




Article

The Intellectual Structure of Social and Sustainable Public Procurement Research: A Co-Citation Analysis

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Abstract: Public procurement has recently taken into account social and sustainable factors, increasing academic literature in this field. The aim of this paper is to map the intellectual structure of social and sustainable public procurement research by means of delimiting the scientific domain's research traditions, its disciplinary composition, and influential research topics. Given that there is a literature gap in bibliometric studies applied to this field, we conducted a co-citation analysis to identify the intellectual structure of this area of knowledge. Co-citation analyses identify networks of interconnections and, consequently, detect the most (and the least) active research areas, being a good complement to traditional literature reviews. This article contributes to science development because it is the first paper to carry out a bibliometric analysis in the field of social and sustainable public procurement, as well as the first one to conduct a co-citation analysis among public procurement research. Consequently, it is also the first article to detect which papers have become burst in this research field. The results show twelve different clusters of publications that were cited by researchers who wrote papers on social and sustainable public procurement. In other words, the sources of knowledge that scholars used as references are analysed, identifying papers that can be considered turning points, as well as those that became specially cited over a discrete period of time. Six different research trends were identified over the last decade in regard to social and sustainable public procurement research. The conclusions highlight the relevance of the findings, especially because they provide guidance to researchers when conducting literature reviews, given that the most significant journals and papers are identified.

Keywords: public procurement; sustainability; social value; ethics; environment; intellectual structure; bibliometric; trends; co-citation



Citation: Torres-Pruñonosa, J.; Plaza-Navas, M.A.; Díez-Martín, F.; Beltran-Cangrós, A. The Intellectual Structure of Social and Sustainable Public Procurement Research: A Co-Citation Analysis. *Sustainability* **2021**, *13*, 774. <https://doi.org/10.3390/su13020774>

Received: 13 December 2020

Accepted: 8 January 2021

Published: 14 January 2021

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1. Introduction

Public procurement is the procedure used by governments and administrations to purchase goods or services from professionals and companies. Public procurement represents a substantial part of the public investment in developed economies; consequently, it has become a pillar in the set of investments of these economies. Public authorities can make strategic use of this tool, in order to optimise the use of public funds and support the development of a more innovative, sustainable, and competitive economy. In this regard, the Organisation for Economic Co-operation and Development (OECD) considers public procurement to be a crucial pillar, given that it represents a sheer volume of spending, “in fostering public sector efficiency and establishing citizen's trust” [1]. For this reason,

public procurement must be well-governed and their systems well-designed in order “to contribute to achieving pressing policy goals such as environmental protection, innovation, job creation and the development of small and medium enterprises” [1]. One of the most remarkable features of public administration and agencies has to do with public procurement. Certainly, public expenditure in the European Union (EU) represents almost 50% of the Gross Domestic Product (GDP), according to Eurostat [2], which means that consumption in the public sector represents a very important part of internal demand. Thus, public expenditure is one of the most significant elements of aggregated demand in developed capitalist economies. An outstanding component of public expenditure is public procurement. For instance, general government expenditures on works, goods, and services (excluding utilities and some concessions) represented 13.3% of the EU GDP in 2017, according to the European Commission [3]. This fact explains the relevance of academic studies on this issue (for an overview on this topic, see [4]).

As indicated above, public procurement can have a wide range of objectives. Obviously, its main objective is to purchase goods and services, as well as to contract professionals at a reasonable price that meets minimum quality standards, with short delivery times. In this regard, public procurement does not differ from private contracting [5]. Nevertheless, higher objectives should be set in public procurement. Public sectors are expected to be exemplary and, in this sense, they should include clauses in their tenders to require suppliers to meet certain requirements related to the concept of sustainability. These requirements are becoming increasingly common in contracts between public sectors and private suppliers. Thus, according to the United Nations Environment Programme (UNEP) [6], sustainable public procurement is implemented worldwide as a policy instrument to support program and policies in regard to “poverty eradication, wealth creation, stimulation of local economies and employment, promotion of labour rights, national sustainable development strategies, and innovation and development of environmental technologies.” In the current context of changing values, an increasing number of arguments are given in favour of sustainability in regard to public procurement. Therefore, social value needs [7–11] to be taken into account. Consequently, the public sector is expected to adapt to these new demands, not only in the issuance of regulations, but, most significantly, in its commitment to specific behaviour and conducts. Considering that public expenditure is the core element of the activities of public institutions and agencies, there is no doubt that procurement must be designed and implemented within the framework of the objective of their own sustainability. This requirement explains the increasing interest of academics in sustainable public procurement, either in socially sustainable public procurement, for instance related to fostering local development, SMEs support or incentivising innovation; or in environmentally sustainable public procurement, such as green procurement or the promotion of circular economy.

This scientific production covers many different issues: sustainable public procurements [12–14], green public procurements [15–23], circular economy [15,24,25] or social sustainability [26–29]. In general terms, the concept of sustainable public procurement includes green procurement, circular economy and social sustainability. Green procurement requires suppliers to offer goods and services that meet certain requirements with regard to the reduction of the ecological footprint, by means of the improvement of energy efficiency, the reduction of both CO₂ emission and water consumption along with an adequate waste management. This kind of procurement is also related to the concept of circular economy, namely the objective of recycling and reusing raw materials and manufactured products to use them again in the process of manufacturing goods and services. Finally, yet importantly, public procurement must be socially sustainable; this means that it should support the development of local communities, the strengthening of Small and Medium Enterprises (SMEs), the reduction of poverty, the inclusion of disadvantaged groups, and the promotion of culture.

Over the last 11 years, from 2010 to 2020, there has been an increasing number of academic papers that deal with social and sustainable public procurement. Only 19.2 papers

were published per year during the period 2010–2014 in the Social Science Citation Index (SSCI) database. This amount has dramatically increased over the years: 36.5 papers per year were published during 2015–2016 and 70.8 published papers in 2017–2020. This increasing number of publications on social and sustainable public procurement makes it complicated to track this developing research area.

When knowledge increases in any field, it must be somehow analysed. Social and sustainable public procurement research is not an exception and literature reviews in this field have been published [15,30–33]. One of the main contributions of these reviews is that they establish the conceptual and theoretical framework. For this reason, they are of vital importance for the future development of this area. Nevertheless, some items have not been identified despite being key aspects to understand how the research field has evolved and its current situation. Thus, the following questions remain answered: what are, currently, the main fields of research on social and sustainable public procurement? By means of what papers has dissemination of the field of knowledge been possible? What papers attracted more attention from scholars, thus setting the research trends, and when did that happen? To put it another way, it is necessary to define the intellectual structure of this area of knowledge. Consequently, scholars would be able to identify the objectives of future research, so that the research they conduct may contribute to current areas of research and create new fields of study that can be included in this field of knowledge.

The bibliometric methodology allows the analysis of large amounts of data from hundreds of academic publications. It offers the possibility of evaluating quantitative data and inferring qualitative aspects. Nevertheless, bibliometric methods, such as the analysis of citations or co-citations, must be accompanied by a large knowledge of the field of study [34]. If this analysis is carried out properly, good insight into the subject studied can be achieved, including: clustering, intellectual turning points, burst papers detection, and so on.

There are two main ways to analyse academic research: quantitative and qualitative. The qualitative approach is particularly focused on expert knowledge on the subject of study and the review of existing literature, while the quantitative approach has to do with bibliometric methodologies. The qualitative methodology mainly needs the subjectivity of the person who performs it. It does not seem to be the best way to establish the intellectual structure of a field of knowledge, or at least the only one to be taken into account. The speed with which new works are published, the quantity of them, the task of selecting the most relevant ones, among others, can easily overwhelm the ability of researchers to process all of that information. Moreover, the results obtained may show or reveal some subjective influence of the researcher's point of view [35,36]. In an attempt to avoid this weakness, in this work, we opted for a quantitative approach, and the use of the methodology based on the analysis of citations (specifically, of co-citations) to build an approximation of the research activity in this field of study.

This article mainly aims to determine and offer a vision of the intellectual structure and dynamics of social and sustainable public procurement research. This implies delimiting the scientific domain's research traditions, their disciplinary composition, and influential research topics [37]. Whereas classical reviews only increase the conceptual understanding of a research area, this article contributes to the field by means of analysing its intellectual structure. Furthermore, we provide researchers with a basis for the future development of this field of knowledge by means of identifying the main research areas, the main contributions that have led to its dissemination, and the trends that have occurred, which have captivated the attention of academia.

The literature gap that we identified is the absence of a bibliometric analysis of sustainable and social public procurement, as well as a co-citation analysis of public procurement, according to the results obtained by means of research conducted in the Web of Science. Therefore, the contribution of this article to the field is threefold: (1) it is the first paper that carries out a bibliometric analysis among the academic literature that deals with social and sustainable public procurement; (2) it is the first paper that conducts a

co-citation analysis in the field of public procurement research; and (3) it is the first article that detects which papers have become burst in the public procurement research, since this is a very specific feature of co-citation analysis.

The structure of this paper will be as follows: methodology will be analysed in Section 2. Section 3 will show and discuss the results of the co-citation analysis. This will include clusters definition, intellectual turning points, and the burst areas (or in other words, the most active areas of research). Section 4 ends with a conclusion and recommendations for further research.

2. Methodology

With the objective of obtaining some approach to the intellectual structure of social and sustainable public procurement, a bibliometric study has been carried out on papers that focused on this subject. This is one of the methods that helps scholars to understand the origin and development of a field of knowledge. There is no doubt that bibliometric analyses have become a good complement to the traditional literature review [35]. Bibliometric methodology aims to examine the publication performance of researchers and to disclose the structure and dynamics of science [38], assisting in the discovery of old and current fields of research, as well as suggesting new ones, and pointing out possible gaps [39]. A search in SSCI shows three papers that deal directly with bibliometric methods applied to the field of public procurement. These are studies on circular economy business [40], green public procurement [41], and sustainable public procurement policies for the promotion of scientific innovation [13]. The existence of only three bibliometric analyses is consistent with the fact that this research area is relatively young (under development). Nonetheless, a co-citation analysis was not carried out in these bibliometric papers.

Among the different methods of bibliometric citation analyses, we have used co-citation, since it is one of the most widely used and validated [38,39]. The use of the co-citation method is especially recommended when the aim of the research is focused on answering any of the following questions: what is the intellectual structure of the field? What are the central, peripheral, or bridging research documents in the field? How has diffusion of the field taken place [38]? The analysis of bibliographic citations, as is well known, is based on the premise that if an author cites the work of another, there must be some kind of interest in doing so; and, a bibliographic citation indicates some type of relationship between the citing work and the cited work. A co-citation is defined by Small [42] as the frequency in which two works are cited together. Thus, two papers are co-cited if both are included among the bibliographic references of the same work. In this way, assuming that the co-cited articles will have related content, the similarity between publications is assessed on the basis of the amount of overlap in their bibliographic references. This type of co-citation analyses also offers the possibility of filtering outstanding papers in a scientific area. Although the citation count measures the relative influence of a document, through the analysis of co-citations, it is possible to detect interconnections between papers, to identify networks, and to find important changes in lines of thoughts and paradigms [38]. Co-citation frequency measures the level or degree of association between two documents and allows the discovery and identification of scientific disciplines. Therefore, co-citation analysis makes it possible to map the intellectual structure of a research field and to detect trends in the research area (by the authors who work on these topics and the nexus between them), and to discover first-line studies and highlight high-impact discoveries [39].

One of the most useful ways to quickly visualise and understand the intellectual structure of different types of study objects (papers, authors, funding entities, organizations, etc.) is the use of bibliometric mapping techniques [43]. Currently there is a variety of software programs [44] that allow, through the construction of bibliometric maps, the analysis of citations and co-citations, such as: CiteSpace, VOSviewer [45], SciMAT [46], and CitNetExplorer [47], BibExcel [48], Sci2Tool [49], among others. Each software programs has advantages and disadvantages [43] and, in general, allows the realization of different types

of mapping visualization from temporal or geospatial network analysis to the detection of bursts [43], or a combination of all, or part of them, to achieve quantitative indicators and infer qualitative results.

CiteSpace software [50] has some advantages compared to the others, such as the identification of major turning points and growth themes, the identification of the main emerging research trends through the detection of bursts, etc. Along with the fact that CiteSpace has already been used in the field of business and economics to analyse the intellectual structure of different areas (ex: [51,52]), it has been the software used in this paper.

Data

All of the scientific journals included in the SSCI database have been selected in order to conduct the study, in view that SSCI is one of the most frequently used databases to conduct bibliometric analysis in business and economics [38]. The search was carried out without any thematic limitation. Therefore, the results obtained belong to different research areas. In order to obtain the documents on social and sustainable public procurement, the following Boolean search strategy, in terms of titles, abstracts, and keywords (TS) has been used: (TS = "public* procurement*" OR TS = "government* purchas*" OR TS = "government* procurement*" OR TS = "public* purchas*" OR TS = "public* tender*") AND (TS = "soci* valu*" OR TS = "soci* account*" OR TS = "soci* effi*" OR TS = environment* OR TS=sustainab* OR TS = "soci* metri*" OR TS = "soci* impact*" OR TS = performan* OR TS = "stakeholder* theor*" OR TS = ethic*). The results obtained, segmenting the papers by means of Web of Science (WoS) categories, are the following: environmental sciences (130), economics (118), environmental studies (105), green sustainable science technology (91), management (91), and engineering environmental (53). Likewise, the main WoS research areas of the obtained papers were: business economics (218), environmental sciences ecology (169), science technology other topics (95), engineering (81), and public administration (65).

The time frame for the study (2010–16 November 2020) and the thematic category parameters originate 452 citing papers containing 24,126 different references, which comprised the data sample of the analysis. Therefore, no citing article was excluded. Among the 232 journals in which the 452 papers are published, while some of them are highly specialised in their field, others have a multidisciplinary scope. Table 1 shows the number of papers on social and sustainable public procurement published by journals, including only those who published three or more papers.

All sources of knowledge on social and sustainable public procurement (24,126 bibliographic references) found in the 452 citing papers obtained from SSCI were included in the bibliometric analysis. This does not mean that only academic journal articles were taken into account for the analysis. In fact, other types of documents (for instance, books, proceedings of conferences, etc.) were also included, since the analysis focuses on the co-cited references of the 452 citing papers.

Table 2 shows the parameters used to configure CiteSpace to perform the analysis (time slice, term source, node type, pruning, and selection criteria). CiteSpace also needs a careful definition of the source of the terms from which clusters are identified. In this study, among different possibilities, we chose the broadest option in SSCI by including the title, abstract, and keywords of the 452 papers found. In this way, it is possible to obtain a good range of terms for the analysis, but CiteSpace allows to complete it by including the terms that also appear in the 24,126 references cited (named in the program: "keywords plus (all)"). This improvement guarantees a greater and more complete source of terms that, in theory, should be well-related to the field of study to be analysed.

Table 1. Top 32 journals that have published research articles related to social and sustainable public procurement (2010–2020).

Journals	Number of Articles
<i>Sustainability</i>	44
<i>Journal of Cleaner Production</i>	38
<i>Journal of Purchasing and Supply Management</i>	15
<i>Public Money and Management</i>	12
<i>Eenergy Policy</i>	9
<i>Industrial Maketing Management</i>	8
<i>Resarch Policy</i>	7
<i>Amfiteatru Economic</i>	6
<i>Food Policy</i>	5
<i>Innovation The European Journal of Social Science Research</i>	5
<i>International Journal of Environmental Research and Public Health</i>	5
<i>Lex Localis Journal of Local Self Government</i>	5
<i>Resources Conservation and Recycling</i>	5
<i>Energies</i>	4
<i>Engineering Construction and Architectural Management</i>	4
<i>International Journal of Operations and Production Management</i>	4
<i>Journal of Business Ethics</i>	4
<i>Public Management Review</i>	4
<i>Ekonomicky Casopis</i>	3
<i>European Journal of Political Economy</i>	3
<i>European Journal of Transport and Infrastructure Research</i>	3
<i>European Planning Studies</i>	3
<i>International Journal of Industrial Organization</i>	3
<i>International Journal of Life Cycle Assessment</i>	3
<i>International Journal of Managing Projects in Business</i>	3
<i>Journal of Industrial Ecology</i>	3
<i>Local Government Studies</i>	3
<i>Natural Resources Forum</i>	3
<i>Public Performance and Management Review</i>	3
<i>Research in Transportation Economics</i>	3
<i>Technological Forecasting and Social Change</i>	3
<i>Technovation</i>	3

Table 2. Parameters for the analysis.

Parameter	Description	Choice
(1) Time slice	Timespan of the analysis	From 2010 to 2020
(2) Term source	Textual fields processed	Title/abstract/author keywords/keywords plus (all)
(3) Node type	The type of network selected for the analysis	Cited reference (the networks are made up of co-cited references)
(4) Pruning	It is the process to remove excessive links systematically	None
(5) Selection criteria	The way to sample records to form the final networks	g-index (k = 25). The g index is the largest number that equals the average number of citations of the most highly cited g publications. It solves some of the weaknesses of the h-index. k is a scaling factor introduced in CiteSpace to control the overall size and clarity of the resultant network

An important decision to consider, to the greatest possible degree, is the node selection criteria in order to achieve a sufficiently cohesive network where clusters are different from each other, in spite of containing similar documents within them. CiteSpace gives different node selection criteria: g-index, Top N, Top N%, and threshold interpolation. In this study,

the g-index was chosen. This criterion allows generating a network with the least number of small clusters and, therefore, improves the visualization of nodes and links [53].

The g-index improves the limitations of the h-index because it measures the overall citation performance of a set of articles [54] and gives more weight to the most cited articles, without the influence due to the total number of considered papers [55]. CiteSpace also introduces into the g-index a scaling factor k in order to regulate the total size of the network obtained. A $k = 25$ was chosen to develop the most suitable network for our set of analysed terms. In the Results section, the structural quality of the network obtained according to the modularity and silhouette indicators of CiteSpace is shown.

3. Results and Discussion

Over the last six years, social and sustainable public procurement research has had, as a whole, clear growth, showing pronounced take-off over the last four years (Figure 1). The growth was moderate between 2010 and 2014 (from 15 to 21 papers per year), with a considerable increase in 2015 and 2016 (36 and 37 papers per year respectively), and a clear upswing from 2017 to the present (between 54 and 79 publications per year). This research was mainly published in “environmental sciences”, “economics”, “environmental studies”, “green sustainable science technology”, “management”, “engineering environmental”, “public administration”, “business”, and “political issues” journals, according to the Web of Science categories. Considering the 11 year over the period between 2010 and 2020, the 452 published papers represent 41.1 publications per year. The publication of articles in journals included in the SSCI database, in other words, in high-impact journals, provides evidence that a field of knowledge was developing in social and sustainable public procurement—but up to what point? This is the aim of the third section of this paper.

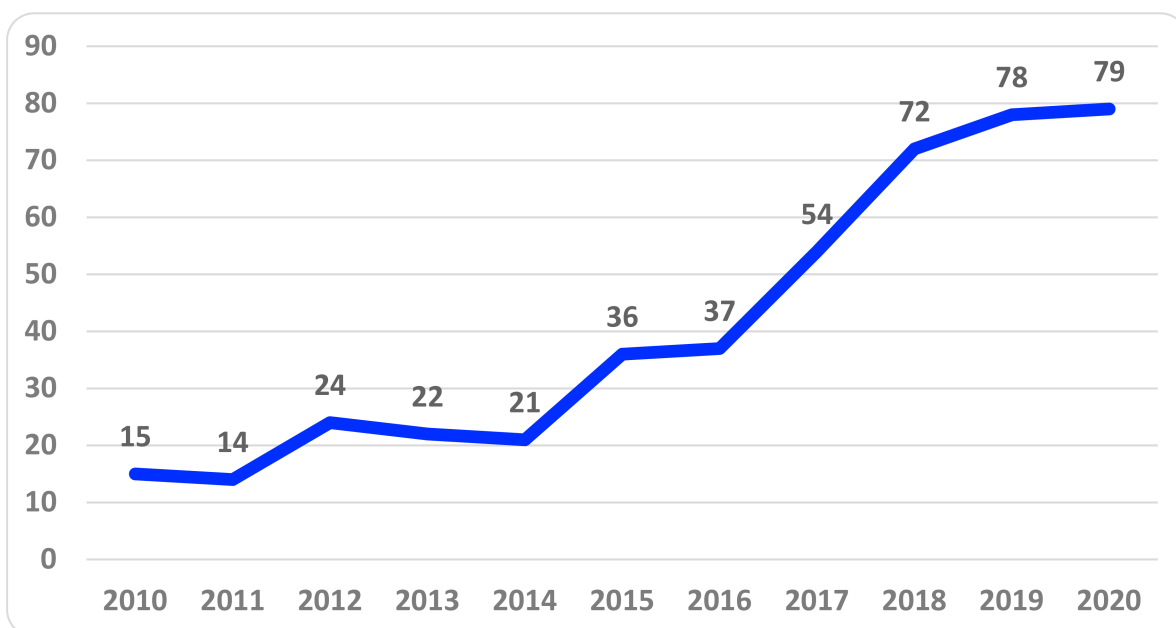


Figure 1. Growth of citing publications on social and sustainable public procurement research (2010–2020).

3.1. Main Research Areas in Social and Sustainable Public Procurement

The main research areas in social and sustainable public procurement are shown in Table 3. The network is divided into 12 main clusters (from #1 to #12). Each cluster corresponds to a different thematic structure. The results obtained in the form of clustering show the impact of subsequent research co-citing. Take the example of cluster #1, which is formed by 63 publications. This means that many scholars used several of these 63 publications together as a source of knowledge. Consequently, cluster #1 is considered a

thematic structure. Even though former researchers might have thought that their research was a contribution to one thematic structure, their papers may have eventually been used in alternative manners, which may derive into the inception of new avenues and, therefore, new clusters. All things considered, every single cluster corresponds to a line of research or thematic structure.

Table 3. Main research areas in social and sustainable public procurement.

Cluster	Size	Silhouette ¹	Mean (Year)	Label	Description
1	63	0.9	2016	Green Public Procurement	Definition of the concept of green public procurement and analysis of their design and implementation based on cases.
2	34	0.903	2012	Private Innovation	Analysis of how public procurement procedures can contribute to encourage and promote investment in Research and Development (R&D) in private companies.
3	31	0.992	2008	Local Small and Medium Enterprises (SMEs) Development	Study on public procurement procedures and their contribution to the development of local SMEs.
4	29	0.924	2014	Innovation in Public Procurement Processes	Description of the initiatives to promote innovation in public procurement procedures and analysis of their impacts on innovation strategies in private companies.
5	28	0.941	2012	Sustainable Procurement and Case Studies	It develops the subject of public procurement linked to the objective of sustainability and several case studies are analysed.
6	26	0.939	2010	School Feeding	Studies on public procurement policies in the specific case of school feeding.
7	23	0.987	2014	Auctions	Analysis of cases in which public tender procedures have been carried out by means of auctions to establish their pros and cons.
8	20	0.904	2016	Public Governance	Relationship between organizational strategies and public procurement procedures and the results obtained.
9	17	0.983	2016	Circular Economy	Research on sustainable public procurement policies specifically regarding integration of the circular economy requirements in processes to design and implement these policies.
10	7	0.971	2010	Case Methodology	Seminal publication introducing the case methodology as an alternative to traditional experimental methods.
11	5	0.995	2012	Energy Efficiency	Public procurement that incorporates the objective of increasing energy efficiency. Control procedures to measure and verify energy and water saving.
12	3	0.986	2017	Social Sustainability	Analysis of public procurement procedures that include different social sustainability requirements.

¹ Quality of a clustering configuration [56], suggested parameters between 0.7 and 1 [50].

In order to select the 12 clusters, the cluster silhouette value was used as a criterion. This value must range between 0.7 and 1.0 according to Chen et al. [50] and assesses the quality of a clustering configuration by means of cohesion and separation. Whereas

cohesion refers to how similar an object is compared to its cluster, separation refers to how similar an object is to its own cluster in comparison with other clusters.

Furthermore, modularity Q assesses the quality of the overall network division. This value ranges from 0 to 1, according to Newman's method [57]. High modularity values suggest that clusters that have been created have clear boundaries. On the contrary, if this parameter is low, a bad-structured network has been carried out [58].

Every single created cluster (12 in total) has a silhouette value higher than 0.9. This means that there is good homogeneity between clusters. Modularity Q value is 0.7973, which means that the created network is reasonably divided into loosely coupled clusters. Figure 2 shows the sustainable and public procurement network.

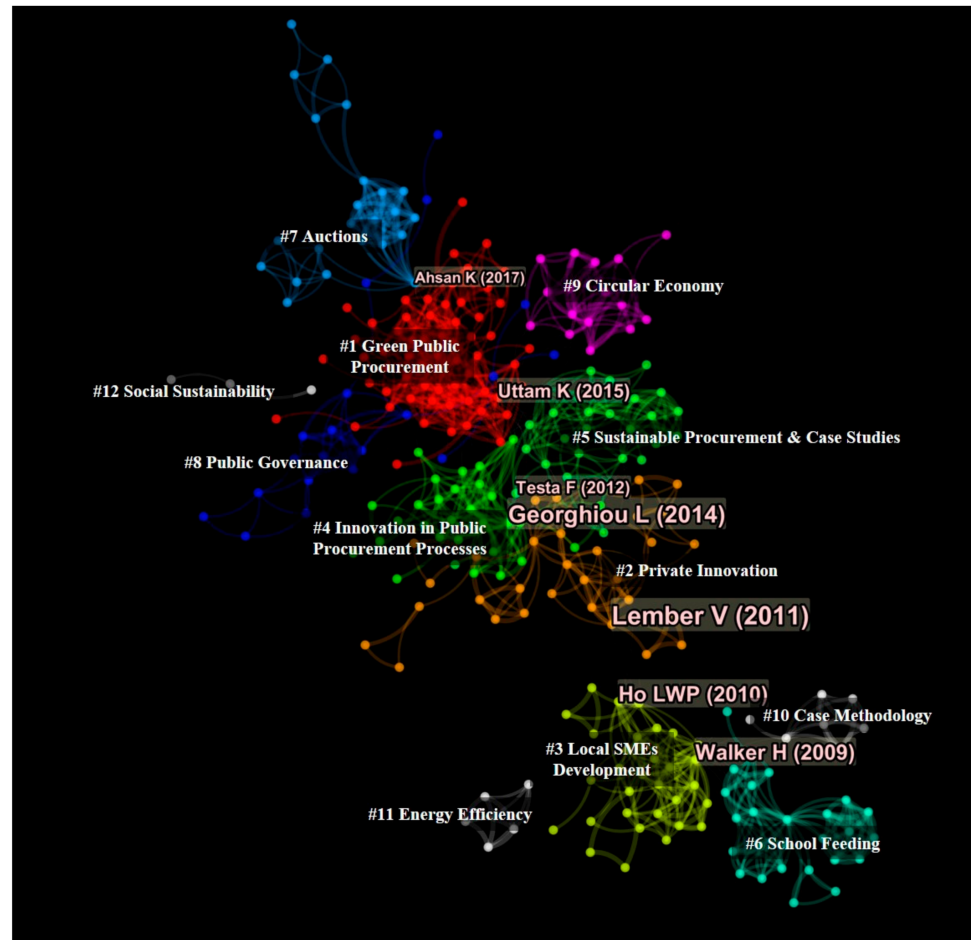


Figure 2. Social and sustainable public procurement network.

Nevertheless, the main limitation of co-citation analysis is that knowledge and experience of analysts are needed to identify clusters and interpret the core thematic structure. Consequently, evidence-based results are difficult to be distinguished from speculations and heuristics [38]. Both the common links between researchers of each cluster and citation have been analysed to summarise the essence of each cluster, as well as to enhance the robustness of the co-citation cluster labelling process

Cluster #1 deals with the subject **green public procurement**, analysing whether its implementation is possible according to different criteria: size of municipalities, economic sector, manager attitudes, and so forth. Some articles analyse this issue in relation with the experience in some specific countries: Italian municipalities [17], Sweden [59,60], China [61], Malaysia [62], and Greece and Cyprus [63]. The authors use specific cases to carry out an analysis of the factors that promote or hinder green procurement. Conversely, Cheng et al. [15] address the subject on the basis of a comprehensive review of the literature

from 2010 to 2016. Likewise, Xu et al. [64] put forth a set of indicators that allow to determine, with reliability, which product is more eco-friendly, and to, therefore, optimise public procurement processes.

Cluster #2 deals with **private innovation**, specifically how public procurement promotes and incentivises innovation in private companies. The key issue has to do with the incentive schemes created by the public sector in their procurement of goods and services procedures; ultimately, whether these procedures create (or not) frameworks that make it easy for the companies to innovate. A source for innovation is by contracting new products or services that need to be developed and provided by the private sector [65]. Guerzoni and Raiteri [66] show that research on this subject has focused on the supply-side policies: Research & Development (R&D) subsidies and tax credits, and less on the demand-side: public procurement. On the other hand, Rolfstam [67] considers that an institutional approach that takes into account this question from a wider perspective is necessary. This author recommends the implementation of institutional theories that, from a macroeconomic perspective, explains how the design of public institutional framework can produce certain results in economic agents; in this case, encouraging innovation in R&D. Likewise, Uyarra and Flanagan [68] propose an approach that pays attention to the great variety of public procurement policies and not just a few unrepresentative examples, since they consider that all public procurement can promote and incentivise business innovation, which can also be promoted by means of competition amongst cities and regions [69].

In **Cluster #3**, the subjects of sustainability related to public procurement and **local SMEs development** and, to a lesser extent, the reduction of the impact on environment, are discussed. In this cluster, the concept of sustainability is analysed in relation to local development, aiming to strengthen the SME business network by means of public procurement procedures. Administrations are expected to support the small and medium enterprises located in their territory; hence, special emphasis is put on the strategies of local governments. Walker and Brammer [70] and Walker and Preuss [71] study the way public procurement from small local suppliers in the United Kingdom has been used as an instrument for local and regional development, pointing out that there are significant differences among the various agencies and that the cost of products and services may act as a barrier. Seuring and Müller [30] make a mere review of the literature on the subject of sustainable supply chain. Furthermore, Preuss [72] studies this topic taking into account three aspects: purchases from small local suppliers, recruitment of voluntary organizations, and replacement of materials that are hazardous to persons and the environment.

Cluster #4 is focused on **innovation in public procurement processes** and the participation of SMEs in tenders. Whereas cluster #2 deals with the fostering innovation in supplier companies and cluster #3 has to do with the development of local SMEs, this one is focused on the internal procedures of public procurement in order to establish whether they are innovative and efficient. Thus, Georghiou et al. [73] analyse whether public procurement processes foster innovation or not; and Uyarra et al. [74] wonder whether public procurement procedures may act as barriers to innovation. On the other hand, Edler and Yeow [75] develop the concept of public procurement of innovation related to the intermediation between supply and demand in public procurement processes, and Knutsson and Thomasson [76] link innovation in the public procurement process to the strategic thinking of governments and administrations. From a different angle, Flynn et al. [77], Loader [78] and Reijonen et al. [79] investigate how public procurement procedures can hinder or reinforce the participation of small and medium enterprises in tenders.

Cluster #5 has to do with **sustainable procurement and case studies**. This cluster identifies and describes sustainable procurement procedures, particularly in terms of respect for the environment and cutting carbon emissions, on the basis of several cases. Brammer and Walker [80] and Meehan and Bride [81] highlight the relevance of the subject, with respect to the reduction of environmental impact, and analyse this practice by means of surveys to assess whether managers use this methodology or not; and Walker and Brammer [82] delve into the connection between this subject and e-procurement. Many

of the articles develop this question by means of practical cases: the healthcare sector and social services in Northern Ireland [83], the case of fifteen French public hospitals [14], the carbon reduction in the United Kingdom [84], the case of a distributor of garden products [85], and the implementation of sustainable procurement in the Netherlands [86]. Both Testa et al. [87] and Blome et al. [88] develop this question focusing on the topic of green procurement.

Cluster #6 deals with social and sustainable public procurement related to **school feeding**. In this cluster, the issue of sustainable procurement is analysed with regard to contracting suppliers for school meals, understanding the concept of sustainability in a broader sense, not only referring to environmental aspects, but also including social objectives. The European Commission [89] presents and develops the concept of green public contract in general, distinguishing it from social and sustainable public procurement: green contract is focused on the impact on the environment. Nevertheless, Sonnino [90], Wahlen et al. [91], Otsuki [92] and Bundy et al. [93] focus on the specific case of public procurement in school feeding. These policies are included in specific programs that have food improvement as their purpose, fostering purchases from local suppliers, and opting for environmentally sustainable food modalities.

The topic of **Cluster #7** is public contracting or tendering by means of **auctions**. A comparison is made between this tendering procedure and other alternative systems, considering their advantages and disadvantages in terms of cost, commitment of the supplier companies and quality of the offer. Coviello and Mariniello [94] study how giving more publicity to an auction can increase the number of companies interested in bidding and, consequently, it contributes to the reduction of the tender cost. Likewise, Decarolis [95] describes this methodology in the case of Italian public administrations: the first auctions initially allow the reduction of prices but the poor performance that ensued because of the lack of commitment of the winning businesses led to a significant increase in final costs. Along this same line, Baldi et al. [96] consider that the institutions' quality and complexity improve the outcomes of awarding in open auctions, and Sánchez Solino and Gago de Santos [97] state that an open auction system is preferable to the negotiated procedures in public contracts. Ahsan and Rahman [16] analyse the subject of green public procurement in the healthcare sector of Australia.

Cluster #8 considers **public governance** and public procurement. This cluster analyses the structure of public organizations and institutions and the impact of this structure on public procurement procedures. In short, it is focused on the relation between governance, which is intimately linked to the design of public institutions, and public procurement. Glas et al. [98] analyse how a more or less centralised organisational structure in administrations results in differences in the design and implementation of the strategic objectives. On the other hand, Gelderman et al. [99] point out that there are significant differences in the objectives for procurement between politicians and purchasing managers, whereas Glas and Ebig [100] study public procurement by means of dividing tenders into lots. Patrucco et al. [101] analyse the systems to measure the local governments' performance in the procedures and public procurement objectives. Likewise, Patrucco et al. [102] conclude that there are opposed objectives in the aforementioned public procurement procedures. Finally, OECD [103] analyses in a comprehensive report the level of performance in the public sector of several countries, in particular members of the OECD.

The reviews of literature about **circular economy** are dealt with in **Cluster #9**. The concept of circular economy is developed by means of both a critical analysis and the definition and scope of this concept and by showing the contributions to the field of sustainability and environmental protection. Geissdoerfer et al. [31] review the bibliography related to the concept of circular economy and its relationship with the concept of sustainability, appreciating the ambiguity of this relationship. Likewise, Ghisellini et al. [32] confirm the great interest of circular economy as an alternative to growth and resource consumption, in particular in urban areas; and Lewandowsky [33] reviews literature in order to identify and classify the characteristics of circular economy depending on the structure of the

business model. Finally, Alhola et al. [104] analyse the role of public procurement in the reinforcement of circular economy.

Cluster #10 has to do with **case methodology**; the work of Yin [105] the most representative of them, which analyses the use of the case study methodology as an alternative to the traditional experimental methods.

Cluster #11 deals with the subject of **energy efficiency**. In this cluster, suppliers are expected to offer goods and services that meet the requirements in terms of energy efficiency and water consumption; namely that they commit to saving energy and water. This cluster analyses to what extent is this requirement present in public procurement and the way to include it in the design of public procurement procedures. Singh et al. [106] analyse the question of public procurement related to the objective of increasing the efficient use of energy and the Department of Energy of the Office of Energy Efficiency and Renewable Energy U.S. [107] studies the protocols to be followed in order to measure and verify energy and water saving.

The subject of public procurement and **social sustainability** is addressed in **Cluster #12**. The degree to which public procurement procedures include clauses to impose certain social objectives, such as the development of local communities, not only from an economic point of view, but also from a social and cultural perspective, is analysed. Bernal et al. [12] study by means of a Delphi analysis to what extent are social considerations taken into account in public tenders and Montalbán-Domingo et al. [108] analyse tender documents to identify the social sustainability objectives described in them. Finally, Loosemore [109] investigates whether building businesses in United Kingdom that take part in tenders have a positive impact on the communities where they build.

The mean publication year of the papers in each cluster is also shown in Table 3. On the one hand, clusters #12 (2017), #1, #8, and #9 (2016) are the clusters with a later mean publication year, which means that they are advancing at a quicker pace than the rest of them. On the other hand, clusters #3 (2008), #6, and #10 (2010) have an older mean. It does not seem to exist any pattern between the size of the cluster and the mean publication for either larger or more recent clusters. In the case of larger clusters, some of them are older (#3) or more recent (#1). Similarly, the smallest clusters are either older (#10) or more recent (#12).

3.2. Intellectual Turning Points in Social and Sustainable Public Procurement Research

Co-citation clusters are common thematic research structures. A node or dot is the representation in the graphic of every single publication. Those that connect different clusters are considered to be intellectual turning points [53]. Betweenness centrality quantifies the number of times a dot or node behaves as if it were a bridge along the shortest path between two other dots or nodes. By means of this methodology, the importance of a node when connecting others is valued. Therefore, a node with high levels of betweenness centrality can be considered as an essential connector between two or more nodes [53]. Betweenness centrality is correlated with future citations of the publication in the long term, according to a bibliometric approach [110].

According to social network theory, nodes with betweenness centrality higher than 0.10 can be considered as high central nodes. These nodes tend to be located on the paths that connect different clusters [53]. Turning points have helped the most to disseminate the field of research on social and sustainable procurement, acting as bridges between different clusters. These publications are connected to a large amount of research papers in the field. This implies that a great number of scholars consider these publications as an intellectual resource.

Table 4 shows seven papers whose betweenness centrality is higher than 0.10 on social and sustainable public procurement. These papers can be considered to be the intellectual backbone of this research field. The average number of papers with high betweenness centrality (>0.10) per cluster is 0.58 per cluster. The research area that spread the most knowledge and that has the most intellectual turning points is cluster #3, with two papers

with betweenness centrality higher than 0.10. Clusters #1, #2, #4, #5, and #7 have only 1 turning point among their notes. Lastly, the least connected research areas are clusters #6, #8, #9, #10, #11, and #12 given that they have no intellectual turning point.

Table 4. Intellectual turning point articles in social and sustainable public procurement.

Centrality	Cluster	Author	Title	Year	Source
0.17	2	Lember, Kalvet, and Kattel	Urban Competitiveness and Public Procurement for Innovation	2011	<i>Urban Studies</i>
0.16	4	Georghiou, Edler, Uyarra, and Yeow	Policy instruments for public procurement of innovation: Choice, design and assessment	2014	<i>Technological Forecasting and Social Change</i>
0.14	3	Walker and Brammer	Sustainable procurement in the United Kingdom public sector	2009	<i>Supply Chain Management</i>
0.14	3	Ho, Dickinson, and Chan	Green procurement in the Asian public sector and the Hong Kong private sector	2010	<i>Natural Resources Forum</i>
0.13	1	Uttam and Le Lann Roos	Competitive dialogue procedure for social and sustainable public procurement	2015	<i>Journal of Cleaner Production</i>
0.12	5	Testa, Iraldo, Frey, and Daddi	What factors influence the uptake of GPP (green public procurement) practices? New evidence from an Italian survey	2012	<i>Ecological Economics</i>
0.11	7	Ahsan and Rahman	Green public procurement implementation challenges in Australian public healthcare sector	2017	<i>Journal of Cleaner Production</i>

The paper with the highest betweenness centrality is by Lember et al. [69]. Despite the fact that public procurement for innovation represents a policy tool on the demand side with high potential for the improvement of urban competitiveness, it has been scarcely studied. Evidences suggest that local and regional governments are getting more involved in the achievement of innovative solutions, but general knowledge about the ways in which they are involved and the effect of their participation, is still limited. Based on a study of cities in the northern part of the Baltic Sea, the authors revealed that public procurement that fosters innovative solutions had a positive impact on suppliers and that, in this sense, authorities might act as market creators as they promote the demand of more innovative products and services. The study also shows that, despite this, public procurement is not regarded as an inherent part of innovation policies. In this sense, there is a lack of conscience among the civil servants of these cities about the connection between procurement and innovation. Furthermore, local authorities are not inclined to take on the risks inherent to the encouragement of innovation through public procurement. Nevertheless, because of its positive effects, a greater development of public procurement policies adopting this approach is recommended.

The second paper with the highest betweenness centrality is by Georghiou et al. [73], where public procurement is regarded as an important instrument for the promotion of innovation and performance in private sector. The article aims to address the basis of public procurement policies to ascertain how administrations promote innovation. It establishes a wide taxonomy of public procurement policies that have appeared in the OECD countries. Then, they are compared with the companies' perceptions, according to a survey to suppliers in the public sector in the United Kingdom. It shows that these policies include the creation of framework conditions that allow to establish organizational frameworks, to identify the needs and to incentivise innovative solutions. Nonetheless, the results confirm that barriers to innovation faced by companies correspond, to a great

extent, to the weaknesses in the design and implementation of these policies, despite the fact that they can also be explained by other factors attributable to companies such as, for instance, risk aversion.

Thirdly, Walker and Brammer [70] analyse the subject of sustainable procurement in the United Kingdom public sector. The analysis of quantitative and qualitative surveys reveals that there is a significant variation among public agencies with regard to the sustainable procurement practices. Thus, for instance, local authorities tend to purchase to small local suppliers. On the contrary, the healthcare sector is not particularly sensitive to this question, whereas in the case of the education sector, environmental questions aspects are taken into account in public procurement processes. The authors conclude that the main barrier for sustainable procurement is the cost. The government of the United Kingdom has the purpose of developing sustainable procurement policies and evidences suggest that progress is being made in this regard.

Fourthly, Ho et al. [111] examine procurement practices and policies in five Asian countries and Hong Kong, with the aim of elaborating a general description of their ecological procurement policies. The conclusion is that the level of governmental participation and public leadership in green procurement contribute significantly to ensure its efficiency and that updated information clearly improves the performance of this type of procurement.

Fifthly, Uttam and Le Lann Roos [59] discuss the way the building sector has adopted ecological public procurement to improve environmental performance. A description of the concept of green public procurement is expounded and its increasing importance is discussed. Administrations negotiate with contractors the conditions of the products and services they are purchasing, requiring them to comply with strict requirements of respect for the environment, thus ensuring that contractors get involved in the development of sustainable solutions. In this regard, the importance of the participation of suppliers in the design and implementation of these requirements is highlighted. This participation belongs to what authors define as “competitive dialogue procedure”, a methodology that ensures the commitment of all the parties, particularly suppliers, in the final solutions.

The sixth paper with the highest betweenness centrality is Testa et al. [87]. Green public procurement is becoming one of the main thrust in environmental policies, both at the European level and in each of the member states. The paper analyses the pros and cons in the adoption of ecological procurement, based on the databases of three Italian regions’ public authorities. Using an econometric approach, the aim is to test the following hypotheses: firstly, whether the existing conscience and knowledge on this topic and the practices, tools and regulations in force help public authorities to develop social and sustainable public procurement. Secondly, whether the support from external experts in the procurement function helps public authorities to develop these same strategies. Thirdly, whether the small size of public administration is an obstacle for their adoption. Fourthly, whether ISO 14001 (International Organization for Standardization) certification increases the possibility that the authorities develop the aforementioned strategies. The results show that the size of public administrations and the level of knowledge about the tools have a positive and significant effect on the probability that they adopt green public procurement policies.

Finally, Ahsan and Rahman [16] investigates the challenges in the implementation of a green public procurement system in the Australian public health system. By means of an extensive literature review, a framework for the implementation of this procurement typology, which includes different challenges classified in five categories, is developed. The problem is structured as a multi-criteria decision-making model based on the analytical hierarchy process. To that end, procurement executives in the healthcare sector were interviewed in order to obtain data and information. Some critical challenges were identified, among which were the lack of an adequate regulatory framework, the lukewarm support from senior managers, the absence of governmental ecological incentives for green procurement, and the lack of financial support. Some of the challenges that had also been identified, though less important, were those related to the ecological preferences in procurement, the

understanding of the ecological policy, the supplier having the requested products and the collaboration with suppliers. The most critical challenges were mainly of a strategic nature, whereas the less important ones were operational. A clear understanding of the nature of these challenges in the making of decisions might help public health care institutions design strategies and policies for more successful green procurement.

With regard to centrality, the obtained results (Table 4) enable us to detect the journals where the most significant or influential articles in this field have appeared, taking into account that they are regarded as intellectual turning points: *Journal of Cleaner Production* (2), *Urban Studies* (1), *Technological Forecasting and Social Change* (1), *Supply Chain Management: An International Journal* (1), *Natural Resources Forum* (1), and *Ecological Economics* (1).

3.3. Burst Detection in Social and Sustainable Public Procurement

The most relevant indicators to deduce the impact of a field of study on scholars are the amount of quotations along with the number of publications, even though aspects, such as its influence, density, or evolution over time cannot be measured. Therefore, an in-depth analysis of the obtained clusters about publishing relations is needed. In this regard, citation burst is a more relevant indicator so as to identify the most active research areas during a specific period of time. CiteSpace identifies changes in a variable relative to others in the same population during time periods using the specific burst algorithm introduced by Kleinberg [112]. Accordingly, when it is detected that a publication receives an increasing amount of citations during a particular period of time, it can be said that a citation burst has taken place. In a brief space of time this paper has attracted great attention from other scholars. Consequently, if a cluster has several burst papers, it can be considered as an emergent and active research area [58].

The results of the burst detection analysis are shown in Table 5. This table also identifies the 26 papers with the largest citation bursts within the social and sustainable public procurement field from 2010 to 2020. The 26 papers were found to have citation bursts by the Kleinberg algorithm [112]. The rest of publications did not show enough bursts (See Appendix A). The analysis is right censoring for burst periods in 2020, therefore, we do not know the end date of the burst periods for papers that are currently burst. Sustainable procurement and case studies (cluster #5) is the area with the most burst papers. Eight papers in this area show strong citation bursts. The second most burstful cluster with five citation burst papers is #1, which deals with green public procurement. Thirdly, cluster #4 has to do with innovation in public procurement processes and has four burst papers. The average number of burst papers per cluster is 2.17. Nevertheless, only 6 clusters out of 12 have burst papers.

All of the burst papers are dated between 2008 and 2016. In spite of the fact that the database includes citing publications from 2010 to 2020, five burst papers are dated in 2008 and 2009, given that they are cited papers and not citing papers. Between 2011 and 2013, the average number of burst papers per year is 4.67, whereas from 2014 to 2016, the average decreases to 2.33. Eight papers published in 2012 have become burst, with 2012 being the most prolific year in this regard. The last burst paper was written in 2016, therefore, no paper written from 2017 has become burst yet. This issue can be considered a paradox, given that the number of citing papers has considerably increased since 2017 (Figure 1). The average interval between the publication of burst papers and its maximum interest is 3.00 years. Whereas no paper became burst the same year in which it was published, one paper did it the next year after its publication [79]. Uyarra et al. [74] records the longest period of time in which a paper has been burst, namely 4 years.

Table 5. Burst papers in social and sustainable public procurement field.

Cluster	References	Year	Strength ¹	Begin	End	2010–2020 ²
3	Walker H, 2009, <i>Supply Chain Management</i> , V14, P128	2009	5.83	2012	2014	
3	Seuring S, 2008, <i>Journal of Cleaner Production</i> , V16, P1699	2008	3.72	2012	2013	
3	Walker H, 2008, <i>Journal of Cleaner Production</i> , V16, P1600	2008	3.09	2012	2013	
3	Preuss L, 2009, <i>Supply Chain Management</i> , V14, P213	2009	2.90	2012	2014	
10	Yin Robert K, 2009, <i>Case Study Research: Design and Methods</i>	2009	2.51	2013	2014	
2	Lember V, 2011, <i>Urban Studies</i> , V48, P1373	2011	2.86	2014	2015	
5	Brammer S, 2011, <i>International Journal of Operations and Production Management</i> , V31, P452	2011	6.71	2015	2016	
5	Testa F, 2012, <i>Ecological Economics</i> , V82, P88	2012	4.65	2015	2017	
5	Meehan J, 2011, <i>Business Strategy and the Environment</i> , V20, P94	2011	4.62	2015	2016	
2	Edquist C, 2012, <i>Research Policy</i> , V41, P1757	2012	4.22	2015	2017	
5	Walker H, 2012, <i>International Journal of Production Economics</i> , V140, P256	2012	4.22	2015	2017	
1	Bratt C, 2013, <i>Journal of Cleaner Production</i> , V52, P309	2013	4.03	2015	2018	
2	Rolfstam M, 2012, <i>Innovation The European Journal of Social Science Research</i> , V25, P303	2012	3.59	2015	2016	
5	Oruezabala G, 2012, <i>Industrial Marketing Management</i> , V41, P573	2012	3.37	2015	2017	
5	Erridge A, 2012, <i>Public Money and Management</i> , V32, P363	2012	2.95	2015	2017	
5	Melissen F, 2012, <i>Journal of Integrative Environmental Sciences</i> , V9, P27	2012	2.56	2015	2016	
5	Crespin-Mazet F, 2012, <i>Journal of Purchasing and Supply Management</i> , V18, P207	2012	2.52	2015	2017	
1	Zhu QH, 2013, <i>Journal of Environmental Management</i> , V126, P85	2013	4.97	2016	2018	
4	Loader K, 2013, <i>Environment and Planning C: Politics and Space</i> , V31, P39	2013	2.82	2016	2018	
4	Uyarra E, 2014, <i>Technovation</i> , V34, P631	2014	2.60	2016	2020	
4	Georghiou L, 2014, <i>Technological Forecasting and Social Change</i> , V86, P1	2014	2.97	2017	2020	
4	Reijonen H, 2016, <i>International Small Business Journal</i> , V34, P468	2016	2.71	2017	2018	
2	Guerzoni M, 2015, <i>Research Policy</i> , V44, P726	2015	2.68	2017	2018	
1	Xu SG, 2016, <i>Sustainability</i> , V8, P0	2016	2.91	2018	2020	
1	McMurray AJ, 2014, <i>Journal of Purchasing and Supply Management</i> , V20, P195	2014	2.91	2018	2020	
1	Nikolaou IE, 2015, <i>Journal of Integrative Environmental Sciences</i> , V12, P49	2015	2.91	2018	2020	

¹ Strength of the burst of a document (citation burst in a certain period) based on the Kleinberg algorithm [112]. ² Red line segment represents the period of time in which a reference was found to have a burst, indicating the year when the burst started and finished.

Burst paper detection reveals research trends in a field of knowledge [113]. In this regard, there have been six trends in the field of social and sustainable public procurement research. Table 6 shows the six trends classified by cluster and indicates the number or burst papers, the year when this trend started (Min (year)) and finished (Max (year)), the mean year, the mean strength value, the year when that trend started (Min (begin)) and the year that the trend finished (Max (end)).

Table 6. Burst papers per cluster in social and sustainable public procurement field.

Cluster	Cluster Label	Number of Papers	Min (Year)	Max (Year)	Mean (Year)	Mean (Strength ¹)	Min (Begin)	Max (End)	2010–2020 ²	Annual Average WoS Citations Received Per Paper
3	Local SMEs Development	4	2008	2009	2009	3.89	2012	2014		76.45
10	Case Methodology	1	2009	2009	2009	2.51	2013	2014		Book ³
2	Private Innovation	3	2011	2015	2013	3.34	2014	2018		9.53
5	Sustainable Procurement and Case Studies	8	2011	2012	2012	3.95	2015	2017		8.51
1	Green Public Procurement	5	2013	2016	2014	3.55	2015	2020		5.94
4	Innovation in Public Procurement Processes	4	2013	2016	2014	2.78	2016	2020		14.15

¹ Mean strength of the burst of a documents of the cluster (citation burst in a certain period) based on the Kleinberg algorithm [112]. ² Red line segment represents the mean time period in which a cluster was found to have a burst, indicating the minimum starting year and the maximum ending year of the duration of the burst in a cluster. ³ This book is not indexed in Web of Science.

The analysis of Table 6 shows that the first trend encompasses 4 papers of cluster #3, which deals with local SME Development. The publication of burst papers started in 2008 and finished in 2009. Nonetheless, they became burst from 2012 through to 2014. Just one year after the inception in the writing of the first trend, the writing of the second one started within cluster #10. This second trend comprises one single document [105] that was written in 2009 and establishes the methodology of case studies. This paper became burst in 2013 and 2014. The same year that these two trends vanished, in 2014, the third trend became burst. This third trend encompasses three papers that were published from 2011 (two years after the end of the writing of the first two trends) to 2015 and deals with private innovation (cluster #2). These papers were burst through to 2018. One year after the inception of the third trend, the fourth and the fifth one appeared (in 2015), which are the largest trends in terms of publications. On the one hand, the fourth trend was written in 2011 and 2012 and is formed by eight papers that became burst from 2015 to 2017. This is the largest trends in number of publications and deals with sustainable procurement and case studies (cluster #5). On the other hand, the second largest trend occurred within cluster #1 where five publications written from 2013 to 2016 became burst from 2015 onwards. In actual fact, this fifth trend that deals with green public procurement is still burst in 2020. Finally, the sixth trend was written in the same period of time as the fifth one (from 2013 to 2016) and became burst from 2016 and was still burst when this paper was written (2020). The sixth trend deals with Innovation in public procurement processes (cluster #4) and is formed by four papers.

All things considered, the second trend (cluster #10) shows that academics initially became very interested in achieving eminently theoretical understanding in the case methodology [105] and later on this method was applied by means of different case studies in the fourth trend (cluster #5), which is the largest one in terms of number of papers and the one

that has the highest strength mean. For the time being, the fourth and the fifth trends are still alive and are the ones that have the highest longevity, namely the fifth trend that deals with green public procurement has been burst over the last 6 years, and the sixth one that deals with innovation in public procurement processes has been burst over the last 5 years. As a matter of fact, three out of the five burst papers, of which the fifth trend is composed (cluster #1), are still so in 2020.

A certain degree of continuity can be observed in the first trend (cluster #3), the third trend (cluster #2) and the sixth trend (cluster #4). In this regard, cluster #3 refers to the impact of public procurement in the development of small and medium local companies. These works analyse to what extent public procurement contributes to strengthening the local business sector, composed in its vast majority of small and medium size companies. These works—four in total—were written in 2008 and 2009. The three burst papers that are part of cluster #2 develop this concept, focusing on the subject of private innovation. These works were written during a period of four years (from 2011 to 2015), after the burst papers of cluster #3 were written. This research is focused on finding out the extent to which public procurement strategies and policies foster innovation in the small and medium suppliers when they are encouraged to invest in R&D. In fact, local development of SMEs makes no sense if it is not associated to promoting innovation. Otherwise, public procurement strategies might benefit inefficient companies and even keep artificially active companies that, under market conditions, would not be sustainable. For this reason, not only is the support to SMES emphasised, but, in particular, the support to the companies that invest, innovate, and create added value. The latter question allows the introduction of the issue of innovation in public procurement processes. Cluster #4 delves into this subject. The four burst papers included in this cluster, and that were written from 2013 to 2016, analyse the public procurement processes to ascertain whether these processes are efficient and innovative, or if, on the contrary, they are cumbersome and inoperative. The connection between this question and the promotion of innovation in SMEs is evident: public procurement processes can promote innovation in SMEs only provided that these processes, in turn, include systems and methodologies that can be considered innovative; thus avoiding contradictions between the objective of promoting innovation in suppliers, and the public procurement processes, by means of which this objective is intended to be achieved. Out of the four burst papers of Cluster #4, two continue to be so nowadays.

Table 6 shows the Annual average of WoS citations received per paper. This ratio has been calculated by means of summing the total number of citations received by the papers that were burst in each cluster, according to Web of Science. This number has been divided by the number of papers that were burst in the cluster. The resulting number has been divided again by the average number of years since the papers were published. Therefore, this bibliometric variable shows the average number of citations that the burst papers in the same cluster received per paper and per year, in other words, the annual citations received per paper for each trend. The results suggest that the first trend, Cluster #3 that deals with Local SME development is the most cited trend followed by the last trend, Cluster #4 that analyses Innovation in Public Procurement Processes. The second trend (Cluster #10) is formed only by a single burst document and it is a book that is not indexed in Web of Science. For this reason, this variable has not been able to be calculated for cluster #10.

With regard to burst detection, the obtained results (Table 6) enable us to detect the journals where the burst papers were published, namely *Journal of Cleaner Production* (3), *Journal of Integrative Environmental Sciences* (2), *Journal of Purchasing and Supply Management* (2), *Research Policy* (2), *Supply Chain Management: An International Journal* (2), *Business Strategy and the Environment* (1), *Ecological Economics* (1), *Environment and Planning C: Government and Policy* (1), *Industrial Marketing Management* (1), *Innovation: The European Journal of Social Science Research* (1), *International Journal of Operations and Production Management* (1), *International Journal of Production Economics* (1), *International Small Business Journal: Researching Entrepreneurship* (1), *Journal of Environmental Management* (1), *Public Money and Management*

(1), *Sustainability* (1), *Technological Forecasting and Social Change* (1), *Technovation* (1), and *Urban Studies* (1).

4. Conclusions

The intellectual structure of social and sustainable public procurement research has been mapped by means of co-citation bibliometric analysis. The findings of this paper are quantitatively rigorous and contribute to further development of this field or research in the following ways.

Firstly, the main research areas within the field of social and sustainable public procurement research have been delineated: green public procurement; private innovation; local SMEs development; innovation in public procurement processes; sustainable procurement and case studies; school feeding; auctions; public governance; circular economy; case methodology; energy efficiency; social sustainability

Secondly, the works that can be regarded as the intellectual structure of research on social and sustainable public procurement have been detected. By means of mapping these papers the paths and connections through which social and sustainable public procurement has disseminated has been revealed. The turning points are the foundations of the knowledge of the area of research. When they are identified, academia can gain a quicker understanding of the field, such as where to start their research. By way of example, green public procurement researchers should start their literature review by means of reading Uttam and Le Lann Roos [59]. Consequently, these works constitute the major sources of information in this particular field. Hence, future research in this field of knowledge should view them as the starting point, using them as the basis of their knowledge. Following this procedure, in particular during the early stages in which the conceptual framework of the research is developed, could save a considerable amount of time, since they use the engines of knowledge of the field as references.

Thirdly, we identified the works that have drawn remarkable attention from the scientific community for a discrete period of time. A picture of the changing status of the social and sustainable public procurement literature is obtained by means of the identification of burst papers. Having this image is vital because researchers are provided with the guidance they need for the design of new research through which the detected trends are developed and also for the creation of new fields on the basis of these trends.

Out of the six trends, we can see a natural development among five of them. In this regard, the burst paper included in Cluster #10 [105] establishes the case methodology so as to allow a later trend (Cluster #5) to apply this methodology by means of different sustainable procurement case studies. Similarly, the trends that include burst papers that deal with SME local development (Cluster #3), Private Innovation (Cluster #1) and Innovation in public procurement processes (Cluster #4) are written and become burst sequentially, although burst papers of Clusters #2 and #4 slightly overlap. For the time being, the trend that deals with green public procurement (Cluster #1), and innovation in public procurement processes (Cluster #4) are still burst, or alive, given that five out of nine papers that became burst are still so in 2020.

This means that there has been no new burst paper since 2017, even though the mean time from publication to maximum interest for a burst paper is 3.00 years. This can be considered a paradox considering that the number of citing papers on social and sustainable public procurement field (Figure 1) written from 2017 to 2020 is higher (283 citing papers) than those written from 2010 to 2016 (169 documents). Future research should address this issue by means of repeating the same co-cites analysis in a few years, to detect which burst papers will eventually become burst. It could happen that some of the papers that will become burst in the future have already been published.

Fourthly, the scientific journals with the most significant contribution to this area of knowledge have been studied. In fact, 232 different academic journals published the 452 citing papers. The journals with over five papers (Table 1) published related to the field of social and sustainable procurement are the following: *Sustainability* (44), *Journal*

of *Cleaner Production* (38), *Journal of Purchasing and Supply Management* (15), *Public Money Management* (12), *Energy Policy* (9), *Industrial Marketing Management* (8), *Research Policy* (7), and *Amfiteatru Economic* (6).

Nonetheless, it can be deduced that the papers with a greater amount of intellectual turning points (Table 4) and burst papers (Table 5) were published in *Journal of Cleaner Production*, and at a lesser level, in *Ecological Economics*, *Supply Chain Management: An International Journal*, *Technological Forecasting and Social Change*, and *Urban Studies*. Having identified which journals published the most influential papers on social and sustainable public procurement will be of great help for future researchers, since they will need to spend less time on conducting the literature review.

Fifthly, by means of a bibliometric analysis, it is possible to give order to a huge amount of data; good quantitative and approximate qualitative evaluations can be extracted from data meaningfully ordered. It has some limitations though, which have been recurrent for decades [114]. To interpret the results that have been obtained, it is essential to have a high level of commitment and, consequently, subjective participation of those conducting the analysis. Therefore, bibliometric techniques need to be complemented by the intellectual refinement that requires, for instance, a thorough review of the bibliography on this subject, its discussion, and/or synthesis among researchers [38,115,116]. The researcher has to make some technical decisions with regard to both the chosen database's parameters and the analytical software in order to obtain a reliable set of indicators that could be used to reach some kind of reasonable conclusions (e.g., restrictions of language, journals, period of time, normalization of cluster labelling, verification of final data to debug errors, etc.) [115]. An additional problem has to do with the fact that, on account of the delay in which citations are done, older publications may have more presence than the newer ones [117] or the consideration or not of self-citations [118,119].

Sixthly, we recognise that the use of a single database (SSCI) is a limitation of the research. In spite of the fact that SSCI is well recognised by social sciences bibliometric analysis and, therefore, the results offered are well supported, many are the databases that could have been taken as a sample, such as Scopus or Dimensions [120]. Future lines of research could include either more databases or data offered by techniques applied to the analysis of scientific publication and activity on the internet, such as Webometrics or Altmetrics [121–123].

Seventhly, most of the studies and analyses of this topic are empirical articles about different countries, municipalities or economic sectors. Since these studies deal with public policies, it could be interesting to address them from a political perspective. In fact, there is not a cluster in which the topic is addressed from a political perspective, thus confirming the existence of a literature gap. For instance, within the modern political theory, the neo-institutionalist approaches would be highly suitable. Certainly, these approaches have proved to be very useful in different disciplines, namely sociology, economics, political science, international relations and historical analysis. Nonetheless, they only are referred to in a single article about sustainable and social public procurement [67]. It should be taken into account the fact that these kind of approaches are common in studies on public policies and also have been used in some articles about public procurement [124–126]. Nevertheless, they could be more widely used in order to relate the empirical side to the theoretical explanation of the link among sustainable public procurement specific policies, the organization of institutions and the performance of the involved agents. The nodal point of these neo-institutionalist approaches is that they can understand the agents' behaviour from the institutional framework in which they operate. This premise would allow to identify the main reasons for success and failure in the design and implementation of sustainable public procurement procedures, as well as the development of comparative studies. In this sense, future lines of research could focus on the analysis of the differences in sustainable public procurement among the countries with models more inclined towards markets self-regulation, and the countries with economic models based on institutionalised markets. Other approaches commonly used in certain social sciences that could also be

applied to the analysis of sustainable public procurement are public choice, rational choice, or games theory, among others. The information has been already compiled and there is an abundance of empirical evidence. Starting with all of this information, it would be appropriate to give them a meaning and interpret them in future research, using the available theoretical models in the different academic disciplines and, in particular, in politic science.

Author Contributions: Conceptualization, J.T.-P.; methodology, J.T.-P., M.A.P.-N. and F.D.-M.; software, F.D.-M.; validation, J.T.-P., M.A.P.-N. and F.D.-M.; formal analysis, J.T.-P., M.A.P.-N. and F.D.-M.; investigation, J.T.-P., M.A.P.-N., F.D.-M. and A.B.-C.; resources, J.T.-P., M.A.P.-N. and F.D.-M.; data curation, M.A.P.-N. and F.D.-M.; writing—original draft preparation, J.T.-P., M.A.P.-N., F.D.-M. and A.B.-C.; writing—review and editing, J.T.-P., M.A.P.-N., F.D.-M. and A.B.-C.; visualization, J.T.-P., M.A.P.-N. and F.D.-M.; supervision, J.T.-P.; project administration, J.T.-P. and M.A.P.-N.; funding acquisition, M.A.P.-N., F.D.-M. and A.B.-C. All authors have read and agreed to the published version of the manuscript.

Funding: We acknowledge support of the publication fee by the CSIC Open Access Publication Support Initiative through its Unit of Information Resources for Research (URICI), Universidad Rey Juan Carlos and Escuela de Turismo y Dirección Hotelera (EUTDH), Universidad Autónoma de Barcelona.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data is contained within the article or supplementary material.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Network Summary.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
1	4.97	0.02	Zhu QH	2013	<i>Journal of Environmental Management</i>	126	85
1	4.03	0.03	Bratt C	2013	<i>Journal of Cleaner Production</i>	52	309
1	2.91	0.00	McMurray AJ	2014	<i>Journal of Purchasing and Supply Management</i>	20	195
1	2.91	0.00	Nikolaou IE	2015	<i>Journal of Integrative Environmental Sciences</i>	12	49
1	2.91	0.00	Xu SG	2016	<i>Sustainability</i>	8	0
1		0.00	Tarantini M	2011	<i>Energy</i>	36	2473
1		0.00	Parikka-Alhola K	2012	<i>Journal of Public Procurement</i>	12	43
1		0.00	Guenther E	2013	<i>Journal of Change Management</i>	13	407
1		0.00	Barlow J	2013	<i>Health Affairs</i>	32	146
1		0.04	Appolloni A	2014	<i>Journal of Cleaner Production</i>	85	122
1		0.04	Rizzi F	2014	<i>Journal of Cleaner Production</i>	85	265
1		0.01	Amann M	2014	<i>Supply Chain Management</i>	19	351
1		0.01	Lember V	2014	<i>Public Procurement, Innovation and Policy</i>	0	0
1		0.00	Gormly J	2014	<i>Journal of Public Procurement</i>	14	395
1		0.13	Uttam K	2015	<i>Journal of Cleaner Production</i>	86	403
1		0.02	Igarashi M	2015	<i>Journal of Cleaner Production</i>	108	442
1		0.02	Grandia J	2015	<i>Innovation The European Journal of Social Science Research</i>	28	243
1		0.01	Grandia J	2015	<i>Public Money and Management</i>	35	119
1		0.00	Alvarez S	2015	<i>Journal of Cleaner Production</i>	93	159
1		0.00	Butt AA	2015	<i>Journal of Cleaner Production</i>	90	163
1		0.00	Lundberg S	2015	<i>Environmental Economics and Policy Studies</i>	17	487
1		0.00	Bostom M	2015	<i>Sustain: Science, Practice and Policy</i>	11	21
1		0.00	Anthonsen J	2015	<i>Journal of Cleaner Production</i>	102	96
1		0.05	Witjes S	2016	<i>Resources, Conservation & Recycling</i>	112	37
1		0.04	Testa F	2016	<i>Journal of Cleaner Production</i>	112	1893
1		0.04	Grandia J	2016	<i>Journal of Cleaner Production</i>	124	183
1		0.02	Smith J	2016	<i>Journal of Cleaner Production</i>	112	249
1		0.02	European Commission	2016	<i>Buying Green! A Handbook on Green Public Procurement</i>	0	0
1		0.01	Testa F	2016	<i>Environment, Development and Sustainability</i>	18	197

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
1		0.01	Cerutti AK	2016	<i>Food Policy</i>	58	82
1		0.00	Pacheco-Blanco B	2016	<i>Journal of Cleaner Production</i>	133	648
1		0.00	Nucci B	2016	<i>Economics and Policy of Energy and the Environment</i>	2016	91
1		0.00	Hall P	2016	<i>Journal of Consumer Policy</i>	39	467
1		0.00	Goggins G	2016	<i>Journal of Cleaner Production</i>	112	257
1		0.03	Aldenius M	2017	<i>Journal of Cleaner Production</i>	164	250
1		0.02	Chiarini A	2017	<i>Journal of Cleaner Production</i>	162	391
1		0.01	Roman AV	2017	<i>Journal of Cleaner Production</i>	143	1048
1		0.01	Aragao CG	2017	<i>Industrial and Commercial Training</i>	49	48
1		0.00	Rainville A	2017	<i>Journal of Cleaner Production</i>	167	1029
1		0.00	Grandia J	2017	<i>International Journal of Public Sector Management</i>	30	302
1		0.00	Fuentes-Bargues JL	2017	<i>International Journal of Environmental Research and Public Health</i>	14	0
1		0.00	Igarashi M	2017	<i>Journal of Public Procurement</i>	17	141
1		0.00	Deambrogio E	2017	<i>Energy Procedia</i>	111	338
1		0.03	Sparrevik M	2018	<i>Journal of Cleaner Production</i>	188	879
1		0.02	Cheng WJ	2018	<i>Journal of Cleaner Production</i>	176	770
1		0.00	Delmonico D	2018	<i>Resources, Conservation & Recycling</i>	134	70
1		0.00	Neto B	2018	<i>Environment, Development and Sustainability</i>	20	1905
1		0.00	Fuentes-Bargues JL	2018	<i>International Journal of Environmental Research and Public Health</i>	15	0
1		0.00	Lundberg S	2018	<i>Economia e Politica Industriale</i>	45	37
1		0.00	Crafoord K	2018	<i>Procedia CIRP</i>	73	137
1		0.00	Bakir S	2018	<i>Journal of Environmental Management</i>	225	325
1		0.00	Cerutti AK	2018	<i>International Journal of Life Cycle Assessment</i>	23	95
1		0.01	Adjei-Bamfo P	2019	<i>Resources, Conservation & Recycling</i>	142	189
1		0.01	De Giacomo MR	2019	<i>Journal of Purchasing and Supply Management</i>	25	0
1		0.01	Liu JQ	2019	<i>Journal of Purchasing and Supply Management</i>	25	0
1		0.00	Liu JQ	2019	<i>Journal of Cleaner Production</i>	211	842
1		0.00	Zaidi SAH	2019	<i>Socio-Economic Planning Sciences</i>	68	0
1		0.00	Marrucci L	2019	<i>Journal of Cleaner Production</i>	240	0
1		0.00	AlNuaimi BK	2019	<i>Journal of Cleaner Production</i>	233	482
1		0.00	Grandia J	2019	<i>Sustainability</i>	11	0
1		0.00	Fuentes-Bargues JL	2019	<i>International Journal of Environmental Research and Public Health</i>	16	0
1		0.00	Harland C	2019	<i>Journal of Supply Chain Management</i>	55	6
1		0.00	Sonnichsen SD	2020	<i>Journal of Cleaner Production</i>	245	0
2	4.22	0.04	Edquist C	2012	<i>Research Policy</i>	41	1757
2	3.59	0.01	Rolfstam M	2012	<i>Innovation The European Journal of Social Science Research</i>	25	303
2	2.86	0.17	Lember V	2011	<i>Urban Studies</i>	48	1373
2	2.68	0.02	Guerzoni M	2015	<i>Research Policy</i>	44	726
2		0.01	Uyarra E	2010	<i>European Planning Studies</i>	18	123
2		0.00	Loader K	2010	<i>Journal of Purchasing and Supply Management</i>	16	41
2		0.00	GHK	2010	<i>Evaluation of SMEs' access to public procurement markets in the EU</i>	0	0
2		0.00	Ajuntament de Barcelona	2010	<i>2010-2013 Economic and Financial Plan of the City of Barcelona</i>	0	0
2		0.00	European Commission	2010	<i>Risk management in the Procurement of Innovation. Concepts and Empirical Evidence in the European Union</i>	0	0
2		0.01	Rolfstam M	2011	<i>International Journal of Public Sector Management</i>	24	452
2		0.01	Hawkins TG	2011	<i>Journal of Business Ethics</i>	103	567
2		0.01	Pickernell D	2011	<i>Environment and Planning C: Politics and Space</i>	29	641
2		0.00	Loader K	2011	<i>Public Money and Management</i>	31	287
2		0.00	Krasnokutskaya E	2011	<i>American Economic Review</i>	101	2653
2		0.00	Preuss L	2011	<i>Entrepreneurship and Regional Development</i>	23	787

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
			House of Lords				
2		0.00	Science and Technology Committee	2011	<i>1st Report of Session 2010-12: Public Procurement as a Tool to Stimulate Innovation</i>	0	0
2		0.00	ABI Research	2011	<i>\$39.5 Billion Will Be Spent on Smart City Technologies in 2016</i>	0	0
2		0.00	Spagnolo G	2012	<i>International Journal of Industrial Organization</i>	30	291
2		0.00	Arlbjorn JS	2012	<i>International Journal of Public Sector Management</i>	25	203
2		0.00	DEste P	2012	<i>Research Policy</i>	41	482
2		0.00	Hottenrott H	2012	<i>Review of Economics and Statistics</i>	94	1126
2		0.00	Center for Responsive Politics	2012	<i>Election will be costliest yet. With outside spending a wild card</i>	0	0
2		0.01	Borras S	2013	<i>Technological Forecasting and Social Change</i>	80	1513
2		0.00	Rolfstam M	2013	<i>Public Procurement and Innovation: The Role of Institutions</i>	0	0
2		0.00	Blanchard P	2013	<i>Industrial and Corporate Change</i>	22	679
2		0.00	Athey S	2013	<i>American Economic Journal: Microeconomics</i>	5	1
			Secretariat of the Council for Public-Private Cooperation				
2		0.00		2013	<i>Competition and Consumer Authority of Denmark. Effects of strengthening and examples of good practice</i>	0	0
2		0.00	Aldy J	2013	<i>Review of Environmental Economics and Policy</i>	0	1
2		0.00	DEste P	2014	<i>Industry and Innovation</i>	21	1
			European Commission-Directorate-General for Enterprise and Industry				
2		0.00		2014	<i>Public Procurement as a Driver of Innovation in SMEs and Public Services</i>	0	0
2		0.00	Rogge KS	2016	<i>Research Policy</i>	45	132
2		0.00	Appelt S	2016	<i>OECD Science, Technology and Industry. Measuring the Link between Public Procurement and Innovation</i>	0	0
2		0.00	Kivimaa P	2016	<i>Research Policy</i>	45	205
2		0.00	Ghisetti C	2017	<i>Technological Forecasting and Social Change</i>	125	178
3	5.83	0.14	Walker H	2009	<i>Supply Chain Management</i>	14	128
3	3.72	0.00	Seuring S	2008	<i>Journal of Cleaner Production</i>	16	1699
3	3.09	0.01	Walker H	2008	<i>Journal of Cleaner Production</i>	16	1600
3	2.90	0.07	Preuss L	2009	<i>Supply Chain Management</i>	14	213
3		0.01	Edler J	2007	<i>Research Policy</i>	36	949
3		0.01	Thomson J	2007	<i>Journal of Environmental Planning and Management</i>	50	421
3		0.01	McCrudden Christopher	2007	<i>Buying Social Justice. Equality, Government Procurement and Legal Change</i>	0	0
3		0.00	Preuss L	2007	<i>Business Strategy and the Environment</i>	16	354
3		0.00	Defra	2007	<i>UK Government Sustainable Procurement Action Plan-Incorporating the Government Response to the Report of the Sustainable Procurement Task Force</i>	0	0
3		0.00	Srivastava SK	2007	<i>International Journal of Management Reviews</i>	9	53
3		0.00	Steurer R	2007	<i>Sustainable Public Procurement in EU Member States: Overview of Government Initiatives and Selected Cases</i>	0	0
3		0.00	European Commission	2007	<i>Guide on Dealing with Innovative Solutions in Public Procurement 10 Elements of Good Practice</i>	0	0
3		0.00	Bolton P	2008	<i>Natural Resources Forum</i>	32	1
3		0.00	Carter CR	2008	<i>International Journal of Physical Distribution and Logistics</i>	38	360
3		0.00	BSI	2008	<i>PAS 2050:2008-Specification for the Assessment of the Life Cycle Greenhouse Gas Emissions of Goods and Services</i>	0	0

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
3		0.00	Equality Commission for Northern Ireland and the Central Procurement Directorate	2008	<i>Equality of Opportunity and Sustainable Development in Public Sector Procurement</i>	0	0
3		0.02	Michelsen O	2009	<i>Journal of Environmental Management</i>	91	160
3		0.00	Aschhoff B	2009	<i>Research Policy</i>	38	1235
3		0.00	European Commission (EC)	2009	<i>Reviewing Community innovation policy in a changing world</i>	0	0
3		0.00	AEA	2009	<i>CDP Public procurement program 2009</i>	0	0
3		0.14	Ho LWP	2010	<i>Natural Resources Forum</i>	34	24
3		0.00	United Kingdom Office of Government Commerce	2010	<i>Sustainable Procurement and Operations on the Government Estate: Government Delivery Plan Update-December 2009</i>	0	0
3		0.00	European Commission (EC)	2010	<i>EUROPE 2020 - a strategy for smart, sustainable and inclusive growth</i>	0	0
3		0.00	European Commission	2010	<i>Buying Social: A Guide to Taking Account of Social Considerations in Public Procurement</i>	0	0
3		0.00	Office of Government Commerce	2010	<i>Policy through procuremen</i>	0	0
3		0.00	National Association of State Procurement Officials	2010	<i>Green purchasing guidelines</i>	0	0
3		0.01	Bouwer M J	2011	<i>Green public procurement in Europe 2006 conclusions and recommendations</i>	0	0
3		0.00	Testa F	2011	<i>Journal of Environmental Management</i>	92	2136
3		0.00	Green Building Certification Institute	2011	<i>LEED for new construction: registering a project</i>	0	0
3		0.00	Accenture	2012	<i>CDP supply chain report 2012</i>	0	0
3		0.00	European Commission	2013	<i>Building the Single Market for Green Products Facilitating Better information on the Environmental Performance of Products and Organisations</i>	0	0
4	2.97	0.16	Georghiou L	2014	<i>Technological Forecasting and Social Change</i>	86	1
4	2.82	0.01	Loader K	2013	<i>Environment and Planning C: Politics and Space</i>	31	39
4	2.71	0.01	Reijonen H	2016	<i>International Small Business Journal</i>	34	468
4	2.60	0.04	Uyarra E	2014	<i>Technovation</i>	34	631
4		0.00	Nijaki LK	2012	<i>International Journal of Public Sector Management</i>	25	133
4		0.00	Gee S	2013	<i>Technolog Analysis and Strategic Management</i>	25	1175
4		0.00	Pickernell D	2013	<i>Journal of Small Business and Enterprise Development</i>	20	358
4		0.00	Cabinet Office	2013	<i>Making government business more accessible to SMEs: two years on</i>	0	0
4		0.00	Cabinet Office	2013	<i>Procurement policy note - further progress update on the modernisation of the EU procurement rules</i>	0	0
4		0.01	Knutsson H	2014	<i>Public Management Review</i>	16	242
4		0.00	Vecchiato R	2014	<i>Research Policy</i>	43	438
4		0.00	Autio Erkko	2014	<i>Innovation from big science, enhancing big science impact agenda</i>	0	0
4		0.00	Tammi T	2014	<i>Journal of Public Procurement</i>	14	304
4		0.00	Central Statistics Office	2014	<i>Business in Ireland 2012</i>	0	0

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
4		0.03	Flynn A	2015	<i>International Small Business Journal</i>	33	443
4		0.01	Loader K	2015	<i>Journal of Purchasing and Supply Management</i>	21	103
4		0.01	Edquist Charles	2015	<i>Public Procurement for Innovation</i>	0	0
4		0.01	Amann M	2015	<i>Innovation The European Journal of Social Science Research</i>	28	282
4		0.00	Flynn A	2015	<i>Public Money and Management</i>	35	111
4		0.00	Dale-Clough L	2015	<i>Innovation The European Journal of Social Science Research</i>	28	220
4		0.00	Aberg S	2015	<i>Innovation The European Journal of Social Science Research</i>	28	360
4		0.00	Lember V	2015	<i>Innovation The European Journal of Social Science Research</i>	28	403
4		0.00	Davis P	2015	<i>Innovation The European Journal of Social Science Research</i>	28	324
4		0.00	Edquist C	2015	<i>R&D Management</i>	45	147
4		0.03	Edler J	2016	<i>Research Policy</i>	45	414
4		0.02	Flynn A	2016	<i>Environment and Planning C: Politics and Space</i>	34	559
4		0.01	Uyarra E	2017	<i>Environment and Planning C: Politics and Space</i>	35	828
4		0.00	Saastamoinen J	2018	<i>Technovation</i>	69	2
4		0.00	Flynn A	2018	<i>Policy Studies</i>	39	422
5	6.71	0.02	Brammer S	2011	<i>International Journal of Operations and Production Management</i>	31	452
5	4.65	0.12	Testa F	2012	<i>Ecological Economics</i>	82	88
5	4.62	0.01	Meehan J	2011	<i>Business Strategy and the Environment</i>	20	94
5	4.22	0.03	Walker H	2012	<i>International Journal of Production Economics</i>	140	256
5	3.37	0.02	Oruezabala G	2012	<i>Industrial Marketing Management</i>	41	573
5	2.95	0.04	Erridge A	2012	<i>Public Money and Management</i>	32	363
5	2.56	0.00	Melissen F	2012	<i>Journal of Integrative Environmental Sciences</i>	9	27
5	2.52	0.00	Crespin-Mazet F	2012	<i>Journal of Purchasing and Supply Management</i>	18	207
5		0.00	Organisation for Economic Co-operation and Development (OECD)	2011	<i>Government at a glance 2011-Size of the public procurement market</i>	0	0
5		0.00	The European Commission	2011	<i>Buying Green! A Handbook on Green Public Procurement</i>	0	56
5		0.01	Hoejmosse SU	2012	<i>Journal of Purchasing and Supply Management</i>	18	232
5		0.00	Walker H	2012	<i>Supply Chain Management</i>	17	15
5		0.00	Walker H	2012	<i>Journal of Purchasing and Supply Management</i>	18	201
5		0.00	Ageron B	2012	<i>International Journal of Production Economics</i>	140	168
5		0.00	Giunipero LC	2012	<i>Journal of Purchasing and Supply Management</i>	18	258
5		0.00	Homes and Communities Agency	2012	<i>The regulatory framework for social housing in England from 2012</i>	0	0
5		0.04	Correia F	2013	<i>Journal of Purchasing and Supply Management</i>	19	58
5		0.00	Snider KF	2013	<i>Journal of Purchasing and Supply Management</i>	19	63
5		0.00	Hoejmosse S	2013	<i>International Journal of Operations and Production Management</i>	33	589
5		0.00	Organisation for Economic Co-operation and Development (OECD)	2013	<i>Green Growth in Stockholm, Sweden</i>	0	0
5		0.02	Blome C	2014	<i>International Journal of Production Research</i>	52	32
5		0.00	Grob S	2014	<i>Australasian Journal of Environmental Management</i>	21	11
5		0.00	Homes and Communities Agency	2014	<i>Homes and Communities Agency Corporate Plan 2014-18</i>	0	0

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
5		0.00	Australian Institute of Health and Welfare (AIHW)	2014	<i>Health Expenditure Australia 2012-2013</i>	0	0
5		0.00	Homes and Communities Agency	2014	<i>2013 Global Accounts of Housing Providers</i>	0	0
5		0.00	Walker H	2015	<i>Public Money and Management</i>	35	141
5		0.00	Touboulic A	2015	<i>International Journal of Physical Distribution and Logistics</i>	45	16
5		0.00	Chartered Association of Business Schools	2015	<i>Academic journal guide 2015</i>	0	0
6		0.00	MEC INEP	2007	<i>Avaliação do Programa Nacional de Alimentação Escolar (PNAE) - Censo Escolar 2004</i>	0	0
6		0.00	Morgan K	2008	<i>The School Food Revolution: Public Food and the Challenge of Sustainable Development. Procurement matters: Reclaiming the public plate</i>	0	0
6		0.00	British Standard Institute (BSI)	2008	<i>PAS 2050:2008 Specification for the Assessment of Life Cycle Greenhouse Gas Emissions of Goods and Services</i>	0	0
6		0.00	GOV UK	2008	<i>Fresh Appr Impr Food</i>	0	0
6		0.07	Sonnino R	2009	<i>Environment and Planning A: Economy and Space</i>	41	425
6		0.01	Bundy D	2009	<i>Rethinking School Feeding: Social Safety Nets, Child Development, and the Education Sector</i>	0	1
6		0.00	Sonnino R	2009	<i>International Planning Studies</i>	14	425
6		0.00	Royal Society	2009	<i>Reaping the Benefits: Science and the Sustainable Intensification of Global Agriculture</i>	0	0
6		0.00	APEC	2009	<i>Government procurement resources-Malaysia</i>	0	0
6		0.00	MDS	2010	<i>Seg al nutr</i>	0	0
6		0.00	FNDE	2010	<i>Pesq av rel entr agr</i>	0	0
6		0.00	Food and Agriculture Organization	2010	<i>The developing world's new burden: obesity</i>	0	0
6		0.00	IBGE	2010	<i>Comunicação Soc 1126</i>	0	0
6		0.00	CEASA CAMP	2010	<i>Alimentação escolar</i>	0	0
6		0.00	CONAB	2010	<i>Transp Publ PAA</i>	0	0
6		0.01	Otsuki K	2011	<i>Natural Resources Forum</i>	35	213
6		0.00	European Commission	2011	<i>Buying Green! A Handbook on Green Public Procurement</i>	0	0
6		0.00	Goodman D	2011	<i>Alternative Food Networks Knowledge, Practice, and Politics</i>	0	0
6		0.00	OECD (Organisation for economic cooperation and development)	2011	<i>Together for Better Public Services: Partnering with Citizens and Civil Society</i>	0	0
6		0.00	Wales Audit Office	2011	<i>Hospital Catering and Patient Nutrition</i>	0	0
6		0.00	Food and Agricultural Organizations of the United Nations—FAO	2011	<i>Food agriculture and cities: the challenges of food and nutrition security, agriculture and ecosystem management in an urbanizing world</i>	0	0
6		0.00	Acao Fome Zero	2011	<i>Premio Gestor Eficiente da Merenda Escolar 2012</i>	0	0
6		0.00	European Commission	2011	<i>Green Paper on the modernisation of EU public procurement policy. Towards a more efficient European Procurement Market</i>	0	0
6		0.00	Wahlen S	2012	<i>Journal of Consumer Policy</i>	35	7
6		0.00	Alderman H	2012	<i>Economic Development and Cultural Change</i>	61	187

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Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
6		0.00	IPC-IG International Policy Centre for Inclusive Growth	2013	<i>Structured Demand and Smallholder Farmers in Brazil: The Case of PAA and PNAE</i>	0	0
7		0.00	DAIpaos C	2013	<i>Journal of Economics</i>	110	25
7		0.00	Bucciol A	2013	<i>European Journal of Political Economy</i>	30	35
7		0.00	Caniels MCJ	2013	<i>Journal of Purchasing and Supply Management</i>	19	134
7		0.03	Coviello D	2014	<i>Journal of Public Economics</i>	109	76
7		0.01	Decarolis F	2014	<i>American Economic Journal: Applied Economics</i>	6	108
7		0.01	Gualandris J	2014	<i>Journal of Purchasing and Supply Management</i>	20	92
7		0.00	Guccio C	2014	<i>European Journal of Political Economy</i>	34	237
7		0.00	Hoejmoose SU	2014	<i>Industrial Marketing Management</i>	43	77
7		0.00	Beske P	2014	<i>Supply Chain Management</i>	19	322
7		0.00	Grosvold J	2014	<i>Supply Chain Management</i>	19	292
7		0.00	Lewis G	2014	<i>Review of Economic Studies</i>	81	1201
7		0.01	Chang WS	2015	<i>Management Science</i>	61	1237
7		0.00	Decarolis F	2015	<i>Economics Letters</i>	132	77
7		0.00	Dosi C	2015	<i>Journal of Law, Economics, and Organization</i>	31	160
7		0.00	Brezovnik B	2015	<i>Transylvanian Review of Administrative Sciences</i>	0	37
7		0.00	De Schepper S	2015	<i>International Journal of Project Management</i>	33	932
7		0.00	Baldi S	2016	<i>European Journal of Political Economy</i>	43	89
7		0.00	Solino AS	2016	<i>Public Performance and Management Review</i>	40	97
7		0.00	Loader K	2016	<i>Local Government Studies</i>	42	464
7		0.00	Fazekas M	2016	<i>European Journal on Criminal Policy and Research</i>	22	369
7		0.11	Ahsan K	2017	<i>Journal of Cleaner Production</i>	152	181
7		0.01	Ansari ZN	2017	<i>Journal of Cleaner Production</i>	142	2524
7		0.00	Borowiec A	2017	<i>Oeconomia Copernicana</i>	8	37
8		0.00	Dawley S	2014	<i>Economic Geography</i>	90	91
8		0.00	Bryson JM	2014	<i>Public Administration Review</i>	74	445
8		0.01	Coenen L	2015	<i>Geography Compass</i>	9	483
8		0.01	Cabinet Office	2015	<i>Social Value Act Review</i>	0	0
8		0.00	Gelderman CJ	2015	<i>Journal of Public Procurement</i>	15	66
8		0.00	Patrucco AS	2016	<i>Local Government Studies</i>	42	739
8		0.02	Glas AH	2017	<i>Journal of Public Procurement</i>	17	572
8		0.00	Patrucco AS	2017	<i>Public Money and Management</i>	37	269
8		0.00	OECD	2017	<i>Government at a Glance 2017</i>	0	0
8		0.00	Glaser BG	2017	<i>Discovery of Grounded Theory: Strategies for Qualitative Research</i>	0	0
8		0.00	Ibrahim M	2017	<i>International Journal of Public Sector Management</i>	30	370
8		0.00	Bals L	2017	<i>Journal of Purchasing and Supply Management</i>	23	256
8		0.02	Glas AH	2018	<i>Supply Chain Management</i>	23	65
8		0.02	Alhola K	2018	<i>Journal of Public Procurement</i>	18	336
8		0.01	Boon W	2018	<i>Science and Public Policy</i>	45	435
8		0.00	Ates MA	2018	<i>Journal of Purchasing and Supply Management</i>	24	68
8		0.00	Eikelboom ME	2018	<i>Journal of Public Procurement</i>	18	190
8		0.01	Adjei-Bamfo P	2019	<i>Journal of Public Affairs</i>	19	0
8		0.00	Crespi F	2019	<i>Industrial and Corporate Change</i>	28	793
8		0.00	Braulio-Gonzalo M	2020	<i>Environmental Impact Assessment</i>	81	0
9		0.02	Ghisellini P	2016	<i>Journal of Cleaner Production</i>	114	11
9		0.01	Lewandowski M	2016	<i>Sustainability</i>	8	0
9		0.00	Bocken NMP	2016	<i>Journal of Industrial and Production Engineering</i>	33	308
9		0.00	Lieder M	2016	<i>Journal of Cleaner Production</i>	115	36
9		0.00	Rizos V	2016	<i>Sustainability</i>	8	0
9		0.00	van Buren N	2016	<i>Sustainability</i>	8	0
9		0.00	Dubey R	2016	<i>Resources, Conservation & Recycling</i>	106	78
9		0.02	Geissdoerfer M	2017	<i>Journal of Cleaner Production</i>	143	757

Table A1. Cont.

Cluster	Burst	Centrality	Author	Year	Source	Vol	Page
9		0.00	Kirchherr J	2017	<i>Resources, Conservation & Recycling</i>	127	221
9		0.00	Murray A	2017	<i>Journal of Business Ethics</i>	140	369
9		0.00	Blomsma F	2017	<i>Journal of Industrial Ecology</i>	21	603
9		0.00	Adams KT	2017	<i>Proceedings of the Institution of Civil Engineers: Waste and Resource Management</i>	170	15
9		0.00	Masi D	2018	<i>Production Planning and Control</i>	29	539
9		0.00	Milios L	2018	<i>Sustainability Science</i>	13	861
9		0.00	De Angelis R	2018	<i>Production Planning and Control</i>	29	425
9		0.00	Esposito M	2018	<i>California Management Review</i>	60	5
9		0.01	Alhola K	2019	<i>Journal of Industrial Ecology</i>	23	96
10	2.51	0.03	Yin Robert K	2009	<i>Case study research: design and methods</i>	0	0
10		0.00	Adger WN	2009	<i>Climatic Change</i>	93	335
10		0.00	Swedish Association of Local Authorities and Region	2009	<i>Laiget i Landet: En Undersokning om Klimatanpassning i den Fysiska Planeringen</i>	0	0
10		0.00	National Board of Housing Building and Planning	2011	Personal Communication	0	0
10		0.00	Akerman J	2011	<i>Energy Policy</i>	34	1944
10		0.00	Swedish National Board of Housing Building and Planning	2012	<i>Build Plann</i>	0	0
10		0.00	Aguado S	2013	<i>Journal of Cleaner Production</i>	47	141
11		0.02	Singh J	2010	<i>Public Procurement of Energy Efficiency Services: Lessons from International Experience</i>	0	1
11		0.00	Energy Valuation Organization	2012	<i>International Performance Measurement & Verification Protocol, Concepts and Options for Determining Energy and Water Savings</i>	1	0
11		0.00	University Grants Committee	2013	<i>List of Higher Education Institutions in Hong Kong and UGC-Funded Institutions</i>	0	0
11		0.00	Office of the Licensing Authority	2013	<i>List of Registered Hotels in Hong Kong</i>	0	0
11		0.00	European Commission	2014	<i>Energy Performance Contracting Campaign (EPCC)</i>	0	0
12		0.01	Loosemore M	2016	<i>International Journal of Project Management</i>	34	133
12		0.00	Montalban-Domingo L	2018	<i>Journal of Cleaner Production</i>	198	1355
12		0.01	Bernal R	2019	<i>Sustainability</i>	11	0

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