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Systematic review of the literature on corporate sustainability performance measurement: a discussion of contributions and gaps

Revisão sistemática da literatura sobre medição de desempenho de sustentabilidade corporativa: uma discussão sobre contribuições e lacunas

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Abstract: The present study discusses the incorporation of the concept of corporate sustainability into the literature of performance measurement systems (PMS), resulting in the investigation of publications on sustainability PMS (SPMS). This study presents an overview of the literature on SPMS, synthesizing the main contributions and pointing out the main trends and gaps in this area of knowledge. The research method is based on a systematic review of the literature, combining bibliometrics and content analysis. The sample is composed of 406 scientific articles. This sample was analyzed quantitatively, with support of descriptive statistics, co-citation network and keywords network. The study shows that the number of publications on the topic surveyed has grown in recent years, but still remains scattered, with low connection between tribes. The study also shows that, despite being relatively consolidated, the literature on SPMS has not yet been exhausted towards addressing the challenges of SPMS. One of the research results shows that the SPMS literature can be divided into three categories according to its main focus: (1) the sustainability indicators themselves and their application in decision making; (2) the set of indicators as a system; and (3) the organizational context of the SPMS. Analyzing these categories, there is little evidence on the consequences of the SPMS implementation, as well as the fact that the literature is still unclear on how managers should consider the contingencies of SPMS, such as industry, company size, type of product or business model.

Keywords: Corporate sustainability; Performance measurement systems; Sustainability indicators; Sustainability performance; Bibliometric study; Content analysis; Literature review.

Resumo: *O presente estudo discute a incorporação do conceito de sustentabilidade corporativa à literatura de sistemas de mensuração de desempenho (SMD), resultando na investigação de publicações sobre SMD de sustentabilidade (SMDS). Este estudo apresenta uma visão geral da literatura sobre SMDS, sintetizando as principais contribuições e apontando as principais tendências e lacunas nessa área de conhecimento. O método de pesquisa baseou-se em uma revisão sistemática da literatura, combinando bibliometria e análise de conteúdo. A amostra é composta por 406 artigos científicos. Essa amostra foi analisada quantitativamente, com apoio de estatística descritiva, redes de cocitação e palavras-chave. O estudo mostra que o número de publicações sobre o tópico pesquisado tem crescido nos últimos anos, mas ainda permanece disperso, com baixa conexão entre "tribos". O estudo apresenta também que, apesar de ser relativamente consolidada, a literatura sobre SMD ainda não foi utilizada em sua totalidade para abordar os desafios dos SMDS. Um dos resultados da pesquisa mostra que a literatura de SMDS pode ser dividida em três categorias, de acordo com o seu foco principal: (1) os indicadores de sustentabilidade em si e sua aplicação na tomada de decisão; (2) o conjunto de indicadores como sistema; e (3) o contexto organizacional do SMDS. Analisando essas categorias, verifica-se que há poucas evidências sobre as consequências da implantação de SMD, bem como que a literatura ainda não é clara sobre como gestores devem considerar contingências dos SMDS tais como setor, tamanho da empresa, tipo de produto ou modelo de negócio.*

Palavras-chave: *Sustentabilidade corporativa; Sistemas de mensuração de desempenho; Indicadores de sustentabilidade; Desempenho de sustentabilidade; Estudo bibliométrico; Análise de conteúdo; Revisão da literatura.*

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1 Introduction

Authors argue that companies can only manage what they can measure (as in Cooper & Edgett, 2008; Ehrenfeld, 2008) and that "[…] you are what you measure" (Hauser & Katz, 1998, p. 516). In this sense, companies that claim to be sustainable should have a performance measurement system (PMS) capable of measuring sustainability performance. Thus, the focus of this article is the sustainability performance measurement system (SPMS), which can be defined as

> […] a system of indicators that provides a corporation with information needed to help in the short-and long-term management, controlling, planning, and performance of the economic, environmental, and social activities undertaken by the corporation (Searcy, 2012, p. 240).

SPMS can be seen as the integration of two main fields of knowledge: corporate sustainability and corporate PMS. In the intersection of these approaches, companies face the challenge of measuring sustainability in a systematic way, including economic, environmental and social indicators (Sikdar, 2003); of integrating SPMS into its business and operations; of disseminating its sustainability performance to its stakeholders.

It is important to note that the scope of this paper does not contemplate the measurement of sustainable development (SD) performance, but rather of corporate sustainability performance (CS). Although they are linked, these approaches are not identical. On the one hand, the SD indicators represent the quantification of the global (or region) situation (see more in Azar et al., 1996; Böhringer & Jochem, 2007; Singh et al., 2009), such as the Ecological Footprint, Index Human Development Index and City Development Index (Böhringer & Jochem, 2007). On the other hand, the performance indicator of SC measures the conditions of an organization, considering its impact (positive or negative) for global sustainable development. In some cases, the same indicator or framework can be used to simultaneously measure DS and SC, such as the Ecological Footprint (Holland, 2003). However, the former's intent is more related to policy making (though not restricted to), while the latter is focused on business management.

Thus, SPMS goes beyond the challenge of defining adequate sustainability indicators, since it has direct effects on business decisions and actions (Hauser & Katz, 1998). Therefore, a relevant challenge is to develop and deploy a SPMS capable of integrating financial, environmental and social indicators to assess corporate sustainability performance and support the company's contribution to SD. This leads to the need to develop and deploy a SPMS that enables the proper analysis of the company's stakeholders and corporate strategy (Perrini & Tencati, 2006). Lee & Saen (2012) highlights the growing number of environmental and sustainability reports, international regulations such as carbon emission reduction targets, and international standards and / or guidelines such as Social Accountability (with the SA8000 standard) and Dow Jones Sustainability Index (DJSI).

Despite these efforts, several gaps still persist and companies face the challenge of dealing with SPMS in practice. Most approaches are just suggestions and recommendations (Lee & Saen, 2012) and are more superficial than effective (Figge et al., 2002b). There is a lack of integration (Figge et al., 2002b), as financial and non-financial organizational processes are separable (Schneider & Meins, 2012) and companies do not know how to systematically measure sustainability (Briassoulis, 2001). Strategic maps and scorecards, which are the main approaches to the MDS literature, can help fill these gaps, such as lack of integration. SMDs assume a series of dynamic relationships between performance dimensions (Neely, 2005). Although studies on balanced scorecards (BSC) sustainability have been proposed (Epstein & Wisner, 2001; Figge et al., 2002a, b; Hahn & Wagner, 2001; Hubbard, 2009); These approaches are not always capable of integrating sustainability into their dimensions in order to promote CS.

The above mentioned research gaps suggest that the literature on SPMS is still not well established, pointing to a lack of integration with the PMS literature. This document provides an overview of the literature on SDMS, summarizing the main contributions and pointing out the main trends and gaps in this area of knowledge. The research method is based on a systematic review of the literature, combining bibliometric and content analysis methods. This study intends to contribute to the literature on performance measurement systems (SMD), incorporating corporate sustainability in this field of knowledge.

2 Initial concepts

This section describes the main research constructs: corporate sustainability and performance measurement systems. This initial conceptual discussion serves as the basis for a research, since an overlapping of these constructions is the object of the present study.

2.1 Corporate sustainability

Although several publications bring interesting debates about the concept of CS / SD (such as Bolis et al., 2014b; Hopwood et al., 2005; Lozano, 2008), the definition of these concepts is not yet completely clear (Glavič & Lukman, 2007; Lindsey, 2011) and the understanding of different authors may still be ambiguous (Glavič & Lukman, 2007). Although environmental concerns are vital to DS,

social and economic aspects of sustainability are also central, as indicated by the triple bottom line (TBL) concept (Elkington, 1997). Nevertheless, the literature points out that DS goes beyond TBL, arguing that SD depends on an axiological mindset (Bolis et al., 2014b). In this perspective, SD aims at the well-being of the whole society (WCED, 1987), taking into account not only the limits of nature, but also incorporating drivers based on collective values to decision making (Bolis et al., 2014b).

Applying the concept of SD in the corporate context, the term corporate sustainability (CS) emerges. It indicates the technological and financial capacity (Elkington, 1997) and the institutional role of companies (Labuschagne et al., 2005) to contribute to global sustainable development. In this sense, to enable corporate sustainability, SD logic must be incorporated into the business (Crittenden et al., 2011; Savitz & Weber, 2006), so that environmental and social objectives are derived from the business strategy itself (Figge et al., 2002a). Thus, investments in socio-environmental initiatives are no longer seen as only an additional cost to the company, but become an opportunity for innovation and enhance competitiveness (Crittenden et al., 2011; Porter & Kramer, 2006; Voltolini, 2011).

Companies should also be able to identify the various stakeholders, develop relationships and find solutions that are advantageous to both business and stakeholders (Savitz & Weber, 2006). This is consistent with stakeholder theory (Freeman, 1984; Mitchell et al., 1997), which can be applied to sustainability issues (Epstein & Widener, 2011; Peloza & Shang, 2011; Roberts, 1992). This is because the company's responsibility for its actions has become a requirement not only for investors and shareholders, but also for clients, politicians, the media, community groups, prosecutors, lawyers, environmentalists, public health organizations, etc. (Savitz & Weber, 2006).

2.2 Performance Meaurement Systems (PMS)

The literature on PMS has intensified since the 1990s and may be considered a relatively mature area of knowledge (Neely, 2005). A performance indicator can be seen as the metric used to quantify effectiveness and / or efficiency of an action (Neely et al., 1995). The PMS consists of three levels: performance indicators, the set of indicators as a system, and the relationship between the measurement system and its organizational context (Neely et al., 1995). Thus, PMS is not restricted to a list of indicators (Bititci et al., 2000), since it also encompasses the necessary infrastructure to collect, compose, classify, analyze, interpret and disseminate company data (Neely, 1998).

Over the years, the literature has presented a series of alternatives to address PMS, proposing various structures for understanding a set of indicators (Chart 1). In terms of complexity, frameworks have evolved beyond a list of financial indicators to include indicators of diverse dimensions, such as internal and external, financial and non-financial, customer and employee satisfaction, and others.

The literature also reinforces the need for alignment between corporate PMSs and the company's vision, strategy and resources (Azzone et al., 1991; Kaplan & Norton, 1993; Lynch & Cross, 1991; Neely et al., 2001), in order to establish a synergistic relationship between corporate PMS and business processes. To intensify and justify the resources needed to define performance indicators, collect data, and disseminate information across the enterprise, PMSs must be dynamic and capable of tracking the needs involved in corporate decisions (Bourne et al., 2000; Hauser & Katz, 1998; Kennerley & Neely, 2002; Lynch & Cross, 1991).

3 Research method

The research consists of a systematic review of the literature (SLR), identifying the main academic discussions about SPMS. With this, we seek to identify main authors, point out relevant publications, track trends over time and evidence literature gaps. Organized, transparent and replicable processes were used to perform the SLR, as indicated by the literature (Littell et al., 2008), and the research conducted in three stages: planning the review, conducting the review and disseminating the results (Tranfield et al., 2003). In the first stage, an exploratory general review of the literature was conducted focusing on the two main research constructs (corporate sustainability and PMS). This was necessary to build an initial knowledge base for planning the SLR on SPMS.

The second stage pointed out by Tranfield et al. (2003) represents the review itself, initiated with data collection. For this stage, an initial sample of articles on sustainability indicators was obtained by consulting the ISI Web of Knowledge (Web of Science) database in June 2013. This database was chosen because of its breadth and compatibility with Sitkis software, a bibliometric analysis tool. The following filters were used, considering that the terms presented in (i) to (iv) were searched in the title, keyword list, and article abstracts: (i) sustainability or "sustainable development" or "triple bottom line"; (ii) indicator* OR measure* OR metric* OR Index*; (iii) performance; (iv) corporate* OR firm* OR organization* OR compan * OR industr * OR business; (v) categories: Web of Science: Environmental Sciences OR Management OR Environmental Engineering OR Business OR Environmental Studies OR Economics OR Engineering Industrial; (vi) type of document.

Chart 1. Dimensions of PMS *frameworks*.

Framework	*Dimensions*	*Observations*
Keegan et al. (1989)	Combination between: (i) costs and non-costs indicators; e (ii) internal and external indicators	Criticized by lack of explicit relationship between indicators
Fitzgerald et al. (1991)	- Result indicators: financial performance and competitiveness - Determinant Indicators: quality, flexibility, resource use and innovation	The model seeks to address Keegan's et al. (1989) framework by tracing the relation between result and determinant indicators
Azzone et al. (1991)	Combination between: (i) internal/external configuration; (ii) Research & Development time / Operation time / Order fulfillment time	Prescriptive model, proposing indicators to companies with competitive strategy based on time
Modelo Du Pont	Tree diagram to decompose financial indicators	DuPont is known as founder of financial performance measurement
Brown (1996)	Types of indicators: Input, Process, Output, Outcome	Model is criticized by linearity of process representation
Performance pyramid of Lynch & Cross (1991)	Levels of the pyramid (from base to top): (i) quality, delivery, cycle time and disposal; (ii) customer satisfaction; (iii) flexibility and productivity; (iv) market and finance; (v) vision	As strength, the model present a hierarchical representation fo indicators, compatible to business process management. Model criticized by its difficulty to operationalize.
European Quality Management Foundation	Excellence business model: (i) means indicators; (ii) result indicators	Model criticized by its difficulty to operationalize.
Kaplan & Norton (1992)	*BSC - Balanced Scorecard* Perspectives: finances, clients, internal processes and innovation/learning	Model well-disseminated in practice.
Neely et al. (2001)	*Performance Prism* Dimensions: stakeholders satisfaction, stakeholders contributions, strategies, processes and competences	Model does not intend to be prescriptive, but rather a tool to influence management issues

Between each filter, Boolean logic analogous to "AND" was used, resulting in the various criteria to arrive at the sample of articles (from i to vi). The symbol (*) was fundamental to include any variation of the searched term, keeping the criteria sufficiently flexible to include, for example, not only the term "measure", but also variations of that term, such as "measure" "measured" and "measuring".

After the sample was defined, data synthesis was conducted. This is the most important step of the review, generating knowledge based on data collection and analysis (Crossan & Apaydin, 2010). Several methods can be applied in an SLR, such as bibliometric approach, meta-analysis and content analysis (Carvalho et al., 2013). The present study contemplates the methods of bibliometry and content analysis. Initially, the data were analyzed through descriptive statistics to obtain an overview of the articles in the sample. Co-citation and keyword networks were constructed using the Sitkis software to organize data (Schildt, 2002) and Ucinet software associated with NetDraw was employed to elaborate the diagrams (Borgatti et al., 2002). Then, the content analysis was conducted. In this stage, the literature was classified into three categories, according to the basic elements of a PMS: the indicator itself, the set of indicators and the organizational context of the indicator system (Neely et al., 1995). The content analysis also includes the most relevant references extracted from the Scopus and Google Scholar databases, complementing the initial ISI Web of Knowledge (Web of Science) sample. The last stage proposed by Tranfield et al. (2003) is the dissemination of results, represented by this article.

4 Results and discussions

This section presents the descriptive statistics of the articles in the sample, analysis of co-citation and keywords networks, and content analysis, including a discussion of the literature divided into three categories.

4.1 Sample demographics

As shown in Figure 1, the literature analyzed includes recent publications that have been accelerating in terms of the number of publications in recent years. This can be seen not only because of the increase in the total number of publications, but also because of the increase in the relative number of publications (proportion of articles on sustainability indicators in the universe of articles on indicators in general) (Figure 1). The journals with the highest number of papers in the sample (more than 10 articles) represent 39% of the sample. Their titles are: Journal of Cleaner Production (54 articles, 13.3% of the sample), Journal of Business Ethics (26 articles, 6.4%), Business Strategy and the Environment (15 articles, 3.7%), Ecological Economics (12 articles, 3%), Journal of Environmental Management (12 articles, 3%), and International Social Responsibility and Environmental Management (11 articles, 2.7%).

Analyzing the papers with the highest number of citations, the distribution of citations of these publications throughout the year is shown in Figure 2a. Note the relevance of the evolution of the number of citations from the studies of Rao & Holt (2005), and of Vachon & Klassen (2008), with increasing participation in the number of citations. Figure 2b points out the importance of the publications of Dowell et al. (2000), Rao & Holt (2005), and Vachon & Klassen (2008), with the highest number of citations per year. These studies examine the impact of green supply chain initiatives on the competitiveness of firms located in the United States (Dowell et al., 2000) and in Southeast Asia (Rao & Holt, 2005). Positive statistical correlation was found in both cases, justifying financial return on environmental investments. On the other hand, Vachon & Klassen (2008) discuss the impact of collaborative environmental activities on productive performance, including suppliers and customers.

In order to evaluate the evolution of the sustainability pillars in the sample, the articles were classified according to the presence of the terms econ* or finan*, environmt*, social* or societ* in their respective titles or summaries. The result is illustrated in Figure 3, which shows the predominance of articles addressing the environmental sustainability pillar (combined or not with another pillar) in at least 72% of the sample articles. On the other hand, the social pillar is the least represented (only 37% of the sample).

4.2 Network analysis

In this stage, two networks were built to assist in this systematic review of the literature on sustainability measurement. The first of these, the co-citation network, links the references used by the same article, with the present connections of Figure 4 indicating that co-citation occurred at least six times. In this network, the thicker lines indicate a higher frequency of co-occurrences compared to the thinner lines (Figure 4). This network allows to extend the number of articles analyzed in the bibliometric study, including the references used by the initial sample. As illustrated in Figure 4, the literature under review is based on references that can be grouped according to the following prevailing themes: management (tools and concepts to support organizations management), sustainability (including a more general view of CS and SD); and environmental, social and economic (with greater emphasis on each of the pillars of sustainability). The network shows a greater interaction between the economic and environmental pillars of sustainability, taking into account the significant overlap of these groups. It is interesting to note that the PMS literature only appears discretely in this network, represented by Kaplan & Norton (1996), focused on the Balanced Scorecard (BSC).

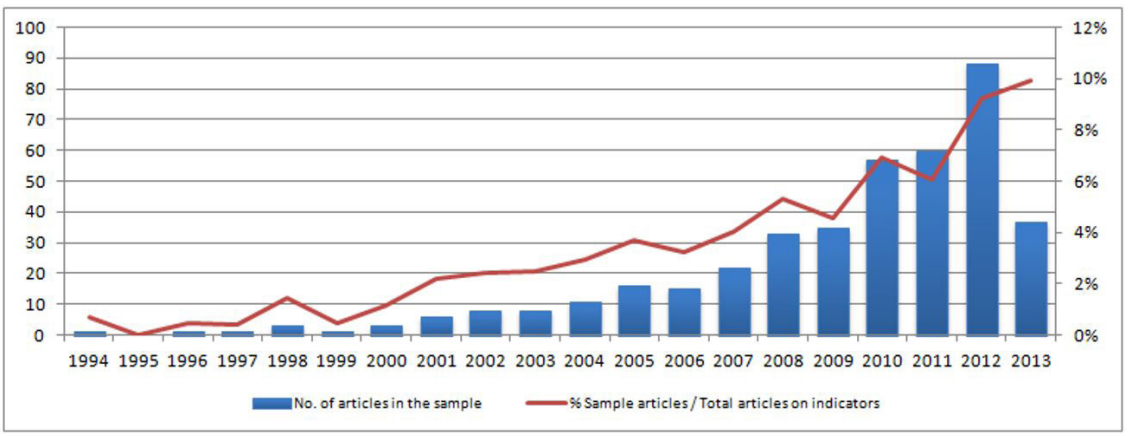

Figure 1. Annual evolution of paper sample.

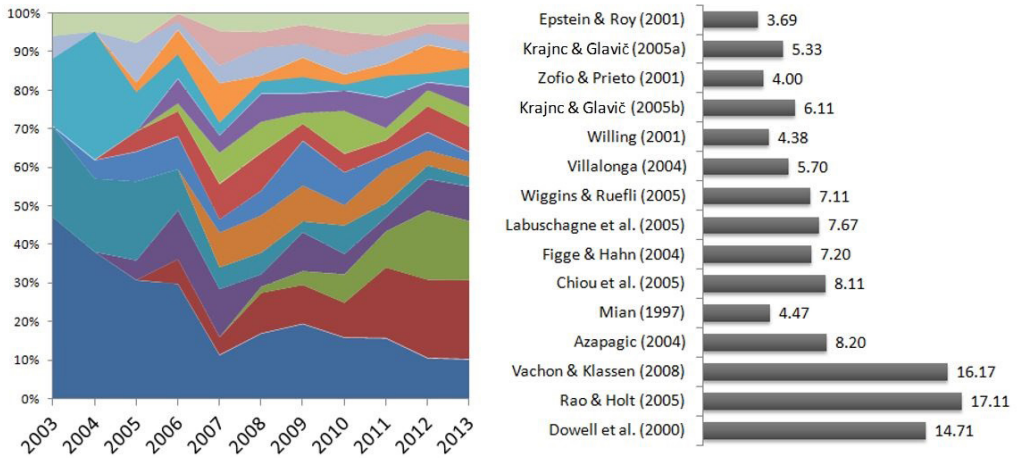

Figure 2. Most cited papers from the sample. Source: Epstein & Roy (2001), Krajnc & Glavič (2005a, b), Zofio & Prieto (2001), Willing (2001), Villalonga (2004), Wiggins & Ruefli (2005), Labuschagne et al. (2005), Figge & Hahn (2004), Chiou et al. (2005), Mian (1997), Azapagic (2004), Vachon & Klassen (2008), Rao & Holt (2005) and Dowell et al. (2000).

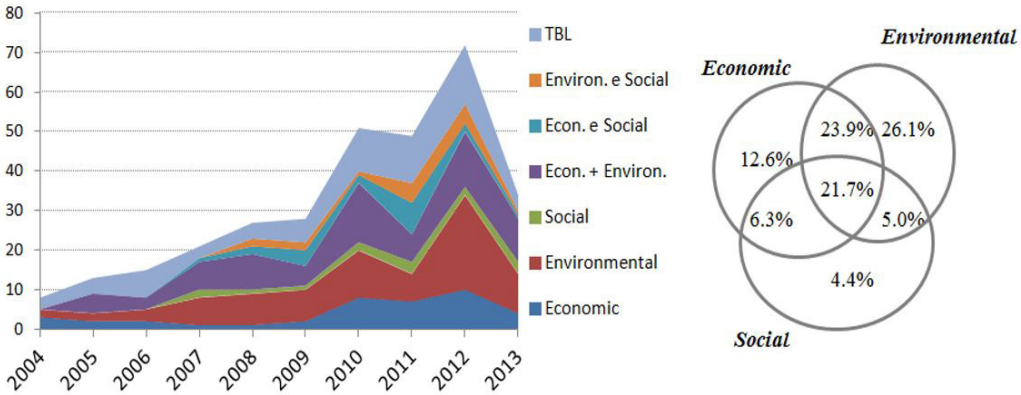

Figure 3. Distribution of papers per sustainability pillar.

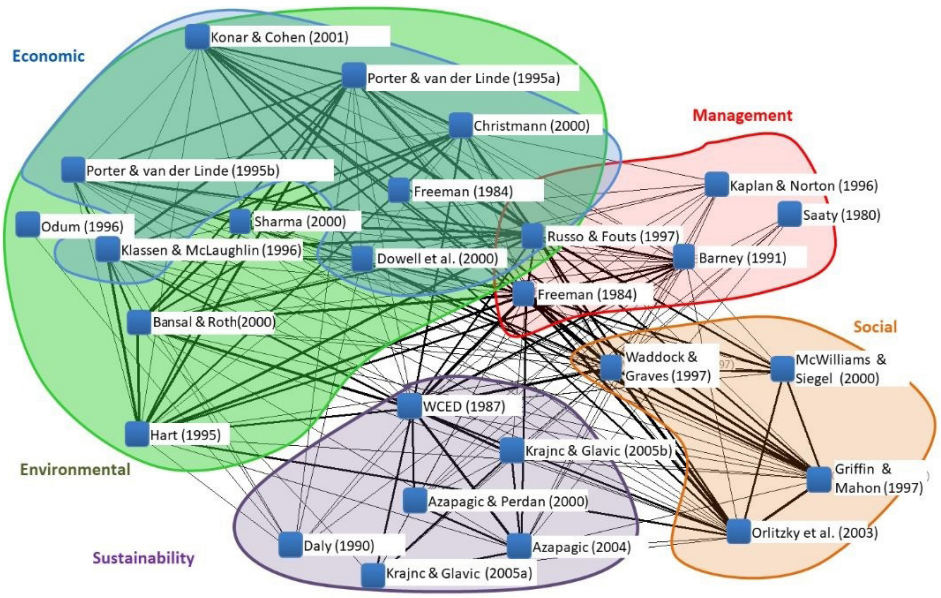

Figure 4. Co-citation network.

Chart A (Appendix A) lists the publications of the co-citation network and their indexes of centrality and intermediation, which indicate, respectively, the intensity of the link between the nodes of the network and the degree of connection between the clusters serving as a connection between tribes (Carvalho et al., 2013). The publications with the highest index of centrality address issues related to stakeholder theory (Freeman, 1984), the challenges of global SD (WCED, 1987), to the application of the resource-based view to assess the interaction between economic and social performance (Russo & Fouts, 1997), to the relationship between social and economic performance (Waddock & Graves, 1997) and to natural resource based view to contribute to competitive advantage (Hart, 1995).

Considering the main publications in terms of interrelationships (intermediation index), the publications of the World Commission on Environment and Development (WCED, 1987), Freeman (1984), and Waddock & Graves (1997), as well as contributions about operational SD principles (Daly, 1990) and on the resource-based view to sustain the firm's competitive advantage (Barney, 1991).

As for the keyword network, Chart B (Appendix B) lists the terms with the highest centrality indexes, such as framework, competitive advantage, environment, information and systems. The main focal points, which serve as a bridge between clusters are also framework and environment, as well as environmental performance, climate change and management. This highlights the discussion of models as well as the strong presence of environmental issues, which serve as evidence that the literature on environmental issues is more mature, since several aspects of these issues have already been discussed by the literature in a more comprehensive way. Figure 5 illustrates the keywords network, including keywords that were used at least by seven articles of the sample. It reveals five thematic groups: (1) environmental issues; (2) economic issues; (3) social issues; (4) dissemination of information; and (5) management / management tools.

The discussion of environmental issues seems to be more in-depth than social issues, since there is a greater diversity of related themes, such as Life Cycle Assessment (LCA), impact, efficiency, AHP (Analitic Hierarchy Process), technology and others (Figure 5). Figure 5 also shows that issues pertaining to the social question of sustainability are related to both financial performance and management / management tools. It is also worth noting that the network is denser (more nodes) on issues involving the dissemination of information on stakeholder discussions and investments. In the thematic group of management and management tools, it is observed the intense relationship between competitive advantage and resource-based view, highlighting the strategic importance of SPMS for the company.

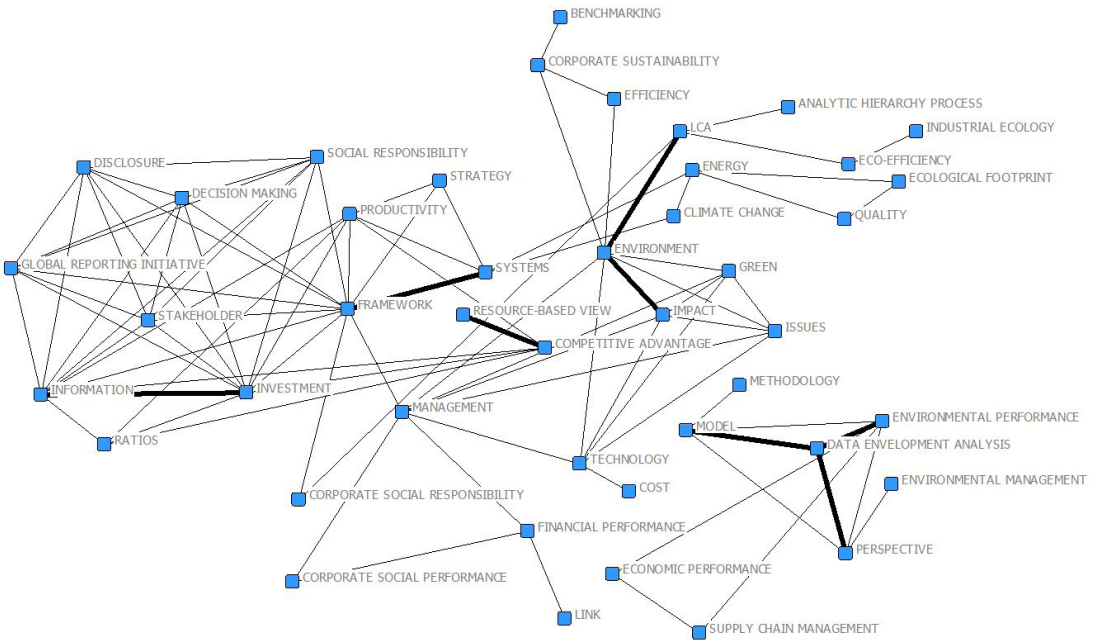

Figure 5. Keyword network.

4.3 Content analysis

Neely et al. (1995) indicate three different levels of PMS. Applied to CS, SPMS levels are: sustainability indicators (category 1), sustainability indicators system (as entity) (category 2) and organizational context of SPMS (category 3). Thus, the categories follow a logic from the specific (the indicators), following the relationship between these indicators and arriving at the more complex context of these systems. Aspects related to each of the categories are discussed below and summarized in Chart 2.

4.3.1 Category 1: sustainability indicators

The first category includes publications discussing sustainability indicators and their application in organizations, highlighting the objective of the indicators. Sustainability indicators and "traditional" corporate performance indicators are not distant concepts. Sustainability indicators carry the essence of "traditional" performance indicators in terms of strategic and operational implication (Kaplan & Norton, 1992), the potential to influence decisions and actions (Hauser & Katz, 1998), among others. In this sense, sustainability indicators represent efficiency and effectiveness of business operations, which is the role of performance indicators (Neely et al., 1995). At the same time, sustainability indicators also aim to support decisions, taking into account the positive or negative impact for the global SD.

Examples of sustainability performance indicators are water consumption, amount of waste produced, costs associated to environmental, health and safety compliance, and number of community-business partnerships (Veleva & Ellenbecker, 2001). CS can also be measured using sustainability stock indices to support investors' decision-making, such as the Dow Jones Sustainability Index (DJSI) and FTSE4Good (Székely & Knirsch, 2005). In addition, Holland (2003) proposes the application of a SD indicator, the ecological footprint, to assess corporate sustainability. Finally, the challenge is not only to find the appropriate indicators to measure financial, environmental and social performance, but also to develop indicators to assess the integration of the three pillars of sustainability (Moneva, Archel, & Correa, 2006; Székely & Knirsch, 2005).

Chart 2. Content analysis categories.

Main aspects		Example of references
Sustainability indicators	General discussion on sustainability indicators	Ethos (2012); Székely & Knirsch (2005); Van Dieren (1995); Veleva & Ellenbecker (2001)
	Application in cases	Aryee et al. (2003); Awaysheh & Klassen (2010); Azapagic & Perdan (2000); Dangelico & Pontrandolfo (2010); Hokkanen et al. (2000); Lewis & Harvey (2001); Ometto et al. (2007); Rahman & Post (2012); Sethi (2005); Walsh (2012); Zhang et al. (2009)
Performance system	Design of indicators with focus on sustainability pillars and based on strategic objectives	Ethos (2012); Global Report Initiative (GRI, 2006); Keeble et al. (2003)
	Priorization and choice of performance indicators	Chiou et al. (2005); Keeble et al. (2003); Meyar-Naimi & Vaez-Zadeh, (2012)
	Implementation and controle of performance systems	Castellani & Sala (2010); Ketola (2010); Porter (2008)
	Structuring and dissemination of sustainability indicators	Cormier & Magnan (2010); Ethos (2012); Global Report Initiative (GRI, 2006); Hahn & Kühnen (2013); Kaenzig et al. (2011); Tsang et al. (2009)
Organizational context	Sustainability and supplu chain	Awaysheh & Klassen (2010); Isaksson et al. (2010); Mollenkopf et al. (2010); Rao & Holt (2005); Vasileiou & Morris (2006); Yakovleva et al. (2012); Lee & Kim (2011)
	Environmental management and operations management	Jiménez & Lorente (2001)
	Internal stakeholders	García-López et al. (2011); Maletic et al. (2011); Callan & Thomas (2011); Eberlin & Tatum (2008); Lee & Kim (2011); Schneider & Meins (2012)

Veleva & Ellenbecker (2001) argue that a company that decides to deploy indicators to track its sustainable production is unlikely to have clear and definitive targets for measurements. Thus, the authors highlight the importance of knowledge management through organizational learning. The authors recommend the use of a partial and transient solution, allowing the organization, over time, to refine the best solution to their context (Veleva & Ellenbecker, 2001). This is in accordance with the guidelines of the dynamic performance measurement systems described by various authors to ensure that the indicators are consistent with the company's reality (Bourne et al., 2002; Hauser & Katz 1998; Kennerley & Neely, 2002; Lynch & Cross, 1991). The evolution of the SPMS through the accumulated knowledge is evidenced in the five levels proposed by Veleva & Ellenbecker (2001): (1) compliance indicators of a production facility; (2) indicators of material use and performance; (3) installation effect indicators; (4) supply chain and product life cycle indicators; and (5) sustainable systems indicators. This approach has similarities with the reactive-defensive-accommodative-proactive (RDAP) approach to evaluate the company's strategy towards its stakeholders, proposed by Clarkson (1995).

Sustainability indicators can serve a variety of purposes, such as evaluating suppliers (Awaysheh & Klassen, 2010), promoting public communication (Singh et al., 2009), educating the business and promoting organizational learning on sustainable production, supporting internal and external benchmarking, and to promote a tool to encourage stakeholder participation in decision-making (Veleva & Ellenbecker, 2001). Other studies have addressed the application of sustainability indicators, including the assessment of the renewable energy market (Walsh, 2012); the choice of alternatives for investment funds of socially responsible companies (Sethi, 2005); assessment of increased uncertainty due to the introduction of environmental factors and the change in strategy formulation and decision-making strategy (Lewis & Harvey, 2001); assessment of environmental impacts of mineral and precious metal mines for improvement initiatives (Aryee et al., 2003); environmental assessment of Chinese steel production 1998-2004 (Zhang et al., 2009); and critical analysis of social and environmental responsibility reports with an emphasis on governance, reliability and environmental performance criteria (Rahman & Post, 2012).

As one can see, Category 1 of content analysis shows several interesting ways to use corporate sustainability indicators in practice. The publications show, however, that sustainability indicators are not enough, since they must be associated with clear corporate sustainability goals and priorities.

4.3.2 Category 2: system of sustainability indicators

Several articles discuss the processes required to manage SPMS, describing specific steps or the process to support the design and maintenance of this system. Based on the papers from this category, a sequential flow of identified processes consists of (1) definition; (2) prioritization and selection; (3) implementation and control; and (4) structuring and dissemination of sustainability indicators. Regarding the definition of indicators, companies can use the sustainability indicators suggested by the Global Reporting Initiative (GRI) to prepare their sustainability reports. Although GRI indicators are widespread in organizations, there are other publications that offer suggestions for sustainability indicators, which can also be used by companies (Chatterji & Levine, 2006; Cuesta-González et al., 2006; Greenhalgh et al., 2010; Hillman & Keim, 2001; Maas & Liket, 2011; Ranganathan et al., 2000).

There are several recommendations for defining indicators, such as that measures should be SMART (specific, measurable, achievable, relevant, time-bound) (Lundberg et al., 2009), useful to users, and analytically sound (with reasonable grounds and consensus) (OECD, 1993). When defining indicators to support SD, organizations should be able to define the four dimensions of the indicators: unit of measure, type of measurement (absolute or relative), measurement period, and unit of analysis boundary (unit of production, department, company, etc.) (Veleva & Ellenbecker, 2001).

Once defined, the indicators can be classified according to the following examples of criteria:

- For general corporate performance indicators: leading (generators or drivers) and lagging (Kaplan & Norton, 1996); or pressure-state-response indicators (Lundberg et al., 2009);
- For environmental performance indicators: (1) direct: level of pollutant load, concentration of pollutant load, impact on the ecosystem, environmental recovery measures; or (2) indirect: technological, economic and organizational;
- For social performance indicators: Corporate Social Responsibility (CSR) indicators, mediation, intermediate results and final results (Peloza, 2009).

In relation to the prioritization of indicators, the literature indicates that they can be classified according to certain criteria that must be compatible with the goals and reality of each company (Porter, 2008). Some criteria and tools can be used in the prioritization of indicators such as the AHP to define the weights

of the indicators (Meyar-Naimi & Vaez-Zadeh, 2012) and multi-criteria analysis and their variations (Chiou et al., 2005). Keeble et al. (2003) suggest criteria for selecting the indicators that are best suited to represent an organization's sustainability pillars: (1) minimum criteria: measurable, verifiable and relevant to stakeholders; (2) prioritization criteria (classification criteria): prefer leading indicators to lagging; being under the control of those responsible; motivate those involved; be a practical measure, provide useful delay information, validated through competitive engagement and differentiation. A principle that supports the prioritization of the indicator is that of materiality, which can be represented by a matrix that relates the degree of relevance of a given sustainability theme to the internal interests of the organization with its relevance to external stakeholders (GRI, 2006).

In the SPMS implementation phase, Ketola (2010) indicate combining two logics: the evolutionary process (step by step) and the revolutionary process (single jump), resulting in a rapid jump-to-jump process towards the three sustainability pillars. An important factor to ensure the success of SPMS implementation is the involvement of different stakeholders in the formulation of indicators, thus increasing the system's adherence to the company's reality and needs (Castellani & Sala, 2010).

Adequate follow-up of sustainability indicators allows achieving data structuring and disclosure phase, generating sustainability reports of interest to internal and external stakeholders. Trends and opportunities in sustainability reports were systematically addressed by Hahn & Kühnen (2013), indicating potential future studies in regulation and governance, quality of reports and stakeholder perceptions. An important function of sustainability reporting is to reduce information asymmetry in the stock market, especially for technical environmental reports (Cormier & Magnan, 2010). Adequate disclosure of a company's sustainability performance can also influence consumer decision making (Meijer & Schuyt, 2005). Based on empirical evidence, the authors concluded that consumers are more willing to boycott companies with a poor reputation for social performance than to pay a little more for products from reputable companies. A critique of community investment reports is the predominant description of philanthropic practices, with little mention of measures of the positive and negative impacts of the company's day-to-day activities (Tsang et al., 2009). On the other hand, higher quality is found in environmental reports, which incorporates the product life cycle logic (Kaenzig et al., 2011), discussing impacts generated in the phases of raw material acquisition, production, use, post-treatment -use, recycling and disposal, that is, from cradle to grave (ABNT, 2008). Critically analyzing sustainability reports, Kolk (2004) points out that only a few "real" performance indicators are included in the disclosure of companies. However, the author sees increasing trend of "probability of execution", which represents the probability that the information content is actually deployed within the company.

It is also be noted that company size should be considered in reporting, since drivers for small firms may differ from those of large multinationals because of their have easier contact with the local community (Borga et al., 2009). In this context, in a study of sustainability reports and the Internet, Morhardt (2010) points out that small companies do not necessarily fall short of the quality of their reports. It is noteworthy that there are no published publications that address the internal dissemination of corporate sustainability performance, in the form of reports and discussion meetings. The literature on sustainability reporting is rich and is not the scope of the present paper to exhaust this approach (for further reading, see, for example, Burritt & Schaltegger, 2010; Lenzen et al., 2004; Yongvanich & Guthrie, 2006).

Regarding SPMS frameworks, Perrini & Tencati (2006) propose a sustainability reporting and evaluation system, composed by three modules: the sustainability reporting system (comprising annual report, social report, environmental report and set of integrated performance indicators); the integrated information system; and the main performance indicators of corporate sustainability. BSC approaches to sustainability emerge (Epstein & Wisner, 2001; Figge et al., 2002b). BSC for sustainability can be criticized for being too superficial (reduced number of indicators) and does not understand cause and effect trends and relationships (Hubbard, 2009). However, the author also argues the strengths of using BSC for sustainability due to its simplicity associated with ease of understanding and an interesting combination of financial and non-financial metrics (Hubbard, 2009).

4.3.3 Category 3: SPMS organizational context

The articles considered in this category address the organizational context of SPMS, e.g., they focus on integrating sustainability into business processes. One of the approaches is sustainable supply chain management, verifying environmental and social impacts on the various layers of the supply chain (Awaysheh & Klassen, 2010; Isaksson et al., 2010; Rao & Holt, 2005; Vasileiou & Morris, 2006). The literature on the measurement of sustainability in the supply chain is vast and the present research brings some interesting evidence, but it is not an attempt to exhaust the theme (further discussions in Schaltegger & Burritt, 2014). Mollenkopf et al. (2010) identify in their review of the literature on green, lean and global supply chains

that the main drivers for promoting sustainable supply chain management are cost reduction, the need for certifications (ISO 9000 and ISO 14000), and risk management. These authors also pointed out the difficulty of managers in measuring and assessing the perceived benefits of an environmentally friendly supply chain. Yakovleva et al. (2012) state that a benchmarking index of sustainable supply chains could help measure and improve sustainability performance, allowing stakeholders to assess and steer towards sustainable performance.

The article by Jiménez & Lorente (2001) is a theoretical and conceptual review that aims to discuss the problem of the intersection between environmental management and operations management. The authors state that managers and researchers should review the objectives of the operations in question considering cost, quality, time, service and also environmental performance. Thus, the economic and environmental pillar of sustainability is explicitly addressed in its research objective, and the authors included the social discussion intrinsic to the discipline of operations management.

Several authors have demonstrated the importance of considering internal stakeholders in the construction and execution of processes with socioenvironmental concepts (García-López et al., 2011; Maletic et al., 2011), as well as the relevance of managerial leadership focused on reinforcing strategic character of sustainable initiatives (Callan & Thomas, 2011; Eberlin & Tatum, 2008). Although still under-explored, the relationship between ergonomics (including work organization and psychodynamics) and corporate sustainability should not be overlooked (Bolis et al., 2014a). In their survey of 261 respondents, Eberlin & Tatum (2008) found that there is evidence of a correlation between decision making and leadership styles and perceived organizational justice of respondents.

On the issue of SPMS, different points of view must be taken into account, which may offer interesting insights for organizations (Epstein & Widener, 2011). Thus, it is interesting to involve customers, suppliers, government authorities and the community at large to ensure the success of sustainability strategies. According to the conceptual review of Mollenkopf et al. (2010), not only the stakeholders management, but also the company's DNA and a competent SPMS are relevant factors for the evolution of sustainability concepts in companies' reality.

Organizations should be able to enjoy the benefits of sustainable practices by incorporating market insight and customer needs in line with company strategy (Crittenden et al., 2011; Peloza & Shang, 2011). On the other hand, in their research on secondary data from published reports, Maas & Liket (2011) found that philanthropy is increasingly viewed as strategic. The authors propose three dimensions: society, business and reputation and stakeholder satisfaction. Porter & Kramer (2006) point out that companies that dedicate themselves to social initiatives should not consider this effort simply as a cost to the company, but as an opportunity for innovation and a gain resulting from competitiveness.

Due to the possible influence of sustainability indicators on business processes and corporate strategy, SPMS tends to serve as a basis for guiding the priorities of the sustainability pillars to be considered in the decision-making process. However, the analyzed literature reveals that the link between the business model and SPMS to translate corporate strategy into action is still not entirely clear.

5 Conclusions

This study contributes to the gap in the SPMS literature as the intersection between PMS and corporate sustainability. As Schneider & Meins (2012) suggest, there is still a lot of research opportunity in this area. This study indicates that the number of publications on SPMS has grown in recent years, but this body of knowledge still remains dispersed in different fields, with weak links between different research tribes.

Although the literature on SPMS is very incipient and growing at the same time, there are several interesting insights and gaps to be explored. Sustainability is about a multi-dimensional integration, e.g., it is necessary to promote the inclusion of social and environmental aspects to the "tradicional" economic goals, the integration of the multiple stakeholders' interests, and the conciliation of long-term decision making process, which is usually based on short-term decision motivations. These aspects indicate that there is no simple solution to measure corporate sustainability and the literature tends to drive towards practical recommendations for companies to be able to address sustainability challenges.

The literature offers several suggestions for sustainability indicators. However, SPMS is not limited to a list of indicators. Future studies still have potential to explore more how the indicators interact to each other (positive, negative or neutral correlations, cause or consequence relationships), once the research published on this so far is still controversial. The idea is not simply to collect secondary data and analyze it using statistical computational resources, but it is about complementing quantitative results with context-specific qualitative explanations. An in-depth understanding on the relationship between sustainability goals is a requirement to justify investments in initiatives aligned with SD.

Previous literature indicates that sustainability solutions is context-dependent (sector of the company, type of product, business model, etc.). This makes sense, since each corporate context is unique and has a specific expected dynamics. However, the

literature is still uncertain about how managers consider contingencies in their SPMS.

The literature also points out the importance of the integration between sustainability and business. Sustainability performance measurement systems need to be incorporated into operational, tactical and strategic levels, since sustainability is not responsibility of a specific department of the organization, but of all workers in their respective jobs. The challenge discussed in many publications focuses on how to integrate sustainability into the specific decisions to be taken, such as supplier selection or investment decisions. Even though these contributions aligned with TBL, with GRI indicators and with other frameworks represent an interesting start, they are still superficial and scattered.

Thus, there is a demand for more studies on the development, implementation and improvement of management tools that can converge towards consolidated and recognized solutions, in order to promote measurable results, integrating the logic of sustainability and business management. Major gaps still remain, since most studies are still limited to discussing a list of indicators. Future studies are needed to see how the reasons lead to the lack of more strategic and multidimensional SPMS. There is still little empirical evidence of the consequences of implementing a measurement system and its results over time.

Most of the literature analyzed tends to be focused on meeting the external demands or pressures of the external stakeholders of the companies, resulting mainly in discussion of sustainability information and impact on the company's financial performance. Thus, new research opportunities can be found in the exploration of SPMS as a tool to translate and implement a corporate strategy, to encourage strategic alignment and, finally, to promote as corporate competitive advantages in line with corporate sustainability. Future SPMS studies can be focused on consolidated management solutions for deploying tools to support the deployment of corporate sustainability across an organization. This was addressed by Gond et al. (2012), but literature still requires more empirical evidence to enrich this discussion.

This article is limited in terms of the applied research method, particularly with regard to the process of searching for the paper sample and choosing the filters to reach the sample of articles analyzed, since they can exclude important contributions in this area of knowledge. For the first steps of data analysis (descriptive statistics and network analysis), the paper analyzed a sample that was restricted to the ISI Web of Knowledge (Web of Science) database, given the limitation of the bibliometric software used. This limitation has been mitigated by including the main Scopus and Google Scholar publications in the content analysis. Given the broad significance of the terms associated with sustainability performance, specific discussions, such as accounting and reporting (Burritt & Schaltegger, 2010; Kolk, 2004; Schaltegger et al., 2013; Yongvanich & Guthrie, 2006). Carbon emissions and water consumption (Böhringer & Jochem, 2007) were not addressed in the present work. These scopes require focused efforts to consolidate a systematic review of the literature. In addition, the article merely discusses the performance measurement of a particular company, rather than addressing the sustainability performance of a particular supply chain or sector. Following the logic that in DS, no company is an island, future research also has strong potential in exploring the challenges of measuring the sustainability performance of a supply chain, such as a network of several interdependent actors.

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Appendix A. Articles from the co-citation network.
Chart A. Articles from the co-citation network.

Group	Author (year)	Centrality index	Leading index
Management (Strategy)	Freeman (1984)	35.897	6.603
Social and Economic	World Commission on Environment and Development (WCED, 1987)	33.013	10.588
Management (RBV), Environmental and Econ.	Russo & Fouts (1997)	32.051	0.232
Social and Economic	Waddock & Graves (1997)	28.526	2.950
Environmental	Hart (1995)	26.282	1.709
Environmental and Econ.	Porter & Van der Linde (1995a)	26.282	1.103
Social and Economic	Orlitzky et al. (2003)	25.000	2.389
Environmental	Bansal & Roth (2000)	23.077	1.691
Environmental and Econ.	Christmann (2000)	22.115	0.478
Environmental and Econ.	Klassen & McLaughlin (1996)	21.795	0.862
Social and Economic	Griffin & Mahon (1997)	20.513	1.405
Environmental	Sharma (2000)	17.949	0.478
Environmental and Econ.	Konar & Cohen (2001)	17.308	0.168
Environmental and Econ.	Dowell et al. (2000)	16.026	1.665
Environmental and Econ.	Porter & Van der Linde (1995b)	14.423	0.862
Social and Economic	McWilliams & Siegel (2000)	14.103	0.111
Management (Resource-Based View)	Barney (1991)	13.141	3.561
Sustainability	Azapagic (2004)	12.500	1.966
Sustainability	Krajnc & Glavič (2005a)	8.333	0.679
Sustainability	Krajnc & Glavič (2005b)	6.410	0.636
Sustainability	Azapagic & Perdan (2000)	5.128	0.584
Management (BSC)	Kaplan & Norton (1996)	4.167	0.563
Sustainability	Daly (1990)	4.167	8.356
Management (AHP)	Saaty (1980)	3.846	0.000
Environmental	Odum (1996)	0.641	0.000

Appendix B. Centrality and betweenes index for keywords.
Chart B. Centrality and betweenes index for keywords.

Keywords	Centrality index	Betweenes Index
Framework	5.73	6.49
Competitive Advantage	3.99	0.48
Environment	3.65	2.76
Information	2.95	0.72
Systems	2.95	1.72
Investment	2.95	0.72
LCA	2.78	1.39
Management	2.43	2.98
Productivity	2.08	0.78
Environmental Performance	2.08	6.44