains general search terms such as environmentally friendly and green, whereas the subcategory waste encompasses for example recycling, waste reduction, and separation of waste.

Table 1
SPP implementation in notices with and without annex(es).

SPP			
<i>Annex(es)</i>	No	Yes	Sum
No	102,330 (88%)	13,967 (12%)	116,297
Yes	8731 (30%)	19,721 (70%)	28,452
Total	111,061 (77%)	33,688 (23%)	144,749

Table 4
Number of SPP sub-subcategories per public procurement notices.

From	Until	Number
0	0	111,031
1	5	24,370
6	10	6299
11	15	2057
16	20	689
21	25	200
26	30	68
31	35	27
36	40	4
41	45	2
46	50	1
51	55	1

Table 2
SPP main category implementation (n = 144,749)^a.

SPP main category	Number
Environmentally friendly procurement	26.271
Ethical trade	11.362
Social Return on Investment	11.335
Sustainable labels	8.417
Local/SME-oriented procurement	4.080
Circular Economy	2.294
Innovation-oriented procurement	1.551
Total	65.310

^a Note. Number = Number of notices in which there is consideration for one or more (sub-) subcategories of the relevant main category.

occurrence of elements of SPP in the contract notices. On average there is a correlation of about .34 between references to elements of SPP at the level of sub-sub-categories (SD = 0.17); a correlation of about .44 at the level of sub-categories (SD = 0.22); and a correlation of about .65 at the level of the main categories (SD = 0.19). This means that procurers, once they implement sustainability in their notices, do not focus on one particular subcategory only but implement different

Table 3
SPP main- and subcategory implementation (n = 144,749)^a.

SPP Main category	SPP Subcategory	Number
Environmentally friendly procurement	General	17.361
Environmentally friendly procurement	Waste	11.696
Ethical trade	Working conditions	8.699
Environmentally friendly procurement	Food	8.485
Sustainable label	Eco label	8.340
Social Return on Investment	Labour participation	6.841
Social Return on Investment	Distance from the labour market	5.857
Environmentally friendly procurement	Environmental pollution	5.383
Ethical trade	Fair working conditions	5.127
Local/SME-oriented procurement	SME	4.043
Ethical trade	Work	3.752
Environmentally friendly procurement	Hazardous substances	3.640
Environmentally friendly procurement	Energy consumption	3.470
Environmentally friendly procurement	Gases	3.243
Ethical trade	Rights	3.086
Environmentally friendly procurement	Transport	3.017
Environmentally friendly procurement	Energy generation	2.554
Circular Economy	N/A	2.294
Environmentally friendly procurement	Soil	1.762
Innovation-oriented procurement	Innovation-oriented procurement	1.551
Environmentally friendly procurement	Water	1.403
Social Return on Investment	Social general	1.033
Environmentally friendly procurement	Sustainable raw materials	801
Environmentally friendly procurement	Sustainable energy	479
Sustainable label	Ethical trade label	288
Environmentally friendly procurement	Forests	270
Sustainable label	Local label	86
Environmentally friendly procurement	Materials consumption	81
Ethical trade	Wages	62
Local/SME-oriented procurement	Local	50
Ethical trade	Prices	7

^a Number = Number of notices in which there is consideration for one or more sub-subcategories of the relevant subcategory.

notices without annex(es), the subsequent analyses are limited to the 20% (28,452) notices containing one or more annexes to increase validity. Due to missing values in background characteristics provided in the .xlm files, the number of notices per analysis can vary slightly.

4.2.1. Co-occurrences of sustainable procurement elements in notices

Given the dichotomous nature of our data—that is, a 1 represents attention for an element of SPP, a 0 represents the absence of attention—tetrachoric correlations were used to investigate the co-

subcategories from a main category simultaneously. Ergo, they do not only focus on solar energy generation, but also on recycling or air pollution.

4.2.2. Sustainable procurement over time

The different categories of SPP have not been designed and implemented all at the same time, but rather developed over time. For example, in practice there have been initiatives around environmentally friendly procurement or Fairtrade for a long time,

Table 5
SPP main category in % per year (n = 28,449)^a.

Year	Sustainability category							Notices
	EF	CE	S	E	L	I	SL	
2011	59	4	24	30	9	6	13	229
2012	70	5	31	36	17	2	30	3214
2013	69	7	31	32	16	5	21	4372
2014	72	9	35	37	16	7	25	4884
2015	53	7	33	35	11	5	19	6778
2016	44	7	34	35	11	4	18	8972

^a EF = Environmentally friendly; CE = Circular Economy; S= Social; E = Ethical trade; L = Local/SME-oriented procurement; I= Innovation-oriented procurement; SL = Sustainable label; Notices = Number of public procurement notices.

whereas circular economy is a more recent development. We therefore wondered if the implementation of the different main categories had changed over time (Table 5). However, we found the implementation of the different subcategories of SPP over the years to be relatively stable. Over the years environmentally friendly procurement was always the most frequently implemented category of SPP. 2014 was its peak year, when 72% of the notices paid attention to environmentally friendly procurement. However, after the peak it decreased to 44% in 2016. Because we do not see a major increase in any of the other categories in these years, the decrease in consideration of environmentally friendly procurement does not appear to be caused by a shift in attention to the other and newer categories of SPP, such circular economy or innovation-oriented procurement. On the contrary, a similar pattern is visible in the other categories of SPP as well. All categories of SPP peak in 2014, only to level off or decrease in 2015 and 2016. The only notable exception is local/SME-oriented procurement, which peaked and decreased even earlier (in 2012).

4.2.3. Sustainable procurement across regions

Based on the postcodes indicated in the .xml files a distinction was made between notices from the Brussels-Capital Region, Flanders, and Wallonia (Table 6). The implementation of the different categories of SPP shows a similar pattern in each of the regions. In every region, environmentally friendly procurement is the most popular, followed by social procurement and ethical trade. If we compare the regions Flanders can be considered the frontrunner with regard to the implementation of 'environmentally-friendly' procurement, 'circular economy', and 'innovation-oriented procurement', and the Brussels-Capital Region with regard to 'social' procurement, 'ethical trade', 'local/SME-oriented procurement', and 'sustainable labels'. Wallonia scores the lowest of the three regions across all SPP categories. Moreover, even environmentally friendly procurement is implemented significantly less in Wallonia than in the other two regions, indicating that they are running behind. More research is necessary to explain why this region is implementing less SPP.

Table 6
SPP main categories in % by region (n = 27,711)^a.

Region	SPP main category							Notices
	EF	CE	S	E	L	I	SL	
Brussels	60	7	39	46	16	4	24	8800
Flanders	67	9	31	31	14	7	21	14065
Wallonia	40	1	26	26	9	0	19	4846

^a EF = Environmentally friendly; CE = Circular Economy; S= Social; E = Ethical trade; L = Local/SME-oriented procurement; I= Innovation-oriented procurement; SL = Sustainable label; Notices = Number of public procurement notices.

Table 7
SPP main category by award method in % (n = 21,495)^a.

Award	Sustainability category							Notices
	EF	CE	S	E	L	I	SL	
MEAT	63	8	29	36	10	5	20	9724
Lowest price	77	9	46	44	22	5	31	11771

^a Number = Number of notices in which there is consideration for one or more sub-subcategories of the relevant subcategory.

4.2.4. Sustainable procurement by awarding method

A total of 21,495 notices specified the award method: lowest price or the most economically advantageous tender (MEAT). The analysis showed that more SPP was identified in notices with lowest price as the award method than in notices with MEAT as the award method (Table 7). This shows that, contrary to common belief in practice, MEAT is no prerequisite for SPP. Regardless of the type of award method we find SPP implemented, and in this case more SPP in project with lowest price as the award method. Innovation-oriented procurement is the only exception as it was identified equally often in both. The difference between award methods and attention for SPP is most notable for local/SME-oriented procurement, which is implemented twice as often in notices with lowest price as the award method.

4.2.5. Implementation of SPP and procurement budget

A total of 28,452 notices reported a budget for the procurement. We calculated what the average reported budget was if a notice did implement a specific category of SPP and the budget if it did not (Table 8). All budgets in the table were rounded off to whole numbers, and to avoid distortion three notices that reported a budget larger than 3 billion euro were excluded from the calculations. There are some salient differences found between the budget of notices with and without SPP implementation. For example, on average a much higher budget is reported in notices that implemented environmentally friendly procurement, circular economy, or ethical trade than in notices without these categories of SPP. The very high average amount stated for public procurement notices that implement circular economy (€18.756.000) is also striking. It shows that circular economy is not frequently implemented, but when it is implemented it is in large (in terms of budgets) projects, which means that its impact on procurement could still be quite big. These findings therefore indicate that the size of the budget for a project might play a role in the decision of public procuring authorities to implement a category of SPP. For example, sustainable labels might be considered more suitable for smaller projects, whereas circular economy is considered more fitting for a large-scale project better. Maybe minor items are not so much forgotten in the implementation of SPP (Haake and Seuring, 2009), but rather they are implemented in a different way.

5. Conclusion

In this part of the paper we provide an answer to the research question. Our research aimed to answer the following three research questions: 1) how can SPP in practice be operationalized to better cover the full concept of SPP, 2) what is the actual implementation of SPP in practice 3) what kind of patterns can we identify therein? Based on the findings from the research we provide the following three answers.

First, the full concept of SPP encompasses seven categories of SPP: 1) environmentally friendly procurement, 2) circular economy, 3) social return on investment, 4) ethical trade, 5) local and/or SME-oriented procurement, 6) Innovation-oriented procurement and 7) the use of sustainability labels. Together these seven categories of SPP encompass the three P's of sustainability: people (social return on investment, ethical trade), planet (environmentally friendly procurement, circular economy). The research shows that the full concept of SPP does

Table 8
SPP main category by budget x 1000 (n = 28,452)^a.

SPP	SPP main category						
	EF	CE	S	E	L	I	SL
<i>Average budget in €</i>	€8.252	€18.756	€1.455	€6.218	€2.324	€1.325	€3.086
<i># notices with budget</i>	1.539	183	893	989	250	119	644
<i># notices without budget</i>	15.567	1.835	8.503	9.010	3.524	1.200	5.460
No SPP	<i>SPP main category</i>						
	EF	CE	S	E	L	I	SL
<i>Average budget in €</i>	€1.807	€4.502	€7.430	€5.031	€5.782	€5.653	€6.203
<i># notices with budget</i>	1.174	2.530	1.820	1.724	2.463	2594	2069
<i># notices without budget</i>	10.172	23.904	17.236	16.729	22215	24539	20279

^a EF = Environmentally friendly; CE = Circular Economy; S = Social; E = Ethical trade; L = Local/SME-oriented procurement; I = Innovation-oriented procurement; SL = Sustainable label; Notices = Number of public procurement notices.

not only exist in policies, but that all the main categories are implemented in the procurement practice and that the detailed operationalization of SPP into sub-subcategories helped describe and examine the implementation of SPP in practice in detail.

Second, more SPP is implemented in practice than was expected based on existing self-reported data. For example, we found that in more than 70% of the notices (with an annex) SPP was implemented, which is significantly more than the 40–60% that was reported for Belgium in the European Commission's report (Renda et al., 2012).

Third, we conclude that in the implementation of SPP four important patterns can be identified. First, the prevalence of environmentally friendly procurement in practice compared to the other main categories of SPP. This pattern is stable across regions and time, indicating the environmentally friendly procurement is not being displaced by the other categories. Second, the overall implementation of SPP appears to be on the decrease, as all categories of SPP are implemented less frequent over time. Third, there appears to be a relationship between the reported budget and the implementation of specific categories of SPP, indicating the certain types of SPP might be considered more applicable or relevant for smaller or larger projects.

5.1. Limitations

The research and analyses were carried out systematically and with great care and attention. However, our study, like any other, does have its limitations, which also offer avenues for future research.

First, because SPP was implemented much more frequently in notices with an annex than in notices without an annex, we must be cautious in interpreting the data. Although we conducted the bivariate analyses only on the notices with an annex this does not completely eliminate the risk of distortion in the data. In order to give a more complete picture of the state of SPP and public procurement in general in Belgium, it is therefore necessary that annexes, such as specifications and technical specifications, are always uploaded with a notice.

Second, unfortunately the information in the notices was not always complete or correct. For validity reasons it was therefore not possible to analyse the data at the organizational level. The procurers submitting the notices for example often created a new account for each procurement project (thus one organization could have dozens of accounts), made spelling mistakes in the information, used different postcodes for the same organization (e.g. not from the headquarters but from subsidiary branches), or did not state whether the procurement was carried out on behalf of another organisation. More research is therefore needed to assess whether specific organizations or types of organizations implement more SPP or implement specific SPP categories more frequently.

Third, the text mining allowed us to examine thousands of documents and assess the implementation of SPP and detect the presence of almost a 1.000 search terms in the procurement notices. It could

however only check if a search term appeared in a notice, not in which context or section of the notice it is mentioned, or with what meaning. As such text mining could not determine the weight of the MEAT criteria, whether the SPP was compulsory or optional, or if perhaps another meaning of the word was actually meant. To prevent false positives and increase the validity of the findings, manual checks were conducted and words that were too often used in a different context were eliminated from the codebook. For example, green was omitted as an individual search term, as it usually refers to a colour rather than sustainability. The text mining did however detect patterns that can serve as starting points for further qualitative research, which will be discussed in the next and final section of the paper.

6. Discussion & future research

In this part of the paper we discuss the findings in relation to the literature and offer venues for future research.

First, more SPP is implemented than expected based on the self-reported data. More than 70% of the notices (with an annex) implemented SPP. This is much more than the 40–60% based on self-reported data for Belgium in the European Commission's report (Renda et al., 2012). Moreover, we expected that due to social desirability bias the self-reported data might have over-emphasized the degree of SPP (Walker and Brammer, 2012). Our study shows that the opposite appears to be true, as we identified more SPP. This could be an indication that public procurers might not always be aware of what SPP and its subcategories actually are and thus include it without realizing it, or that other actors in the procurement process (such as engineers drawing up the technical specifications) insert sustainability into the procurement. Further research into the implementation of SPP and the differences between actual and perceived SPP is thus necessary.

Second, the strong focus on environmentally friendly procurement in the literature (Grandia, 2017) is also found in practice. Environmentally friendly procurement is implemented twice as often as the other types of SPP. The focus on environmentally friendly procurement is not only consistent across all three regions, but also over time. While the implementation of environmentally procurement did decline over time, the implementation of the other categories of SPP also declined. The attention for environmentally friendly procurement is thus not being displaced to other categories of SPP. This could be explained by the finding by Grandia and Voncken (2019) that environmentally friendly procurement has different antecedents than the other types of SPP, and that for example a high degree of affective commitment the implementation of environmentally friendly procurement increases, but not the implementation of social return on investment. Further research into the drivers and barriers of the different types of SPP is therefore necessary to see if and how the implementation of the other types of SPP can be increased.

Third, as stated earlier the implementation of all types of SPP

appears to be on the decrease. In every category of SPP a general pattern was visible where the implementation peaked around 2014, only to level off or decrease in 2015 and 2016. Although this decline could be affected by overall increase in the number of notices with an annex over time, we have not found any indications that this is the case, which was validated by experts and practitioners. This finding therefore highlights the need for more longitudinal and explanatory research in public procurement to further our understanding of why SPP is not implemented to its full potential and if the downward trend continued or not.

Fourth, there are substantial differences between the different categories of SPP when we look at the reported budgets. On average, higher budgets were reported in notices where 'environmentally-friendly', 'circular economy' and 'ethical trade' were implemented compared to cases where there was no implementation of these SPP categories. On the other hand, a higher budget was also reported in notices where there was *no* implementation of 'social', 'local/SME-oriented procurement', and 'innovation-oriented procurement' compared to the notices in which there was implementation for these categories. As such, it is difficult to identify a uniform pattern here; it does appear that certain types of SPP are implemented more (and thus possible considered more suitable) for notices with a large budget (e.g. circular economy), and others for projects with a smaller budget (e.g. social procurement). Further research is thus necessary to examine and explain the relationship between SPP and budget.

Fifth, contrary to what is a common belief more SPP was implemented in procurement notices with lowest price as an award method, than in procurement notices with MEAT as the award method. For example, more reference was made to sustainable labels, ethical trade, and social procurement in notices with lowest price as the award method. Perhaps opting for a lowest price award method is also a way of dealing with the risk of higher prices for sustainable alternatives, which was identified as a main barrier to SPP implementation (Preuss, 2009; Sönnichsen and Clement, 2020). Our research however does show that a MEAT award method is no prerequisite for implementing SPP. It shows that in a lowest price award method there are still numerous ways in which SPP can be implemented. More in-depth research is however necessary to examine and explain why the implementation of SPP per award method differs, also in light of changing rules and regulations aimed at making MEAT the norm.

Finally, our research shows text mining to be a useful method for assessing the implementation of SPP in actual procurement notices and avoiding the pitfalls of measuring the implementation of SPP via surveys or interviews. The text mining showed us not only the presence of SPP in the notices, but also allowed us to search for specific categories and identify patterns in the data, such as developments over time. Because it is an objective research method, it is able to assess the implementation of SPP even in older procurement notices, as it does not depend on the memory or availability of actors and is therefore able to present reliable assessments of the implementation of SPP and patterns therein. We therefore suggest further research into the implementation of SPP, for example in other countries or across countries, to use this research method for determining the actual implementation of SPP.

Declaration of competing interest

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

Author statement

Jolien Grandia: conceptualization, validation, investigation, writing original draft, writing review, project administration, funding acquisition, supervision.

Peter Kruyen: methodology, software, validation, formal analysis,

investigation, data curation, funding acquisition.

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Appendix A. Supplementary data

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