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On the basis of research on 'green' in the disciplines of management and business

Francisco García-Lillo *, Pedro Seva-Larrosa, Eduardo Sánchez-García

Department of Management, University of Alicante, P.O. Box 99, ES E-03080, Alicante, Spain

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ABSTRACT

In this research, we analyze and map the existing literature on 'green' in the disciplines of management and business by applying citation, co-citation, and bibliographic coupling analyses, i.e. using bibliometric methods, from two different perspectives: first, identifying and analyzing the works that have had the greatest impact on research and the changes that have taken place in the intellectual structure of this disciplinary area; and second, reviewing the most recent literature to unveil current trends and future priorities as they are reflected at the forefront of research. To carry out the study we used Clarivate Analytics' Web of Science Core Collection™ (WoS) –in particular, one of its indexes: the Social Sciences Citation Index (SSCI). From this database, 4,888 articles published between 1968 and 2022 were retrieved. The sample period of 55 years was then divided into two sub-periods: 1968–2011 and 2012–2022 to longitudinally examine the data. To the best of our knowledge, no such study has dealt with this field and we believe the outcomes can help coordinate future research efforts.

1. Introduction

As a general rule –and, given the large amount of knowledge produced–, once a scientific discipline has reached a certain degree of maturity, it is "common" practice for its scholars to turn their attention towards the literature generated by the scientific community, treating it as a research topic in its own right (Ramos-Rodríguez and Ruíz-Navarro, 2004; Calabretta, Durisin and Ogliengo, 2011; Mukherjee et al., 2022; among others). From this perspective, some scholarly journals have also been recently analyzed (Gaviria-Marín et al., 2018; Martínez-López et al., 2018; Donthu et al., 2020; Ratten et al., 2020; Jain, Oh and Shapiro, 2022).

Accordingly, the purpose of this paper is to gain a general impression of the research on 'green' as a disciplinary area or separate academic field in the disciplines of management and business –our focus is particularly on these two disciplines: *management* and *business* only– and its evolution by considering the works of a great number of researchers in the field over an extended period of time: 55 years, using bibliometric methods.

Following the reasonings of White and McCain (1998), the aim of this type of paper is usually to ascertain how a field or discipline has evolved by focusing on and describing what can be seen in the rear-view mirror (Ramos-Rodríguez and Ruíz-Navarro, 2004, p. 981). That is, to look back by undertaking a journey through the history, the classics, and the theoretical "pillars" of the discipline (e.g. Calabretta, Durisin and Ogliengo, 2011; Vogel and Güttel, 2013; Sainaghi et al., 2020). However, research evolves in all fields and it is important to keep one's finger on the pulse. We can even attempt to peer into the future and anticipate where it is headed next. Hence the twofold aim of our study.

In this research, we analyze and map the existing literature on 'green' from two different perspectives: first, identifying and analyzing the works that have had the greatest impact on research and the changes that have taken place in the intellectual structure of this disciplinary area; and second, reviewing the most recent literature to unveil current trends and future priorities as they are reflected at the forefront of research (i.e. some of the most active research "fronts").

To the authors' knowledge, no other studies have dealt with the field under examination from these two perspectives; therefore, this paper aims to fill a gap in green literature by applying bibliometric techniques to a representative collection of research articles, with the intention of complementing and enhancing the findings of other more qualitative works. To this end, this paper analyzed 4,888 articles retrieved from the WoS database.

It goes without saying that our study is exploratory in nature and we are not interested in generating any sort of controversy. Considering theoretical lenses or perspectives such as the stakeholder view of the

* Corresponding author.
E-mail address: f.garcia@ua.es (F. García-Lillo).

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firm (Freeman, 1984), it is evident that organizations should recognize the importance of environmental issues and find ways to incorporate these issues into their business strategies.

The remainder of this paper is organized as follows. Once the methods have been discussed, the next section (Methodology) deals with data collection and research design. The outcome of the analyses carried out are summarized in the subsequent section (Results and discussion). Finally, in the last section we outline the conclusions, limitations, and directions for future research.

2. Methodology

2.1. Methods: Co-citation vs. Bibliographic coupling analysis

In the Library and Information Science (LIS) area – and even beyond this domain (González-Alcaide, 2021; Khanra et al., 2021a)– a wide variety of 'methods' and 'techniques' vie with each other while simultaneously complementing each other –e.g. text mining, computational linguistics, text analysis natural language processing– when it comes to studying the quantitative aspects of information and the quantitative features and characteristics of science and scientific research in a particular 'field' or domain with the aim of detecting possible subfields, organizing the extant literature, delineating lines of future research or, for instance, the search for distinct schools of thought (the so-called "invisible colleges" [1] that might exist in a 'field' (Gmür, 2003; Vogel, 2012; among others). Among them, it is worth mentioning bibliometric 'methods.' Some studies –not exclusively in the area of LIS, but also in other fields–, have used co-word analysis, DCA or author co-citation analysis (ACA) (e.g. Grégoire et al., 2006; Chen et al., 2010; Leydesdorff and Welbers, 2011; Zhao and Strotmann, 2011; Batistič, Černe and Vogel, 2017; Wong et al., 2021; Chabowski and Samiee, 2023). Others have used the technique that was first introduced by Kessler (1963) of bibliographic coupling analysis (BCA) (e.g. Glänzel and Czerwon, 1995, 1996; Huang et al., 2003; Ma, 2012; Huang and Chang, 2014; Yuan et al., 2015; Maseda et al., 2022; García-Lillo, Seva-Larrosa and Sánchez-García, 2023). There is yet a third group of academics who combine two or more bibliometric analysis methods: e.g. citation and co-citation analyses with BCA (Zhao and Strotmann, 2014), bibliometric and text mining analysis (Hung, 2012; Martí-Parreño et al., 2016), co-word analysis and DCA or ACA (e.g. Zitt et al., 2011). Notwithstanding the above, two types of analysis stand out: co-citation and bibliographic coupling analysis (BCA).

Co-citation analysis –pioneered by Henry Small (1973) (cf. Irina Marshakova, 1973) [2]– is based on the hypothesis that a certain "intellectual connection" could exist –at least from the citing author's perspective (McCain, 1990, p. 443)– between two documents, "A" and "B", that are cited together, i.e. co-cited, so that the greater the co-citation frequency, the closer the connection between them (Garfield, 1970; Griffith et al., 1974; Small and Griffith, 1974; Cawkell, 1976). According to Small (1973, p. 265), if it may be hypothesized that highly-cited documents symbolize the "key concepts, methods, or experiments" in a scientific domain or discipline, i.e. they can be viewed as "exemplars" –using Thomas S. Kuhn's terminology (Aksnes et al., 2019) or, in the words of Glänzel and Czerwon (1995, 1996), as "core documents" in the context of co-citation analysis–, such co-citation "patterns" could then be used to provide details on the evolution of the intellectual structure of a discipline, leading to the identification of the documents that could have served as "pillars" for the future advancement of the discipline by providing a comprehensive assessment of its evolution. Needless to say, this method or technique of analysis provides a "retrospective" vision, i.e. a more past-oriented point of view (Verbeek et al., 2002; Calabretta et al., 2011; Ertz and Leblanc-Proulx, 2019), in so far as it reveals the documents with a higher impact on research in the scientific communication system.

In the second of the techniques mentioned above –bibliographic coupling analysis (BCA)– two documents citing a third publication, i.e. two "citing" documents, are coupled because high instances of mutual references in their bibliographies suggest a common intellectual capital (Xu et al., 2018; Khanra et al., 2021). So, the fact that two documents, "A" and "B", have a certain number of references in common –"… a single item of reference shared by two documents is defined as a unit of coupling between them" (Kessler, 1962)– allows us to infer that documents "A" and "B" could be thematically related (Martyn, 1964). Bibliographic coupling links primary-source documents that present similarities in their reference lists, "indicating the probability of a shared related topic" (Maseda et al., 2022, p. 282). As is to be expected, the greater the amount of overlap between the reference lists of "A" and "B", the greater the thematic affinity between them. In particular, the importance of studies grounded on the application of BCA lies in the fact that documents connected by strong bibliographic coupling links can provide insights into the structure of the research "fronts" within an academic field in terms of subject relatedness (Vladutz and Cook, 1984; Peters et al., 1995). Unlike co-citation analysis, this technique can be qualified as "prospective" (Verbeek et al., 2002; Vogel and Güttel, 2013); de facto, "citing" documents are more recent than the publications that they cite (except for those cited as forthcoming). Additionally, this technique can be used to reveal "hot" research topics (Glänzel and Czerwon, 1995, 1996; Jarneving, 2007a, 2007b), and provides a useful basis for "detecting current trends and future priorities as they are reflected at the forefront of research" (Vogel and Güttel, 2013, p.429).

In sum, as Vogel and Güttel (2013, p. 429) point out, "co-citation analysis is advantageous for mapping the intellectual heritage of a particular field on the basis of high-impact publications, but tends to neglect the publication dynamics at the forefront of the research. Bibliographic coupling, in contrast, captures more recent contributions, including the classics of tomorrow, so to speak, however, this method has a blind spot with regard to the history of an intellectual field.".

Fig. 1 exhibits a graphical depiction of the two procedures described above –co-citation analysis and BCA– for analyzing the "cited" references in a scientific publication.

Since 'method' choice –*co-citation* vs. *bibliographic coupling analysis* (BCA)– directly depends on the research question(s) that a study like ours sets out to answer and, given that our paper's aim is twofold: first, to identify the works that have had the greatest impact in the research on 'green' and to analyze the changes that have taken place in its intellectual structure; and second, to review the most recent literature to unveil current trends and future priorities as they are reflected at the forefront of research (i.e., research "fronts") with the purpose of providing a "prospective" approach, i.e. "forward-looking" (Verbeek et al., 2002; Vogel and Güttel, 2013) to the research in this particular disciplinary area, both techniques of analysis were used. Social network analysis (SNA) as well as the principal components factor analysis (FA) and hierarchical clustering analysis (HCA) were also utilized.

2.2. Source for data analysis and "citing" document dataset

Clarivate Analytics' Web of Science Core Collection™ (WoS) –in

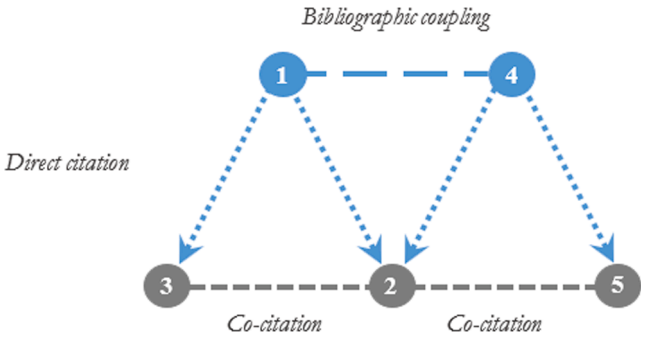

Fig. 1. Bibliographic coupling vs. co-citation analysis.

particular, one of its indexes: the Social Sciences Citation Index (SSCI)–, was the database used to perform this study. Since the simultaneous use of different databases –e.g. Web of Science (WoS) in conjunction with Scopus– is unhelpful owing to duplication of records (Harzing and Alakangas, 2016) and Web of Science (WoS) is renowned as the 'gold standard' database for bibliometric use (Pranckuté, 2021), WoS was our choice. From this database, a first search in the TOPIC field for all publications on 'green' issued up to November 10, 2022 (the database consultation date) was executed. We started with a query string for the topic mentioned above in the 'Management' and 'Business' categories in WoS (Languages: English), this search resulted in an initial dataset comprising 5,452 documents.

Since they are the only ones that can be viewed –in the Merton' words (Merton, 1973)– as "certified knowledge", it is of standing out at this point that only "peer-reviewed scholarly journal articles," rather than books, chapters in books, conference proceedings, or documents containing reviews or notes were collected. Moreover, the use of articles that have been published in peer-reviewed journals –the peer-review process acts as a mechanism of control to validate the knowledge of these articles– is "common practice" in these studies, given that it increases the reliability of the obtained results. Sometimes, only publications in such journals are considered as a "real" scientific output (Ochsner, 2021).

As a result, on 10 November 2022, a total of 4,888 articles were downloaded as the 'dataset' from which to extract the bibliographic data for this study. No documents published prior to the year 1968 appeared indexed in the WoS.

The 4,888 "peer-reviewed journal articles" were downloaded to a ". txt file" to be handled through Bibexcel®, a versatile toolbox for bibliometricians designed by Professor Olle Persson at the Swedish University of Umeå to assist users in analyzing bibliographic data (or any data of a textual nature formatted in a similar manner). It enables the user, among other functionalities, to extract the information included in a bibliographic record using any document's field –including the references cited by each of the primary-source documents which were initially extracted from the WoS–, or some combination of these fields. As Fahimnia et al., (2015,p. 104) recommend, interested readers can refer to Paloviita (2009) and Persson et al. (2009) for additional details about the procedure on how to apply this software/toolbox in scientometrics and bibliometrics.

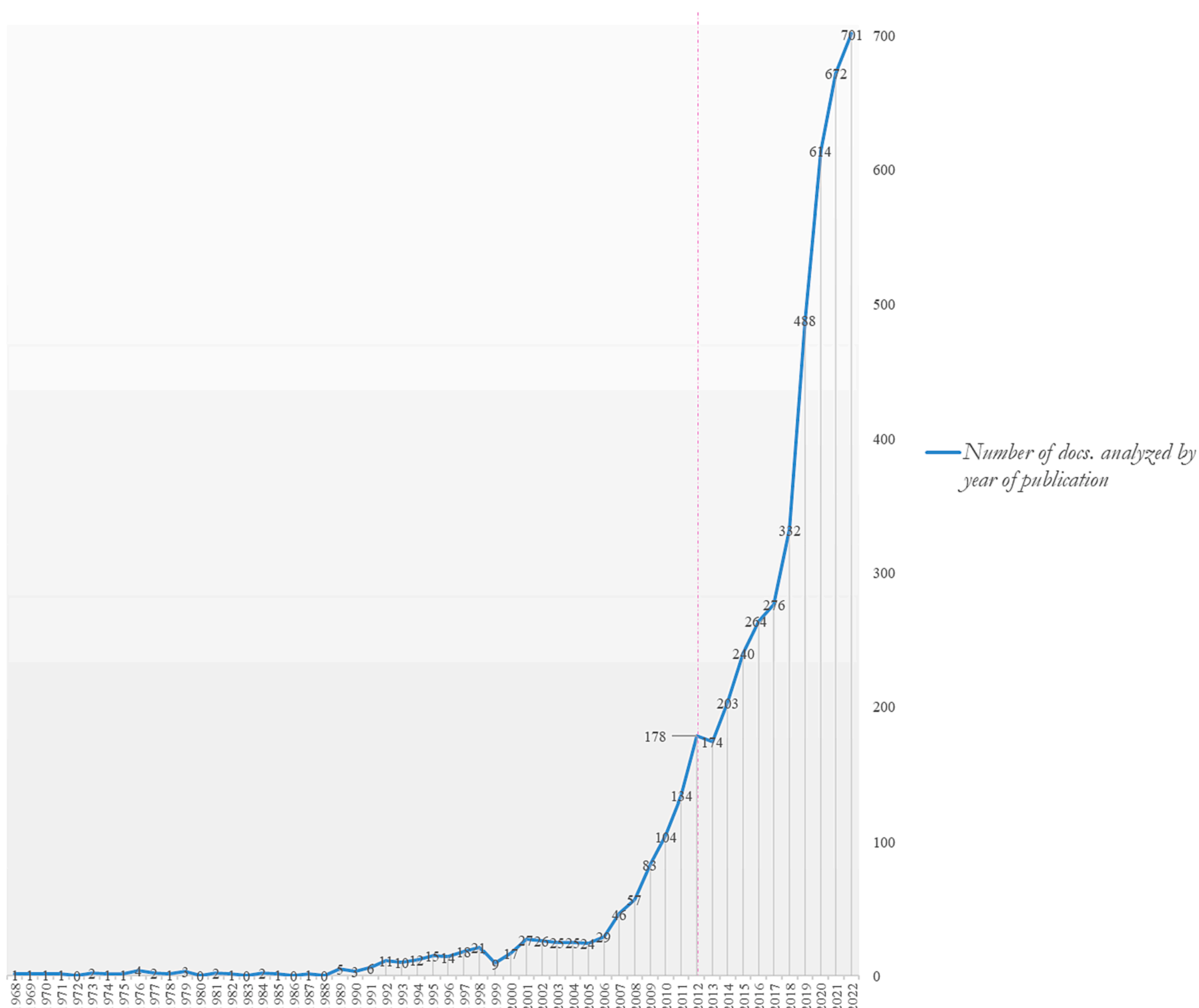

Fig. 2. Number of papers analyzed by year of publication, 1968–2022*, * as of November 10, 2022 (database consultation date); 4,888 "peer-reviewed journal articles"/"citing" documents.

Bibexcel® was chosen for this research due to its flexibility and versatility in adjusting and modifying input data imported from different databases and its ability to provide comprehensive data analysis to be used in a wide range of network analysis tools such as Pajek, VOSviewer, SciMAT, UCINET, and Gephi (Dai et al., 2020; Arora and Majumdar, 2022; Kumar and Sharma, 2022).

Bibliometrix® (https://www.bibliometrix.org/home/) –a user-friendly R package to ease interfacing with bibliographic data and records developed by Aria and Cuccurullo (2017) to carry out quantitative research in bibliometrics and scientometrics– was also used.

Fig. 2 illustrates the diachronic evolution by year of the "peer-reviewed journal articles" analyzed in this study.

2.3. Research design: The various and separate stages in which the study was conducted

The study was conducted in two separate stages. The first stage was a citation analysis to compute the frequency of citation of the bibliographic references used in all the articles analyzed, in order to identify the works that had made most impact on the scientific community. The sample period of 55 years was then divided into two sub-periods: 1968–2011 and 2012–2022, and the analysis was repeated in order to observe any changes that might have taken place in the influence of these works.

In the first stage, document co-citation analysis (DCA) was also used to analyze possible changes in the intellectual structure of research on 'green.' The co-citation matrices for each of the two sub-periods were constructed from the documents cited at least 15 times for the first sub-period and from the documents cited at least 100 times for the second, given the differences in sample sizes (n = 746 and n = 4,142). In this way, two co-occurrence matrices $\mathbf{C(c_{ij})_{nxn}}$ of dimensions 107x107 and 80x80 respectively were obtained.

Once a co-occurrence matrix $\mathbf{C(c_{ij})_{nxn}}$ has been constructed –and, after deciding how the principal diagonal elements in the matrix will be treated– the next step in the application of co-citation and BCA analyses consists in calculating a similarity matrix, $\mathbf{S(s_{ij})_{nxn}}$. In this study we used Pearson's correlation coefficient –known as Pearson's r– because, in spite of all the adverse criticism [3] (e.g. Ahlgren et al., 2003, 2004; Leydesdorff, 2005, 2007, 2008; Leydesdorff and Vaughan, 2006; Zhou and Leydesdorff, 2016), it is one of the most commonly used relatedness measures among a wide range of normalized frequency measures (e.g. Salton's cosine measure, Jaccard index, Ochiai coefficient, etc.) [4].

The second stage consisted of applying the BCA technique to the documents of the second sub-period: 2012–2022.

In this research all "citing" documents with a coupling strength of, at least, 27 shared references with, at least, one of the remaining source documents were considered. Bibliographic coupling (BC) occurs when two scholarly works cite a common third work in their reference lists. So, two documents, "A" and "B", are bibliographically "coupled" if they both cite one or more documents in common. In theory, all 4,142 "citing" documents could be incorporated into the analysis. However, the difficulty of working with all of them –furthermore, it becomes meaningless– makes it necessary to fix a minimum coupling threshold. The "cut-off point" mentioned above allowed us to obtain a "co-occurrence" matrix, $\mathbf{C(c_{ij})_{nxn}}$, of dimensions 252x252 with the amount of "cited" references in common between each pair of "citing" documents.

3. Results and discussion

3.1. First stage - citation and co-citation analyses results

This section contains the results of the citation and co-citation analyses of the bibliographic references made by the 9,823 authors in the 4,888 articles on 'green' published in 309 journals from 1968 through 2022 (Table 1), with Sarkis J (29 articles), Jabbour CJC (25 articles), and Feng TW (22 articles) standing out as the authors (co–)authoring the largest number of articles (Table 2). The average citations per document was 44.41.

Table 1
List of the top ten most prolific authors (sorted by number of publications).

Authors	Frequency(Number of articles)	Articlesfractionalized
Sarkis J	29	11.12
Jabbour CJC	25	5.82
Feng TW	22	6.35
Kumar A	20	5.73
Boiral O	19	8.75
Han H	19	7.15
Paillé P	19	6.03
Chen YS	16	8.71
Wang Y	16	4.27
Zhu QH	15	4.67

In Fig. 3, a Sankey diagram –also known as a "three-field" plot– for the 4,888 documents mentioned above provides a snapshot of the relationships between the top ten most prolific authors, the most relevant journals, and the most frequently used keywords reflecting research themes on green. The top 10 most used keywords were: "sustainability," "sustainable development," "green," "environmental," "corporate social responsibility," "environmental management," "green innovation," "innovation," "performance," and "environmental performance." The most relevant source was *Business Strategy and the Environment.* The size of a node in the plot indicates its dominance inside the unit of analysis. The thickness of the arrows depicts the strength of the bibliometric linkages.

3.1.1. Initial and descriptive results of the citation analysis

As we have explained in the section on methodology, in order to highlight changes in the intellectual basis our set of articles was divided into two sub-periods. The first comprised 746 articles published between 1968 and 2011; the second, a total of 4,142 works published between 2012 and 2022* (database consultation date: November 10, 2022). In all 347,880 bibliographic references to 175,840 different works were analyzed, giving an average of 71.2 references per article. Fig. 4 reveals the frequency distribution of the dates of the citations analyzed.

A preliminary analysis of all these bibliographic references showed that by far the most frequently cited journal, was *Journal of Cleaner Production* (12,647 articles), followed by *Journal of Business Ethics* (9,552 articles) and the journal *Business Strategy and the Environment* (7,473 articles) (Table 3). *Strategic Management Journal* (5,489), *The Academy of Management Journal* (5,484), *Journal of Business Research* (5,041), *The Academy of Management Review* (4,776), *Journal of Marketing* (4,071),

Table 2
Main information about data, document contents, authors, and authors collaboration.

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1968:2022
Sources (journals, books, etc.)	309
Documents	4,888
Annual growth rate %	12.66
Document Average Age	6.98
Average citations per doc.	44.41
References	175,840
DOCUMENT CONTENTS	
Keywords Plus (ID)	5,333
Author's Keywords (DE)	11,152
AUTHORS	
Authors	9,823
Authors of single-authored documents	586
AUTHORS COLLABORATION	
Single-authored docs.	679
Co-authors per doc.	2.85
International co-authorships %	35.45

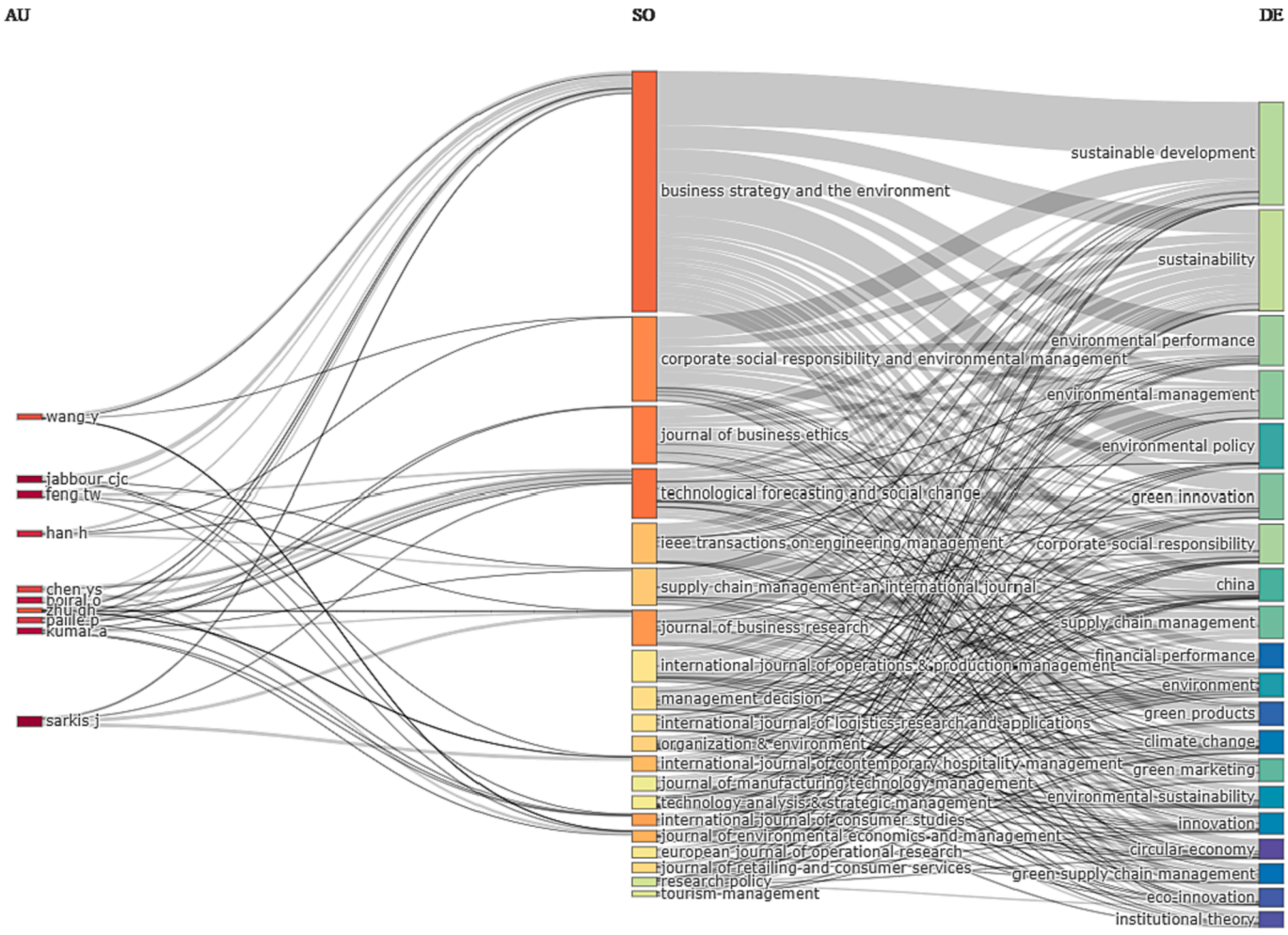

Fig. 3. Sankey diagram shown interlinkages between most relevant authors, sources, and author's keywords.

International Journal of Production Economics (3,857), and *Journal of Consumer Research* (3,154) complete the top ten most cited sources (from reference lists) of a total of 50,286 entries.

Table 4 reports the top ten most local cited documents – ranging from 437 to 151 citations– by the articles included in our dataset. Local citations measure how many times a document (or an author) included in a collection, e.g. the dataset from which the bibliographic references were extracted, have been cited by the documents included in the same collection. In terms of total local citations (TLC) and total local citations per year (TLC/t) received, the most influential document, with 437 citations, was the article by Porter and van der Linde C (1995a) entitled: *'Green and competitive: Ending the stalemate,'* published in *Harvard Business Review,* followed by the articles by Russo and Fouts (1997): *'A resource-based perspective on corporate environmental performance and profitability,'* and Bansal and Roth (2000): *'Why companies go green: A model of ecological responsiveness,'* both published in *The Academy of Management Journal.*

Moreover, Table 5 reveals the top ten most local cited authors, with Chen YS at the lead with 957 local citations, followed by Sarkis J and Chang CH, with 627 and 479 citations respectively.

3.1.2. *Most influential works and changes in their patterns of citation*

Table 6 shows the 50 most cited works and their frequency –total count– in the articles published during the 55 years covered by the study, arranged in order of the number of citations. Table 6 also shows the percentage of articles from the period that cited each work, and the total counts and percentages –in terms of relative citation frequency– broken down into the two sub-periods: 1968–2011 and 2012–2022 in which the sample consisting of 4,888 articles was divided. References that appear in *italics* refer to works (books, articles, etc.) included among the top 20 in either of such sub-periods.

A few remarks regarding the data thus obtained are mentioned below:

- Of the 20 most frequently cited works –some authors, such as White and McCain (1998), go so far as to refer to them as the *'canonical literature'*– 19 were published as articles in journals and only one in book form: Hair et al. (2010). In general, this is due to the tendency among authors to use articles published in journals as their source of data for research work and to rely more heavily on empirical studies (Üsdiken and Pasadeos, 1995; Ramos-Rodríguez and Ruíz-Navarro, 2004).
- In addition to the articles by Fornell and Larcker (1981) and Podsakoff et al. (2003), the top 5 most cited works brings together the articles by Porter and van der Linde (1995a, 1995b) and Hart (1995): *'A Natural-Resource-Based View of the Firm.'* Building upon the original resource-based view (RBV) of the firm (e.g. Wernerfelt, 1984; Barney, 1991), which contends that a firm's unique resources and capabilities are the main sources of sustainable competitive advantage, Hart (1995) proposes that a company's competitive advantage is based upon its relationship with the natural environment. The conceptual framework for this theory is comprised of the interconnected strategies of pollution prevention, product stewardship, and sustainable development (Pane Haden et al., 2009, p. 1048).

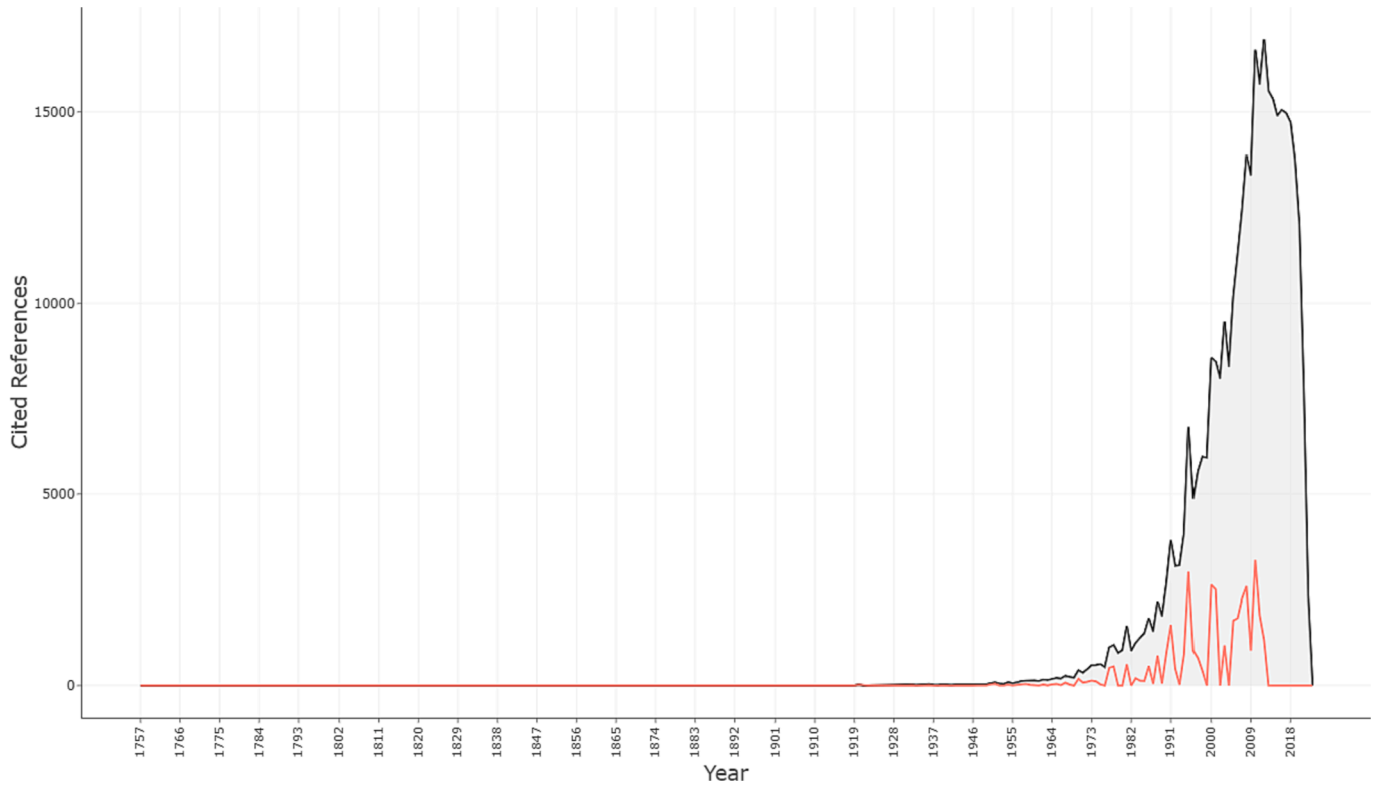

Fig. 4. Reference publication year spectroscopy showing the frequency distribution of the dates of the citations analyzed.

Table 3
List of the top ten most local cited sources (from reference lists).

Source	Frequency	Percentage	Total percentage
Journal of Cleaner Production	12,647	7.19 %	7.19 %
Journal of Business Ethics	9,552	5.43 %	12.62 %
Business Strategy and the Environment	7,473	4.25 %	16.87 %
Strategic Management Journal	5,489	3.12 %	19.99 %
The Academy of Management Journal	5,484	3.11 %	23.10 %
Journal of Business Research	5,041	2.87 %	25.97 %
The Academy of Management Journal	4,776	2.72 %	28.69 %
Journal of Marketing	4,071	2.32 %	31.01 %
International Journal of Production Economics	3,857	2.19 %	33.21 %
Journal of Consumer Research	3,154	1.79 %	35.00 %
Other sources (50,276)	114,296	65,00 %	100 %
TOTAL	**175,840**	**100 %**	

Showing 1 to 10 of 50,286.

- Other "examples" of works that maintained a high profile over the whole of the sample period are those that have proposed different approaches or theoretical perspectives to the study of green in the disciplines of management and business, such as the resource-based view of the firm (Barney, 1991), institutional theory (DiMaggio and Powell, 1983), and Ajzen's (1991) theory of planned behavior. In relation with this last theory, this is due to the fact that models grounded in social psychology such as Fishbein and Ajzen's (1975) theory of reasoned action ("TRA") and Ajzen's (1991) theory of planned behavior ("TPB") have been used to understand consumer green purchasing behavior. By way of example, a modified Ajzen's (1991) theory of planned behavior ("TPB") is also used by Cordano and Frieze (2000) to analyze the behavioral preferences of 295 U.S. environmental managers. Works such as the article by Aragón-Correa and Sharma (2003), seeking the integration of perspectives from the literature on contingency, dynamic capabilities, and the natural RBV of the firm also maintained a high profile of citation.
- A further outcome is the marked influence of a series of scholarly works on methodological aspects in research (e.g. cutoff criteria for fit indexes in covariance structure analysis). These are the works by Armstrong and Overton (1977), Nunnally (1978a), Anderson and Gerbing (1988), Baron and Kenny (1986), Bagozzi and Yi (1988), Hu and Bentler (1999), Podsakoff and Organ (1986), Podsakoff et al. (2003), Henseler, Ringle and Sarstedt (2015), and Fornell and Larcker (1981), with this last publication occupying the first position in the 'ranking.'

The next step in this first stage –*as a previous step before analyzing the changes in its intellectual structure*– was to analyze changes in citation percentages in order to reveal gains or losses in influence over the length of the study period and thus obtain a dynamic picture of the transformations that have taken place within the research. Fig. 5 records these changes for the two sub-periods in the sample.

All of the works analyzed in the study fit one of a limited number of patterns (White and McCain, 1998). One of the most common is for documents to increase their influence from the first to the second sub-period. This, of course, indicates a trend of increasing influence over the entire study period; examples of works exhibiting this pattern are, in order of their percentage gain from the first to the second sub-period: Fornell and Larcker (1981), Podsakoff et al. (2003), Anderson and Gerbing (1988), Ajzen (1991), Teece, Pisano and Shuen (1997), and Barney (1991).

3.1.3. *Changes in the intellectual structure of research on green*

In order to observe possible changes in the intellectual basis of research on 'green,' shown below are the results of the DCA analyses conducted on the most influential works in each of the two sub-periods in which the sample was divided. As previously explained, "co-occurrence" and "similarity" matrices for these analyses were constructed from the documents cited at least 15 times for the first sub-period and from documents cited at least 100 times for the second.

Figs. 6 and 7 visually map –using VOSviewer– the 'patterns' that

Table 4
List with the top ten most local cited articles –ranging from 437 to 151 citations– by the 4,888 articles included in our dataset.

Ranking		TLC	TGC
1	Porter ME, van der Linde C (1995). Green and competitive: Ending the stalemate. Harvard Business Review 73(5), 120–134.	437	2,488
2	Russo MV, Fouts PA (1997). A resource-based perspective on corporate environmental performance and profitability. The Academy of Management Journal 40 (3), 534–559.	384	2373
3	Bansal P, Roth K (2000). Why companies go green: A model of ecological responsiveness. The Academy of Management Journal 43(4), 717–736.	345	1,836
4	Chen YS, Lai SB, Wen CT (2006). The influence of green innovation performance on corporate advantage in Taiwan. Journal of Business Ethics 67, 331–339.	230	852
5	Christmann P (2000). Effects of "best practices" of environmental management on cost advantage: The role of complementary assets. The Academy of Management Journal 43(4), 663–680.	221	1,160
6	Ambec S, Lanoie P (2008). Does it pay to be green? A systematic overview. The Academy of Management Perspectives 23(4), 45–62.	219	848
7	Buysse K, Verbeke A (2003). Proactive environmental strategies: A stakeholder management perspective. Strategic Management Journal 24(5), 453–470.	208	1,116
8	Rao P, Holt D (2005). Do green supply chains lead to competitiveness and economic performance? International Journal of Operations & Production Management 25(9), 898–916.	197	1,168
9	Chen YS (2008). The driver of green innovation and green image – Green core competence. Journal of Business Ethics 81, 531–543.	171	631
10	Vachon S, Klassen RD (2006). Extending green practices across the supply chain: The impact of upstream and downstream integration. International Journal of Operations & Production Management 26 (7), 795–821.	151	795

TLC = Total local citations received. Local citations measure how many times a document (or an author) included in a collection, e.g., the dataset from which our bibliographic data were extracted, have been cited by the documents included in the same collection; TGC = Total global citations received. Global citations measure the total citations that an article, included in a collection, has received from documents indexed on bibliographic databases (WoS, Scopus, etc.) worldwide.

Table 5
List of the top ten most local cited authors (sorted by number of local citations).

Authors	Local citations
Chen YS	957
Sarkis J	627
Chang CH	479
Russo MV	465
Porter ME	437
van der Linde C	437
Pujari D	433
Dangelico RM	429
Boiral O	424
Zhu QH	411

emerge for the analyses of the most influential works from 1968 to 2011 (Fig. 6) and from 2012 to 2022 (Fig. 7).

Tables 7 and 8 summarize the results of the hierarchical clustering analyses–in data mining and statistics, hierarchical cluster analysis is a method of cluster analysis that seeks to build a hierarchy of clusters, i.e. a tree-type structure (dendrogram) based on this hierarchy– applied to the 'patterns' of co-citation referred to in previous paragraph. The quantitative data analysis was conducted using the software SPSS statistical package 28.0.1.

Our results show a progressive maturation of the research in the field analyzed: as regards changes in its intellectual structure, ten different clusters were identified in the second sub-period in comparison to only five identified in the first sub-period (Tables 7 and 8). Furthermore, in the first sub-period two of the clusters integrate one or two works only: the work by Roberts (1996) (Cluster 4) on the profile of green consumers in the 1990 s and the articles by Ellen, Wiener and Coob-Walgren (1991) and Kinnear, Taylor and Ahmed (1974) (Cluster 5).

Moreover, works clustered close to each other in one period gain a cluster of co-citation profiles of their own in the subsequent period –in early periods, the most cited documents in a discipline are normally works dealing with many different topics and dedicated to establishing the theoretical foundations and legitimizing it as an academic discipline–, indicating increasing sophistication in the analysis of specific issues and how some topics are parceled out in ever finer grained topics.

The maturation of this separate field or disciplinary area into the disciplines of management and business which has developed around some seminal works increasingly recognized as "classics;" they consistently rank among the most cited contributions despite their increasing age (e.g. Hart, 1995; Porter and van der Linde, 1995a, 1995b; Russo and Fouts, 1997; among others) is also evidenced by the influence of works addressing methodological issues: the presence in the ranking of Fornell and Larcker's (1978), Podsakoff et al.'s (2003) or Anderson and Gerbing's (1988) works is a clear sign that more empirical research is now taking place. These works come to occupy a central position when the intellectual structure of the most recent research is mapped (Fig. 7).

3.2. Second stage - bibliographic coupling analysis and SNA results

At this point, the outcomes of the BCA and SNA carried out in this study are displayed and interpreted below.

BCA proved to be useful in identifying a total of 1,449,783 unique pairs of source-documents: 57.16 % (n = 828,687) of these pairs of "citing" documents with a single bibliographic reference in common; 42.06 % (n = 609,746) between two and nine; and finally, 0.78 % (n = 11,350) with over ten references. As previously explained in the Methodology section, in this study the co-occurrence matrix $\mathbf{C(c_{ij})_{nxn}}$ for BC analysis was constructed with the bibliographic couplings between 252 source-documents, a number which eventually went down to 64 –as will be explained later– in the SNA and the principal components factor analysis (FA).

In this second stage of the study, social network analysis (SNA), which is based on graph theory, in conjunction with factor analysis (FA) –there are several advantages of analyzing and visualizing co-occurrence data such as the ones used in BCA with tools from SNA (Leydesdorff and Vaughan, 2006; Yang et al., 2012; among others)– was adopted as the principal technique of analysis. The suitability of combining these two analytical techniques lies in the fact that results can be provided with enhanced robustness, as highlighted by Vogel and Güttel (2013, p. 430).

More precisely and, using the 'Force Atlas' layout algorithm provided by Gephi –an open source software package that uses a three-dimensional render engine to provide expressive and insightful visual illustrations of large networks (Bastian et al., 2009; Jacomy et al., 2014)–, an effort was made to calculate the layout of a bibliographic coupling network through which the active research "fronts" identified in this study can be visualized. In the network, "citing" documents are shown as nodes and the amount of overlap between the reference lists of each pair of documents are represented by the arcs/edges between the nodes. The path length, i.e. the number of arcs/edges between them, approximates the distance between any two nodes. The shorter the mean path length between a given node and the other nodes, the higher its centrality in the network.

In our particular case, and consistent with the criteria used to obtain the co-occurrence matrix $\mathbf{C(c_{ij})_{nxn}}$ on which this analysis is primarily supported, a decision was made to establish the same "coupling strength" between each "citing" document. In the present study, a

Table 6
List of the 50 most cited works and their frequency.

Rank	Document cited	1968–2022 (n = 4,888)		1968–2011 (n = 746)		2011–2022 (n = 4,142)	
1	Fornell and Larcker (1981)	750	15.34 %	22	2.95 %	728	17.58 %
2	Hart (1995)	587	12.01 %	118	15.82 %	469	11.32 %
3	Podsakoff et al. (2003)	542	11.09 %	11	1.47 %	531	12.82 %
4	Porter and van der Linde (1995a)	432	8.84 %	125	16.76 %	307	7.41 %
5	Porter and van der Linde (1995b)	389	7.96 %	50	6.70 %	339	8.18 %
6	Russo and Fouts (1997)	384	7.86 %	92	12.33 %	292	7.05 %
7	Barney (1991)	367	7.51 %	47	6.30 %	320	7.73 %
8	Bansal and Roth (2000)	345	7.06 %	65	8.71 %	280	6.76 %
9	Hair et al. (2010)	345	7.06 %	0	0.00 %	345	8.33 %
10	Anderson and Gerbing (1988)	290	5.93 %	14	1.88 %	276	6.66 %
11	Ajzen (1991)	282	5.77 %	15	2.01 %	267	6.45 %
12	*Zhu and Sarkis (2004)*	266	5.44 %	33	4.42 %	233	5.63 %
13	Armstrong and Overton (1977)	256	5.24 %	27	3.62 %	229	5.53 %
14	*Sharma and Vredenburg (1998)*	237	4.85 %	59	7.91 %	178	4.30 %
15	DiMaggio and Powell (1983)	232	4.75 %	28	3.75 %	204	4.93 %
16	Baron and Kenny (1986)	230	4.71 %	16	2.14 %	214	5.17 %
17	*Chen, Lai and Wen (2006)*	230	4.71 %	14	1.88 %	216	5.21 %
18	*Christmann (2000)*	221	4.52 %	58	7.77 %	163	3.94 %
19	*Ambec and Lanoie (2008)*	219	4.48 %	14	1.88 %	205	4.95 %
20	Aragón-Correa and Sharma (2003)	214	4.38 %	31	4.16 %	183	4.42 %
21	*Klassen and McLaughlin (1996)*	213	4.36 %	58	7.77 %	155	3.74 %
22	*Buysse and Verbeke (2003)*	208	4.26 %	35	4.69 %	173	4.18 %
23	*Griskevicius, Tybur and Van den Bergh (2010)*	207	4.23 %	2	0.27 %	205	4.95 %
24	*Rao and Holt (2005)*	197	4.03 %	25	3.35 %	172	4.15 %
25	Podsakoff and Organ (1986)	184	3.76 %	16	2.14 %	168	4.06 %
26	Seuring and Müller (2008)	184	3.76 %	14	1.88 %	170	4.10 %
27	Srivastava (2007)	181	3.70 %	14	1.88 %	167	4.03 %
28	Vachon and Klassen (2008)	175	3.58 %	10	1.34 %	165	3.98 %
29	Chen (2008)	171	3.50 %	7	0.94 %	164	3.96 %
30	Bagozzi and Yi (1988)	178	3.64 %	9	1.21 %	169	4.08 %
31	*Hart and Ahuja (1996)*	165	3.38 %	29	3.89 %	136	3.28 %
32	*Sharma (2000)*	165	3.38 %	39	5.23 %	126	3.04 %
33	Laroche, Bergeron and Barbaro-Forleo (2001)	164	3.36 %	11	1.47 %	153	3.69 %
34	Hu and Bentler (1999)	163	3.33 %	4	0.54 %	159	3.84 %
35	*Henriques and Sadorsky (1999)*	159	3.25 %	54	7.24 %	105	2.54 %
36	Horbach (2008)	157	3.21 %	5	0.67 %	152	3.67 %
37	Orlitzky, Schmidt and Rynes (2003)	156	3.19 %	20	2.68 %	136	3.28 %
38	Rennings (2000)	154	3.15 %	8	1.07 %	146	3.52 %
39	Sarkis, Zhu and Lai (2011)	153	3.13 %	1	0.13 %	152	3.67 %
40	Henseler, Ringle and Sarstedt (2015)	152	3.11 %	0	0.00 %	152	3.67 %
41	Vachon and Klassen (2006)	151	3.09 %	18	2.41 %	133	3.21 %
42	Freeman (2010)	148	3.03 %	0	0.00 %	148	3.57 %
43	Hart and Dowell (2011)	147	3.01 %	0	0.00 %	147	3.55 %
44	Renwick, Redman and Maguire (2013)	142	2.91 %	0	0.00 %	142	3.43 %
45	Berrone et al. (2013)	139	2.84 %	0	0.00 %	139	3.36 %
46	Carter and Rogers (2008)	139	2.84 %	16	2.14 %	123	2.97 %
47	*Shrivastava (1995a)*	139	2.84 %	41	5.50 %	98	2.37 %
48	Nunnally (1978a)	160	3.27 %	21	2.82 %	139	3.36 %
49	Sarkis, González-Torre and, Adenso-Díaz (2010)	138	2.82 %	1	0.13 %	137	3.31 %
50	Teece, Pisano and Shuen (1997)	138	2.82 %	10	1.34 %	128	3.09 %

minimum number of two other source documents was set –owing to the fact that only research "fronts" made up of at least three source documents will be examined here in order to consider them exclusively at or above these thresholds. It is worth noting here that variations to these thresholds caused changes in the size of the network, even though its structure did not change to a significant extent, remaining practically invariable. This led to the final decision to utilize the previously mentioned values (tie strength ≥ 27; node degree ≥ 2) as parameters. The number of documents was thus reduced from the 4,142 initial papers and 252 whose bibliographic coupling values shape matrix $\mathbf{C(c_{ij})_{nxn}}$ to a much smaller number of documents.

FA, applied this time on the matrix $\mathbf{S(s_{ij})_{nxn}}$ of Pearson's r-correlation coefficients, i.e. on the matrix of similarities between documents–led to the extraction of 108 factors with an eigenvalue ≥ 1 through the implementation of principal component analysis and VARIMAX rotation. From these, only those factors comprising at least three of the different nodes (i.e. of the documents considered in SNA with factor loadings that have an absolute value ≥ 0.7) and eigenvalue ≥ 3 were selected. In the event that more than one factor should have to be loaded, the factor with the highest factor loading was selected. The reason for this choice was that it additionally implied eliminating all the other documents that did not significantly load in any of the extracted factors. Once again applying the parameters defined in the preceding analysis, the number of nodes represented in the network was fixed at 64 documents. Finally, with respect to the factors considered (19 in all), they accounted for 26.6 % of the total explained variance, drawing a correspondence with each of the active research "fronts" identified in our study [5].

Fig. 8 illustrates the layout of the BC 'network' comprising the 64 "citing" documents mentioned above. The color of each node in the network is indicative of the research "front" to which the "citing" document belongs –one or another of the 19 identified in the FA–, and the node diameters are scaled to their respective betweenness centrality degree.

For ease of understanding, the 'network' was visualized, as previously explained, in an aesthetically pleasant 'Force Atlas' layout. This is a classic *force-directed algorithm* that uses the properties of a graph to draw linked nodes closer and push unrelated nodes farther apart [6].

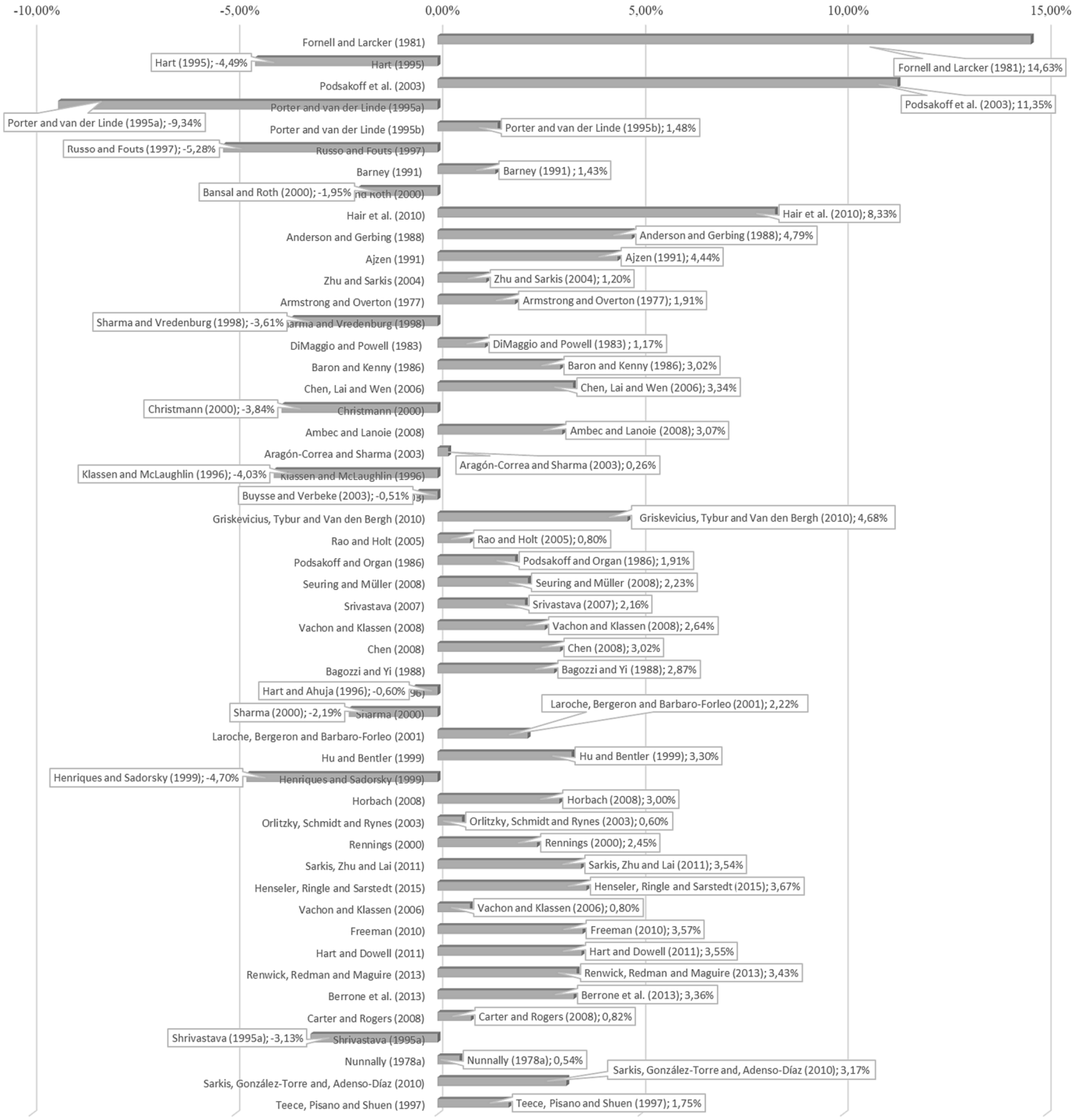

Fig. 5. Changes in citation percentages in order to reveal gains or losses in influence.

Table 9 reports the values of three different network centrality measures –*weighted degree, closeness centrality,* and *betweenness centrality*– obtained for several of the nodes shaping it. The calculation of the value of these measures for such 'nodes' (the 'five' with greatest values) allowed us to complete our work from the perspective supplied by SNA.

In this study, the highest betweenness centrality degree –when the total amount of "citing" documents in the sub-set of data was considered (4,142 articles in all)– is attributable to the paper by Li et al. (2022): '*Environmental taxes, green subsidies, and cleaner production willingness: Evidence from China's publicly traded companies,*' –in this article, a quantitative study is carried out on the cleaner production willingness of enterprises by means of "textual analysis"– published in *Technological Forecasting and Social Change.*

The role of "intermediaries" that certain nodes can exert is very often related to either the fact that such nodes represent documents that deal with transversal issues common to several research fields or that they are documentary typologies such as literature reviews or represent documents written for a general purpose. These documents have particular value because they favor connectivity and cohesion in research undertaken within a discipline.

To conclude, the different research "fronts" at the forefront of knowledge that reveal the current, and even future, trends in the 'field' are shown in Table 10.

Obviously, all these fronts have as their "pillars" some of the

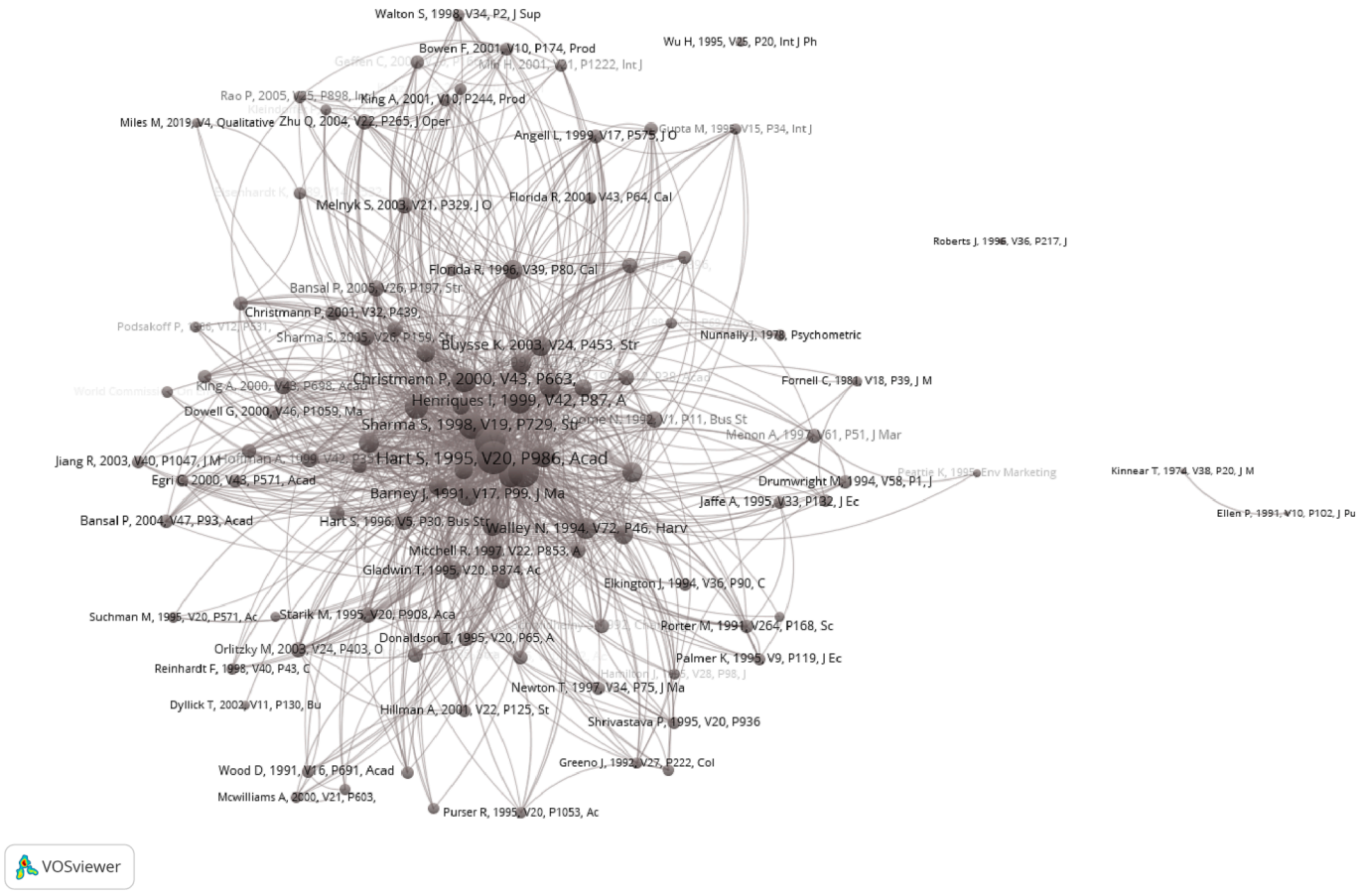

Fig. 6. Map of the intellectual structure of research for the first of the sub-periods in which the sample was divided: 1968–2011.

documents that are part of the intellectual structure of the research mapped for the second of the sub-periods analyzed.

By way of example, the first of the research "fronts" identified in our study (Table 10), brings together the papers by De Burgos-Jiménez et al. (2013), Trumpp et al. (2015), Wong et al. (2018), Endrikat (2016), Trumpp and Guenther (2017), Ben Lahouel et al. (2022), and Endrikat, Guenther and Hoppe (2014). All these papers deal in one way or another with the relationship between environmental performance and financial performance. Drawing on a hybrid theoretical framework (combining the theoretical reasoning of the natural-resource-based view (NRBV) with instrumental stakeholder and slack resources arguments), authors such as Endrikat, Guenther and Hoppe (2014) address the apparent lack of consensus –despite the tremendous number of publications concerned with this relationship, inconsistent empirical findings persist and the overall picture remains vague– by *meta*-analytically integrating the findings of 149 studies.

Another of the identified research "fronts" was related to promoting green behavior through 'ethical leadership.' The works by Ahmad et al. (2021) and Islam et al., (2021a,2021b) integrate this research "front." The first of these papers examines the mediating role of green human resource management (GHRM) between ethical leadership and employees' citizenship behavior towards the environment with the moderating effect of individual green values.

As far as the rest of research "fronts" are concerned and, with the intention of not extending the analysis further by describing all 'nineteen' identified in this study, Table 10 includes a series of descriptors for each of these fronts.

4. Conclusions, limitations, implications, and future research

This study is among the works that have as their main purpose to identify, visualize, and characterize –within a certain timespan– the research developed in a scientific discipline, disciplinary area or field by using bibliometric methods.

For this research, we chose bibliometric analysis over other traditional methods like systematic literature review (SLR) –an important point to take into consideration is that SLR, like any other type of review, very often involves practices and interpretivist procedures that may not be objective (Pahlevan-Sharif et al., 2019)– as bibliometric techniques are replicable, transparent, objective, unbiased, and rigorous, and thus superior to other techniques for conducting literature reviews (García-Lillo et al., 2023; Gupta et al., 2021; White and Borgholthaus, 2022; among others). Well-conducted bibliometric studies may considerably objectively improve–findings from bibliographic studies are inherently objective and quantitative in composition (Tiberius et al., 2020)– the knowledge of a field or research domain by allowing and empowering scholars to gain a holistic perspective, identifying research gaps, and conducting critical assessments of contextualized research issues (Aparicio et al., 2019; Arora and Chakraborty, 2021; Jain et al., 2022; Leung et al., 2017; among others). Scholars have previously acknowledged that bibliometrics is a highly effective approach due to its ability to succinctly, efficiently, and objectively summarize the knowledge available on a particular research topic (Khanra et al., 2021a, 2021b; Tandon et al., 2021). In fact, bibliometric methods are ideal for mapping the intellectual structure of a given field because doing so enables scholars to recognize "'what', 'where', and 'by whom' established the field" (Dharmani et al., 2021, p. 253). Moreover, because bibliometric studies avoid subjectivity, they enhance and extend qualitative reviews by converting the descriptive information about an article (e.g. authors, keywords, references, journals, institutions) into networked maps, clusters, and nodes that can be leveraged for further systematic analyses (Waltman et al., 2010).

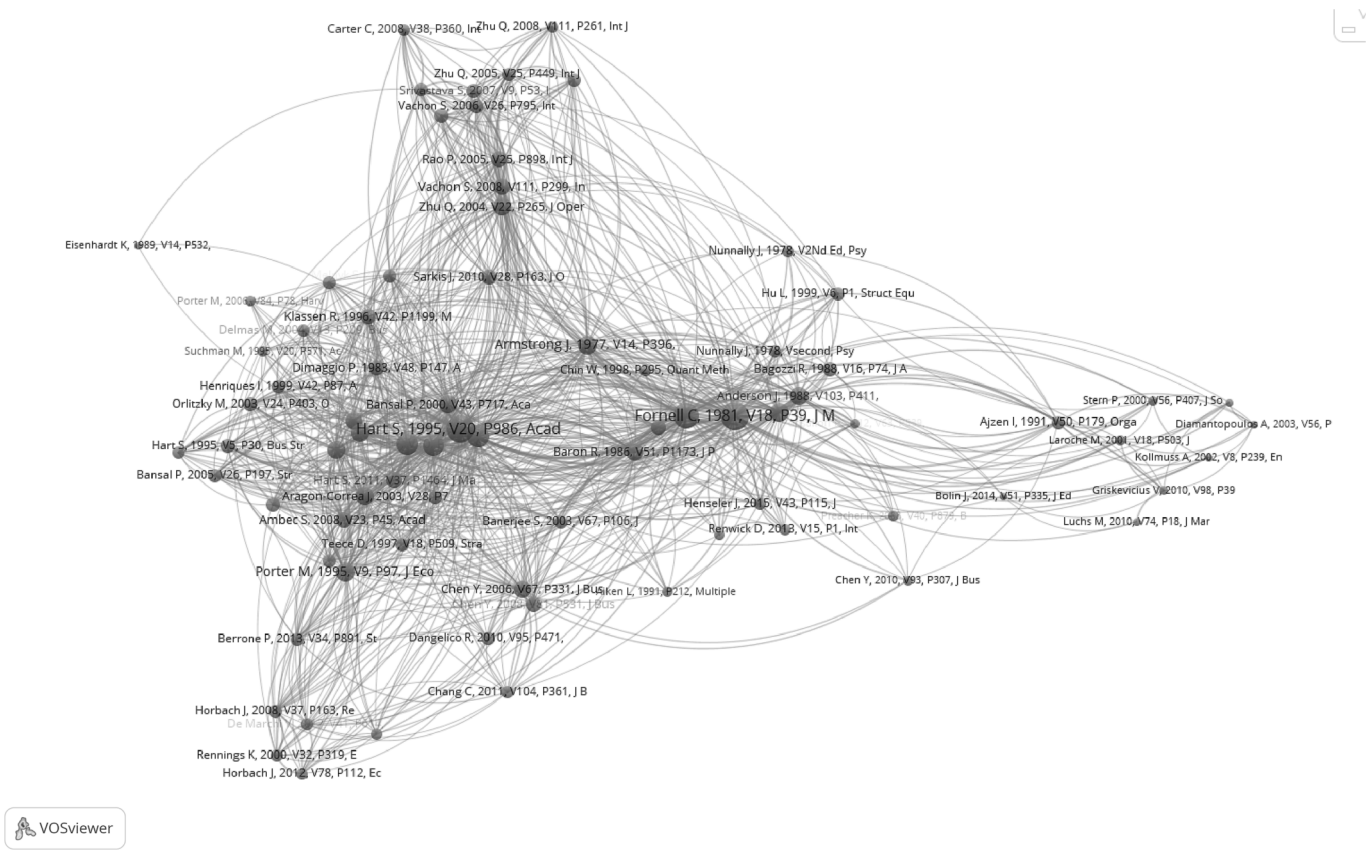

Fig. 7. Map of the intellectual structure of research for the second of the sub-periods in which the sample was divided: 2012–2022.

In relation to the above, by describing the changes in the intellectual structure of research on 'green' over time using bibliometric methods, our work contributes to the field in different ways. By supplementing and expanding the results of previous studies, our findings contribute to the theoretical advancement of research by providing a comprehensive assessment of its evolution, and by identifying the classics of the field. Particularly, our findings point toward two important achievements: first, the progressive maturation of this separate field or disciplinary area into the disciplines of management and business and how some topics are parceled out in ever finer grained topics.; and second, the attestation that more empirical research is now taking place.

Drawing insights from these findings and beyond, this study also provides some suggestions as well as highlighting implications and directions for future research. However, since our manuscript is not exempt from limitations, we have considered it appropriate to first enumerate such limitations.

4.1. Limitations

As with all research, this study comes with several limitations, some of which are a consequence of the design of the research itself –e.g. in this study only "peer-reviewed scholarly journal articles" were collected to retrieve the bibliometric references to carry out this study and it could be criticized–, while others are a direct result of using bibliometric methods such as BCA and co-citation analysis, i.e. due to the intrinsic drawbacks of bibliometric methods. As regards this last kind of analysis: first, especially in the early stages of a discipline, citations might be driven by particularistic rather than universalistic criteria (Boyd et al., 2005), and might not always reflect transfer of knowledge or intellectual indebtedness but be driven by opportunistic considerations (Baumgartner and Pieters, 2003). For example, factors like interpersonal relationships (Pasadeos et al., 1998) and institutional prestige of the affiliation (Crane, 1967; Pfeffer et al., 1977; Rodgers and Maranto, 1989) have been found to positively influence citation patterns. A common criticism of bibliometric studies points to the fact that relying exclusively on citations does not distinguish the motives for which citations are made. The consequent risk would be that drawing the intellectual structure of a field only on the basis of citations could provide a biased overview of a discipline, especially of its early stages.

Co-citation analysis has some other limitations, which should be considered when interpreting bibliometric maps. For example, for clarity reasons this technique of analysis only allows maps to include a small portion of the documents cited (Ramos-Rodríguez and Ruíz-Navarro, 2004; Calabretta, Durisin and Ogliengo, 2011; among others). Additionally, maps give higher prominence to works that have been highly co-cited with other works, and less prominence to works that might have received more individual citations, but are not frequently co-cited with other works. Thus, the interpretation of the maps inevitably presents a certain degree of subjectivity. However, this bias can be progressively reduced, as highlighted by Calabretta, Durisin and Ogliengo (2011), by making these maps a starting point for a discussion within the field, where their interpretation is supplemented by other experts' perspectives and analytical tools.

Despite these limitations, we consider our bibliometric study of influential works, authors, and co-citation patterns provides relevant evidence for the maturation process of green research. One of the main contributions of this study is that it offers a quantitative analysis of the changes that have taken place in the intellectual structure of this research over time to supplement (but not substitute) traditional qualitative methods for reviewing the literature. Bibliometric analysis is particularly useful for identifying influential works in a discipline and establishing links among them. Thus, researchers can use our findings as an overview of the relevant literature on 'green' in the disciplines of management and business as determined by its authors in their citation

Table 7
Results of the application of hierarchical clustering analysis (I).

Cluster 1	Russo and Fouts (1997) Sharma and Vredenburg (1998)Christmann (2000)Henriques and Sadorsky (1999)Aragón-Correa (1998)Rugman and Verbeke (1998) Hart (1995)Barney (1991)Porter and van der Linde (1995a) Klassen and McLaughlin (1996)Shrivastava (1995a)Klassen and Whybark (1999)Judge and Douglas (1998)Hart and Ahuja (1996)Hunt and Auster (1990)Roome (1992)Berry and Rondinelli (1998)Azzone and Bertelè (1994)Maxwell et al. (1997)Henriques and Sadorsky (1996)Shrivastava (1995)Jennings and Zandbergen (1995)Buysse and Verbeke (2003)Sharma and Henriques (2005) Bansal (2005)	Hoffman (1999) Delmas and Toffel (2004) Bansal and Roth (2000)Sharma (2000) Aragón-Correa and Sharma (2003) Schmidheiny (1992)Shrivastava (1995)Newton and Harte (1997)Walley and Whitehead (1994)Porter and van der Linde (1995)Nehrt (1996)Hart (1997) Wernerfelt (1984) Elkington (1994)Orlitzky, Schmidt and Rynes (2003)Reinhardt (1998)Hamilton (1995) Freeman (1984) Mitchell, Agle and Wood (1997)Clarkson (1995)Fineman and Clarke K (1996)Donaldson and Preston (1995)Greeno and Robinson (1992)Banerjee (2002)Nunnally (1978a)	Armstrong and Overton (1977) Bansal and Clelland (2004)Jiang and Bansal (2003)King and Lenox (2000)Christmann and Taylor (2001)Dowell, Hart and Yeung (2000) Podsakoff and Organ (1986)King and Lenox (2002)Gladwin, Kennelly and Krause (1995)Starik and Rands (1995)Suchman (1995)Egri and Herman (2000)Andersson and Bateman (2000) Cordano and Frieze (2000)DiMaggio and Powell (1983) Handfield et al. (1997)Gupta (1995)Florida and Davison (2001)Florida (1996)Angell and Klassen (1999)Melnyk, Sroufe and Calantone (2003)Kitazawa and Sarkis J (2000)Min and Galle (2001)Wu and Dunn (1995)
Cluster 2	Palmer, Oates and Portney (1995)Jaffe (1995)Porter (1991)King and Lenox (2001a)Ullmann (1985)Porter (1980) Carroll (1979)	Wood (1991) Waddock and Graves (1997)Hillman and Keim (2001)McWilliams and Siegel (2000)Purser, Park and Montuori (1995)Shrivastava (1994)Dyllick and Hockerts (2002)	Fornell and Larcker (1981)Hair et al. (2006)Drumwright (1994)Menon and Menon (1997)Brundtland (1987)Peattie (1995)
Cluster 3	King and Lenox (2001b) Kleindorfer, Singhal and van Wassenhove (2005) Zhu and Sarkis (2004)	Geffen and Rothenberg (2000) Rao and Holt (2005) Bowen et al. (2001) Walton, Handfield and Melnyk (1998)	Eisenhardt (1989) Miles, Huberman and Saldaña (2019)
Cluster 4	Roberts (1996)		
Cluster 5	Ellen, Wiener and Cobb-Walgren (1991)Kinnear, Taylor and Ahmed (1974)		

choices. Particularly, influential publications and citation practices provide academic novices with an empirical basis to quickly become acquainted with the research in the field.

Table 8
Results of the application of hierarchical clustering analysis (II).

Cluster 1	Vachon and Klassen (2006) Sarkis, Zhu and Lai (2011) Zhu, Sarkis and Geng (2005) Rao and Holt (2005) Zhu, Sarkis and Lai (2008) Green et al. (2012)	Carter and Rogers (2008) Seuring and Müller (2008) Srivastava (2007) Zhu and Sarkis (2004) Vachon and Klassen (2008)
Cluster 2	Sarkis, González-Torre and, Adenso-Díaz (2010)	
Cluster 3	Ajzen (1991) Stern (2000) Laroche, Bergeron and Barbaro-Forleo (2001) Roberts (1996)	Kollmuss and Agyeman (2002) Griskevicius, Tybur and Van den Bergh (2010) Diamantopoulos et al. (2003) Luchs et al. (2010)
Cluster 4	Baron and Kenny (1986) Podsakoff and Organ (1986) Aiken and West (1991)	Armstrong and Overton (1977) Ramus and Steger (2000)
Cluster 5	Chen (2010) Bolin (2014) Anderson and Gerbing (1988) Hair et al. (2010) Bagozzi and Yi Y (1988) Nunnally (1978a) Hu and Bentler (1999) Preacher and Hayes (2008)	Henseler, Ringle and Sarstedt (2015) Podsakoff, MacKenzie and Podsakoff (2012) Fornell and Larcker (1981) Renwick, Redman and Maguire (2013) Podsakoff et al. (2003) Chin (1998) Nunnally (1978b)
Cluster 6	Hart and Ahuja (1996) King and Lenox (2002) Bansal (2005) Hart (1995) Hart and Dowell (2011) Porter and van der Linde (1995a) Aragón-Correa et al. (2008) Bansal and Roth (2000) Buysse and Verbeke (2003) Henriques and Sadorsky (1999) Russo and Fouts (1997) Christmann (2000) Sharma and Vredenburg (1998) Aragón-Correa and Sharma (2003)	Orlitzky, Schmidt and Rynes (2003) Sharma (2000) Ambec and Lanoie (2008) Freeman (2010) Porter and Kramer (2006) Klassen and McLaughlin (1996) DiMaggio and Powell (1983) Delmas and Toffel (2004) Suchman (1995) Barney (1991)Teece, Pisano and Shuen (1997)Wernerfelt (1984) Banerjee, Iyer and Kashyap (2003) Melnyk, Sroufe and Calantone (2003)
Cluster 7	Chen (2008) Chen, Lai and Wen (2006)	Chang (2011) Dangelico and Pujari (2010)
Cluster 8	Porter and van der Linde (1995b) Berrone et al. (2013)	Cohen and Levinthal (1990)
Cluster 9	Horbach (2008) Rennings (2000)	Horbach, Rammer and Rennings (2012) De Marchi (2012)
Cluster 10	Eisenhardt (1989)	

4.2. Practical and theoretical implications

As already mentioned, the findings of our manuscript have implications for both academics and practitioners: First, our study provides researchers with an overarching snapshot of the research on 'green' in the disciplines of management and business by determining its current scope and boundaries. Therefore, researchers can leverage our study's findings to gain a deeper understanding of the past, present, and future of this field in these disciplines. In pursuit of advancing the field, novice researchers can also exploit our findings to identify potential collaborators (key authors) and guiding forces (e.g., high-performing journals in this arena). This idea is suggested by Vedula and Agrawal (2023) in their work titled *Mapping Spiritual Leadership: A Bibliometric Analysis and Synthesis of Past Milestones and Future Research Agenda.* By identifying the most influential works, prominent authors, journals at the forefront of research, and above all, current research themes, this study represents in addition an opportunity for academics and practitioners to check the extent to which academic research is keeping pace with green issues

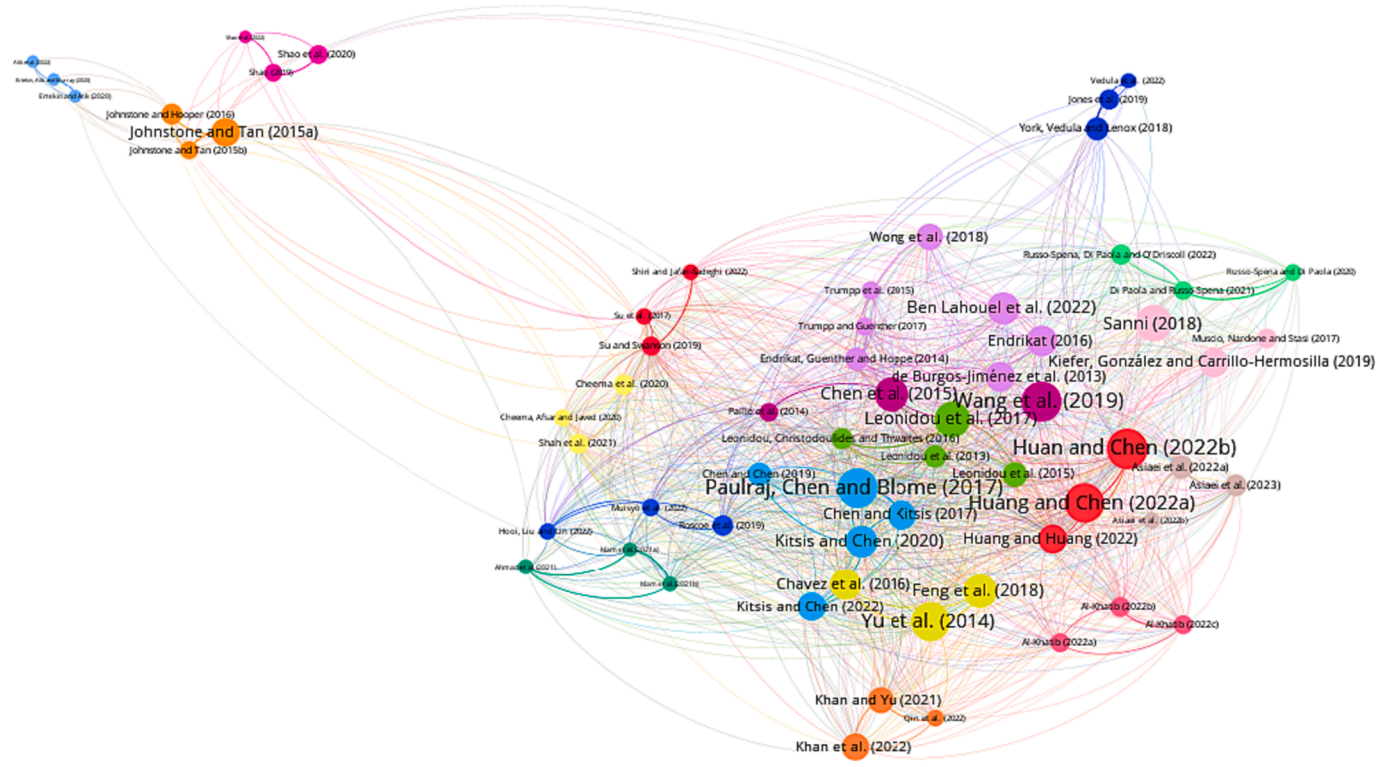

Fig. 8. Force Atlas layout of the bibliographic coupling network comprising the 64 "citing" documents included in the nineteen research "fronts" identified in our study.

Table 9
Network centrality measures –weighted degree, closeness centrality and betweenness centrality– calculated for some of the nodes of BC network.

Document	Centrality (weighted degree)	Document	Closeness (closeness centrality)	Document	Betweenness (betweenness centrality)
Leonidou et al. (2017)	7646.0	Huan and Chen (2022b)	0.670985	Huan and Chen (2022b)	10090.167978
Paulraj, Chen and Blome (2017)	6960.0	Paulraj, Chen and Blome (2017)	0.670428	Wang et al. (2019)	9789.581343
Huan and Chen (2022b)	6835.0	Huan and Chen (2022a)	0.668542	Paulraj, Chen and Blome (2017)	9700.652741
Chavez et al. (2016)	6613.0	Leonidou et al. (2017)	0.667769	Huan and Chen (2022a)	9637.206999
Feng et al. (2018)	6563.0	Yu et al. (2014)	0.663383	Yu et al. (2014)	9318.498517

indicated as relevant by managers and, of course, to identify new insights and research gaps in the field. Given the increasing business relevance of these issues, researchers should make the effort to address topics of interest to managers, and, for this, a deep knowledge of the field is required.

4.3. Future research

As far as future inquiry is concerned, a relevant avenue for future research could be to delve deeper into the analysis of key findings and major debates in each of the themes under the umbrella of any of the nineteen research "fronts" that, over a wider pool of specialized literature on green, emerge in this study. Some of the papers that are part of these different research "fronts" already propose an agenda for future research regarding certain (sub)fields or 'topics.' For example, based on their findings, in the paper entitled: *'Making sense of conflicting empirical findings: A meta-analytic review of the relationship between corporate environmental and financial performance,'* authors such as Endrikat, Guenther and Hoppe (2014) outline avenues for future research.

Notes

1. It is widely accepted that researchers tend to gather in "invisible colleges" –informal networks where common questions are examined with common frames (Price, 1963; Crane, 1972; Burt, 1977). The "invisible colleges" constitute the intellectual basis on which a discipline develops and are largely revealed by scientific articles' citations.
2. Henry Small and Irina Marshakova are credited for introducing co-citation analysis in 1973. Both researchers came up with the measure independently, although Marshakova gained less credit, likely because her work was published in Russian.
3. In practice, "confusion and controversy persist concerning the proper statistical analysis to be applied" (Leydesdorff and Vaughan, 2006, p. 1627). Ahlgren et al. (2003) provide arguments for using Salton's cosine instead of *Pearson's r* correlation coefficient, particularly if one aims at visualization of the structure of data as in the case of the SNA and MDS, whereas Bensman (2004) provide "evidence" regarding why one might nevertheless prefer *Pearson's r* correlation coefficient when the purpose of the study is a statistical analysis.
4. The use of r-Pearson as a measure of similarity rather than the raw co-citation frequency offers at least two advantages: (1) for any given pair of documents, Pearson's correlation coefficient serves as a

Table 10
Research "fronts" identified after the application of factor analysis upon Matrix **S.**

#01	De Burgos-Jiménez et al. (2013), Trumpp et al. (2015), Wong et al. (2018), Endrikat (2016), Trumpp and Guenther (2017), Ben Lahouel et al. (2022), and Endrikat, Guenther and Hoppe (2014)	*Papers dealing in one or another way with the relationship between corporate environmental performance and corporate financial performance* (e.g. *exploring U-shaped relationships, making sense of conflicting empirical findings, etc.).*
#02	Leonidou et al. (2013), Leonidou et al. (2017), Leonidou et al. (2015), and Leonidou, Christodoulides and Thwaites (2016)	*Eco-friendly orientation in SMEs: external determinants and financial outcomes; small firm green business strategy; Eco-based competitive advantage and performance.*
#03	Kitsis and Chen (2020), Chen and Chen (2019), Kitsis and Chen (2022), Chenand Kitsis (2017), and Paulraj, Chen and Blome (2017)	*Sustainable supply chain management practices: motives and performance outcomes.*
#04	Yu et al. (2014), Chavez et al. (2016), and Feng et al. (2018)	*Green supply chain management; GSCM and financial performance.*
#05	Johnstone and Hooper (2016), Johnstone and Tan (2015a), and Johnstone and Tan (2015b)	*Green consumption behavior; environmentally-conscious consumers.*
#06	Al-Khatib (2022a), Al-Khatib (2022b), and Al-Khatib (2022c)	*Big data analytics capabilities and GSCM: impact in green supply chain performance.*
#07	Ahmad et al. (2021), Islam et al. (2021a), and Islam et al. (2021b)	*Papers investigating how to promote green behavior through 'ethical leadership.'*
#08	Asiaei et al. (2022a), Asiaei et al. (2022b), and Asiaei et al. (2022c)	*Green intellectual capital:* e.g. *papers dealing with how green intellectual capital can boost performance.*
#09	Russo-Spena, Di Paola and O'Driscoll (2022), Di Paola and Russo-Spena (2021), and Russo-Spena and Di Paola (2020)	*Environmental innovation strategy.*
#10	Huang and Chen (2022a), Huang and Huang (2022), and Huang and Chen (2022b)	*Institutional pressure, firm's green resources and green product innovation.*
#11	Hooi, Liu and Lin (2022), Roscoe et al. (2019), and Muisyo et al. (2022)	*Green human resource management (GHRH); implications of GHRM on organizational citizenship behavior.*
#12	Kiefer, González and Carrillo-Hermosilla (2019), Muscio, Nardone and Stasi (2017), and Sanni (2018)	*Drivers and barriers of eco-innovation.*
#13	Wang et al. (2019), Paillé et al. (2014), and Chen et al. (2015)	*Peer-reviewed articles linking market orientation and environmental performance.*
#14	Cheema, Afsar and Javed (2020), Shah et al. (2021), and Cheema et al. (2020)	*Papers dealing with how employees' perceived corporate social responsibility affects employees' pro-environmental behavior.*
#15	Qin et al. (2022), Khan et al. (2022), and Khan and Yu (2021)	*Eco-environmental performance assessment; green practices in food supply chains; circular economy practices to improve organizational performance.*
#16	Vedula et al. (2022), Jones et al. (2019), and York, Vedula and Lenox (2018)	*Transition toward environmentally beneficial practices in some industries: impact of public policy, private actors, regional institutional logics.*
#17	Shao et al. (2022), Shao et al. (2020), and Shao (2019)	*China: sustainable consumption, circular business models generation, consumers' purchasing behavior of environmentally friendly products, etc.*
#18	Shiri and Jafari-Sadeghi (2022), Su et al. (2017), and Su and Swanson (2019)	*Perceived Corporate Social Responsibility (CSR) and green behavior.*
#19	Ertekin and Atik (2020), Atik et al. (2022), Ertekin, Atik and Murray (2020)	*Papers dealing with the sustainability challenges of fashion industry.*

measure, not of the frequency with which the two were cited (raw citation frequency), but of the degree of similarity between their co-citation profiles and those of the rest of the works considered: two works that are always co-cited along with a third, but rarely with any others, will have strong positive correlation and can be said to be considered by the citing population to have some relationship or similarity to one another. Secondly, the correlation coefficient also overcomes differences of scale between a document that is very frequently cited and other very similar ones less frequently cited, because this fact would limit their possibility of being co-cited (Kerlinger, 1973; White and McCain, 1998).

5. Even though it can be stated that the various research "fronts" identified in this study reflect and collect a significant part of the research developed during the period under examination, other possible "fronts" might not have been identified. It is necessary to take into consideration that a minimum coupling threshold between each pair of "citing" documents was required, as well as a minimum number of two other documents (tie strength ≥ 27; node degree ≥ 2).
6. 'Force Atlas' is a *force-driven algorithm* and maybe the most recommended layout by developers in terms of simplicity and readability. The network is arranged in a way that linked edges attract and linked nodes repulse each other. It also allows for the manual adjustment of repulsion strength, gravity, speed, node size, and other characteristics (Bastian et al., 2009). With this algorithm, the most connected nodes move to the center of the network while the less connected nodes move to the borders.

CRediT authorship contribution statement

Francisco García-Lillo: Visualization, Software, Methodology, Formal analysis, Conceptualization, Investigation, Writing - original draft. **Pedro Seva-Larrosa:** Software, Methodology, Formal analysis, Conceptualization, Data curation, Supervision, Writing - review & editing. **Eduardo Sánchez-García:** Writing - review & editing.

Declaration of Competing Interest

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

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jbusres.2023.114432.

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Note: References in Tables and Figures are separately listed by alphabetical order in Appendix A.

Francisco García-Lillo (born 1970) received his PhD in Management in July 2002 at the University of Alicante, where he has been working since 1994. Since September 2021, he is Full Professor of strategic management at this university. His research interests include bibliometrics applied to different fields related to management (e.g., knowledge management). He has published articles in leading international journals such as *Journal of Business Research, Journal of Knowledge Management, Scientometrics, International Journal of Hospitality Management, International Journal of Contemporary Hospitality Management,* or *International Business Review,* among others.

Pedro Seva-Larrosa (born 1988) received his PhD in Management in 2019 at the University of Alicante, where he currently works. His research interests include SEM (Structural Equation Modelling) and other methodologies applied to different fields. He has published articles in leading refereed journals such as *Journal of Business Research, Regional Studies, Papers in Regional Science*, or *International Journal of Emerging Markets*.

Eduardo Sánchez-García received his PhD in Management in 2021 from the University of Alicante. His research interests are related to fields such as strategic and knowledge management. Eduardo is (co-)author of different journal papers and publications in international conference proceedings indexed by the Web of Science Core Collection.