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Corporate Sustainability Performance Measurement Systems: A Review and Research Agenda

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Abstract Corporate sustainability performance measurement systems (SPMS) have been the subject of a growing amount of research. However, there are many challenges and opportunities associated with the design, implementation, use, and evolution of these systems that have yet to be addressed. The purpose of this article is to identify future directions for research in the design, implementation, use, and evolution of corporate SPMS. A concise review of key literature published between 2000 and 2010 is presented. The literature review focuses on research conducted at the both the individual corporation- and sector-levels. The review of published literature provides a basis for the identification of a structured set of 65 key research questions to guide future work. The research questions will be of interest to both practitioners and researchers in corporate sustainability performance measurement.

Keywords Sustainable development · Indicators · Composite indicators · Performance measures · Metrics · Corporate sustainability

Introduction

There is a growing realization that corporations must address the issue of sustainability. However, there are ongoing debates regarding the meaning of sustainability in a corporate context and many definitions of corporate sustainability have been offered. For example, Dyllick and Hockerts (2002) have defined corporate sustainability as: "meeting the needs of the firm's direct and indirect stakeholders (such as shareholders, employees, clients, pressure groups, communities, etc.), without compromising its ability to meet future stakeholder needs as well." In another representative definition, van Marrewijk (2003) explained that corporate sustainability refers to "demonstrating the inclusion of social and environmental concerns in business operations and in interactions with stakeholders" (van Marrewijk 2003). Like many others, these definitions build on stakeholder theory (Freeman 1984), which is one of the most widely applied theoretical frameworks for research on corporate sustainability. Stakeholder theory implies that corporations have obligations to individuals and groups both inside and outside of the corporation, including shareholders, employees, customers, and the wider community.

Corporate motivations for engaging in sustainability have been the subject of much research. For example, research has been conducted on why corporations would behave in socially (Campbell 2007) or environmentally (Bansal and Roth 2000) friendly ways. The business case for corporate sustainability has also been extensively researched (see, for example, Salzmann et al. 2005; Weber 2008). The need to address stakeholder requirements is widely recognized in the research, but additional corporate motivations could include improved image and reputation, cost savings, improved employee motivation, improved competitiveness, and reduced risk, among others. While it is recognized that there is a need for additional evidence to support the motivations cited, many authors have moved from a focus on whether or not corporations should engage in sustainability to how it can be done in practice.

In an effort to address sustainability at the corporate level, many strategies, policies, projects, programs, and other initiatives have been proposed. For example, there is a growing body of research on corporate sustainability

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reporting (see, for example, Brown et al. 2009a), sustainability auditing (Nitkin and Brooks 1998), corporate codes of conduct (Bondy et al. 2008), and standardized systems for environmental and socially responsible management (Castka and Balzarova 2008). In many corporations, sustainability has its roots in addressing environmental or social issues. Research in these areas has in many cases provided a foundation for current research on corporate sustainability. Among the many relevant examples are the extensive amount of research on environmental reporting (see, for example, Jose and Lee 2007), environmental auditing (Maltby 1995), and corporate accountability (Brennan and Solomon 2008). In any case, governments generally provide relatively little guidance on the implementation of sustainability at the corporate level. The majority of these efforts are voluntary initiatives that represent forms of firm-, industry-, or business-level self-regulation. As Hemphill (1992) explains, self-regulation exists where a firm, an industry, or the wider business community "establishes its own standards of behavior where no such statutory and/or regulatory requirements exist" or when such standards "assist in complying with or exceeding pre-existing statutory and/or regulatory requirements". The key characteristics of self-regulation are that it is "voluntary and that it covers behavior that is discretionary" (Wotruba 1997). While there are widely recognized limits to self-regulation (see, for example, Maitland 1985), the motivations for self-regulation are fairly consistent with those for corporate sustainability, such as improved image, cost efficiency, risk management, and altruism. In fact, Maitland (1985) equated firm-level self-regulation directly with corporate social responsibility, a topic closely related to corporate sustainability (van Marrewijk 2003; Steurer et al. 2005).

Despite widespread efforts, many corporations have struggled to develop meaningful sustainability initiatives that are integrated with their mainstream activities. There are a number of reasons for this, but one major reason is that corporate sustainability is fundamentally a complex problem characterized by "pluralistic goals, ambiguity, uncertainty, emergence, and context dominance" (Searcy 2009a). Efforts to implement sustainability at the corporate level are further complicated by the fact that sustainability initiatives must be tailored to suit local circumstances (van Marrewijk 2003; Searcy 2009b; Steurer et al. 2005). However, in many corporations, people are simply not equipped to effectively pursue a commitment toward corporate sustainability. The reasons for this vary, but may include a lack of education and training, an inability to see how sustainability relates to other corporate initiatives, and a lack of authority, among other reasons.

There are a number of strategies corporations may employ to build the internal capacity needed to pursue a commitment toward corporate sustainability. These include developing a sound business case, building the principles of sustainability into existing goals and targets, and providing education and training opportunities, among others. In any case, a key component of any corporate sustainability initiative will be the development of a corporate sustainability performance measurement system (SPMS). The notion of corporate sustainability performance measurement has been discussed by Atkinson (2000), Beloff et al. (2004), Schwarz et al. (2002), Szekely and Knirsch (2005), and Tanzil and Beloff (2006), among others. The closely related areas of environmental (see, for example, Olsthoorn et al. 2001) and social (see, for example, Wood 2010) performance measurement have also been extensively discussed in the literature. Research on environmental performance measurement, for example, provides insight into measurement system development processes, indicator selection criteria, the use of data in measurement systems, the development of composite indices, and the role of measurement systems in corporate governance. This research has provided a strong starting point for research in the broader area of SPMSs.

There are many definitions of a performance measurement system. As Tangen (2005) explains, "a successful performance measurement system is a set of performance measures that provides a company with useful information that helps manage, control, plan, and perform the activities undertaken by the company." Given the general lack of government requirements for internal corporate performance measurement systems, they may be viewed as forms of self-regulation. A SPMS is distinguished from other performance measurement systems by its "need to measure the ability of a system to adapt to change and continue to function over a long time span" (adapted from Milman and Short 2008). By definition, a SPMS must also focus on issues relevant to sustainability. This is typically interpreted to mean that a corporate SPMS must address issues associated with the "triple bottom line" (Elkington 1998) of economic, environmental, and social performance. A SPMS is thus broader than a performance measurement system that limits its focus to environmental or social issues. Building on those points, one possible definition of a corporate SPMS is "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".

Over the past decade, dozens of articles on corporate SPMSs have been published in a wide variety of journals. A robust SPMS can help decision makers navigate the challenges of corporate sustainability by helping them to better understand their current situation and their desired end state. The majority of publications have focused on the

design of sets of corporate sustainable development indicators (SDI). A brief introduction to SDIs is provided by Spangenberg (2002, 2004). In a relatively limited number of publications, the individual SDIs have been combined to form a composite index. An introduction to composite indices is provided by Nardo et al. (2008). Research on indicators and indices has focused on both the individual corporation- and sector-level. However, despite many excellent contributions, many corporations have struggled to develop, implement, use, and improve SPMSs that address the needs of both their internal and external stakeholders. This is an important gap since a robust SPMS is needed for a corporation to assess how well it is doing in meeting its sustainability priorities. This, in turn, underscores the need for further research on the theoretical and practical aspects of corporate SPMSs.

The purpose of this article is to identify future research directions for the design, implementation, use, and evolution of corporate SPMSs. The remaining discussions are structured into three main sections. The current state of research on corporate SPMSs is briefly reviewed first. That discussion provides the basis for a section focused the critical research questions that must be addressed as a part of an integrated research agenda on corporate SPMSs. This article finishes with a conclusion and a summary of the implications for future research.

Current State of Research

This section concisely reviews the literature on corporate SPMSs. An overview of the approach employed in the research is provided in Fig. 1. As Fig. 1 highlights, a systematic review of literature was conducted to identify relevant contributions. Relevant publications were identified through a structured, iterative search strategy by selecting several keywords and incorporating other search terms as relevant articles were identified. The keywords (and variants) searched were: "sustainability", "sustainable development", "environment", "responsibility", "social", "indicators", "measures", "metrics", "performance measurement", "performance management", "index", "indices", "corporate", "business", "firm", "industry", and "organization". Major databases, including Springer Link, Wiley Interscience, Science Direct, Emerald Insight, Inderscience, Compendex, ABI Inform, JSTOR, Scholars Portal, EconLit, IEEE Explore, EBSCO, and Google Scholar, were searched using the keywords. The articles were screened based on the year of publication, language, and relevance. The focus was on articles published in English over the last 10 years (2000–2010). Focus was also devoted to research conducted at the individual corporation- and sector-levels. Papers focusing on corporate

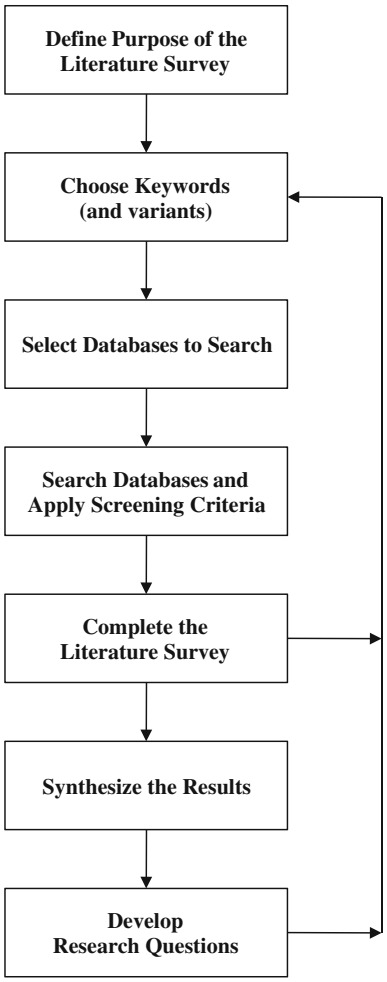

Fig. 1 Overview of research approach

sustainability performance measurement at the market-level (see, for example, Fowler and Hope 2007) or on the relationship between corporate sustainability and financial performance (see, for example, Lopez et al. 2007) were not included in the review. The search of the identified databases provided the basis for completing the literature survey. References cited were used as a secondary source to identify additional relevant publications. Following the completion of the search for relevant contributions, the results were synthesized. This provided the basis for the development of the research questions suggested in the "Future Research Directions" section of this article. As illustrated in Fig. 1, the development of the research questions was an iterative process.

With the above in mind, a snapshot of the literature on corporate SPMSs is presented below. The discussion focuses on identifying the key contributions and research gaps in the literature. The discussion is organized into three key sections: (1) design of a corporate SPMS, (2) implementation and use of a corporate SPMS, and (3) evolution

of a corporate SPMS. These three sections address the key phases in the development of any performance measurement system (adapted from Bourne et al. 2000). It should be emphasized that the phases are conceptual and there may be some overlap between them, but, collectively, they represent the phases through which any SPMS should progress (adapted from Bourne et al. 2000).

Design of a Corporate SPMS

Over the last decade, much of the focus in the literature has been devoted to the design aspects of a corporate SPMS. This is reflected in the literature focused at both the individual corporation-level and the sector-level.

Several publications have explored the process used to develop a SPMS in a corporate context. Searcy et al. (2005) presented a paper explicitly focused on the development of a six-step indicator design process to guide the development of a SPMS tailored to the needs of a particular corporation. Chee Tahir and Darton (2010) presented another generalizable model, "The Process Analysis Method", for selecting indicators to measure business sustainability performance. Specific aspects in the development of a SPMS have also been explored in greater detail, including the identification of priorities for action (Searcy et al. 2008) and the development of diagnostic frameworks to guide the process (Searcy 2009b). Building on research focused on the indicator design process, a number of sets of sustainability indicators have been developed for individual corporations. The most well-known set of corporate sustainability indicators are the 79 measures included in the Global Reporting Initiative's (GRI) G3 reporting guidelines (GRI 2006). The GRI guidelines have been voluntarily applied in over 1,000 companies worldwide (GRI 2010a). The GRI guidelines have been applied by corporations in numerous sectors, including automotive, chemicals, construction, energy, financial services, mining, real estate, and telecommunications, among others (GRI 2010a). Further details on the institutionalization (Brown et al. 2009a) and historical evolution (Brown et al. 2009b) of the GRI are available in the literature. However, despite its popularity, there are several publications that go beyond the indicators suggested by the GRI. These publications provide insight into the design of context-specific indicators, indicators targeted to different levels in a corporation, and the design of composite indices. For example, Keeble et al. (2003) presented two case studies on the development of corporate sustainability indicators. The first case study employed a five-step approach to establish nine indicators to help measure corporate-wide sustainability performance. The second case study focused on the development of 69 sustainability indicators applicable to the project-level. The case studies demonstrated the importance of encouraging debate within the organization on the indicators to employ, involving external stakeholders in the development of the indicators, and using existing standards as reference points (Keeble et al. 2003). Searcy et al. (2007) developed a system of 98 sustainability indicators for an electric utility. The indicators were organized according to a hierarchical approach linked to the case company's business planning process. The indicators were used to develop a composite index to provide an overall indication of the company's progress toward its sustainability goals and targets. Issues associated with the development of indicators relevant to supply chain management have been discussed by Clift (2003) and Hervani et al. (2005), among others. Through a review of several case studies, Clift (2003) highlighted the difficulty of developing indicators of social performance. Hervani et al. (2005) focused on performance measurement for green supply chain management and found that there is a need to further extend measurement of supply chain issues beyond the focal firm. A number of publications have specifically focused on a Balanced Scorecard approach to sustainability performance measurement (Dias-Sardinha and Reijnders 2005; Figge et al. 2002; Hubbard 2009; Schaltegger and Wagner 2006). In efforts to build on corporate Balanced Scorecards that are already in place, these papers typically focus on mimicking the broad approach employed by the Balanced Scorecard or on modifying or extending the Balanced Scorecard's four perspectives (i.e., financial, customer, internal process, and learning and growth) to incorporate sustainability. While much of the corporation-level research has focused on individual indicators, the development of a composite sustainable development index for corporations has been investigated by Krajnc and Glavic (2005a, b). Krajnc and Glavic employed a seven-step process for developing the composite index, including the use of the Analytic Hierarchy Process (AHP) to determine the weights of the indicators included in the index. In one paper, Krajnc and Glavic (2005a) presented a composite index for a diversified multinational corporation consisting of 6 economic, 22 environmental, and 10 social indicators. In the second paper, Krajnc and Glavic (2005b) compared two multinational oil companies on the basis of a composite index consisting of 4 economic, 6 environmental, and 4 social indicators. Finally, many of the listed publications discuss the development of indicator selection criteria, conceptual frameworks, and indicator design processes.

At the sector level, the GRI has developed supplements for several sectors that are in varying stages of development, including automotive, electric utilities, mining and metals, oil and gas, and telecommunications, among others (GRI 2010b). The supplements provide sector-specific guidance on the application of the core GRI guidelines, but also provide lists of new indicators. Several other

industry-specific sets of indicators have been published outside of the peer-reviewed literature. One prominent example is the Institution of Chemical Engineers' (IChemE) set of sustainability metrics for use in the process industry (IChemE 2003). The economic, environmental, and social indicators suggested by IChemE were accompanied with limited guidelines on their calculation. In the academic literature, there have been numerous contributions focused on the sector-level. Indicators of sustainable production have been developed by a number of authors. Veleva and Ellenbecker (2001) presented 22 core indicators accompanied by detailed guidance on their application. Building, in part, on the indicators suggested by Veleva and Ellenbecker (2001), Krajnc and Glavic (2003) focused primarily on environmental issues in suggesting 63 environmental, 16 economic, and 10 social indicators of sustainable production. Krajnc and Glavic (2003) were careful to caution that the suggested indicators "are not aimed at being uniformly applicable to all sectors". Fan et al. (2010) presented a list of 32 indicators organized around six key aspects: energy and material usage, emissions to the natural environment, economic performance, products, workers, and community development and social justice. Azapagic and Perdan (2000) presented a broadly applicable framework for industrial sustainable development consisting of over 30 indicators. The authors emphasized that specific indicators would need to be selected on a case-by-case basis. Staniskis and Arbaciauskas (2009) provided a number of illustrative indicators accompanied by recommendations on how sustainability indicators could be developed by industrial enterprises, including developing indicators suited to the unique circumstances of the company and building on existing management systems where possible. Staniskis and Arbaciauskas (2009) also noted that the "biggest shortcoming of many existing sustainability performance evaluation systems is their focus on external reporting and underestimation of internal information needs for decision-making, increased management effectiveness and actual performance improvement". Singh et al. (2007) developed a sustainability performance index for the steel industry. The index addressed all three areas of the triple bottom line along with two additional dimensions, organizational governance and technical aspects. AHP was used to determine the weights of the individual indicators in the index. The application of the index was demonstrated through a case study with steel company in India. Arena and Azzone (2010) provided another approach to selecting indicators for steel companies, emphasizing the need to develop indicators suited to different local settings. Based on a survey of European companies, Nordheim and Barrasso (2007) developed a preliminary set of 34 indicators for the aluminum industry. The authors noted that the indicators would be subject to ongoing refinement. In the energy sector there are several relevant initiatives. For example, La Rovere et al. (2010) used data envelopment analysis as an evaluation tool to develop a set of 3 economic, 5 environmental, 2 social, and 4 technological indicators to analyze the sustainability of the expansion of electricity generation. Limited discussions on the use of the suggested indicators to develop indices were also provided. Additional representative examples are provided by Diniz da Costa and Pagan (2006), who developed environmental indicators for coal power generation, and Al-Sharrah et al. (2010), who developed indicators for planning in the petrochemical industry. Azapagic (2004) has written a widely cited paper on SDIs for the mining industry. Azapagic adapted and extended the indicators proposed by the 2000 version of the GRI guidelines. Azapagic heavily emphasized the need to identify relevant stakeholders and to take their interests into account in the development of the indicators. A total of 24 economic, 63 environmental, and 45 social indicators were proposed. A number of integrated indicators that address two dimensions of sustainability were also provided as examples. Much has been written on the development of indicators for sustainable forest management (SFM), including Gough et al. (2008) and Wijewardana (2008). The literature highlights that several challenges remain on indicators for SFM, including further research on the use of the indicators, further development of social indicators, and improving linkages between research and practice, among other issues. Other representative papers at the sector level have focused on the development of indicators for the pharmaceutical industry (Veleva et al. 2003), the retailing sector (Erol et al. 2009), the detergent industry (Seuring et al. 2003), food production systems (Gerbens-Leenes et al. 2003), the food and beverage industry (Maxime et al. 2006), and airports (Upham and Mills 2005). These papers help further illustrate the wide-range of approaches used to develop sets of sustainability indicators for a given sector. The Sustainable Process Index (SPI) has been developed to assess the impacts of process industries, and has been applied in energy production systems (Narodoslawsky and Krotscheck 2004). Finally, several papers have also been published that focus on exploring the application of the Ecological Footprint to corporations (Barrett and Scott 2001; Holland 2003; Herva et al. 2008). These papers generally focus on exploring the merits of applying the Ecological Footprint to the company-level and/or on determining the amount of land necessary to support a company's operations.

While the published efforts have made many important contributions, they have yet to adequately address many important facets associated with the design of corporate SPMSs. The generic indicators developed by the GRI have been criticized on several grounds, including that they are

not a management tool, they are overly general, and there are too many indicators (Goel 2005; Smith and Lenssen 2009). A more detailed criticism of the GRI is provided in Moneva et al. (2006). Most of the existing efforts beyond the GRI are based on single case studies, and there are questions regarding the broad applicability of the approaches and results. The emphasis on single case studies underscores that a corporate SPMS must be designed, implemented, used, and updated based on the unique context in which the corporation operates. Further research is required on how corporations may either develop or tailor existing indicators and SPMS design processes to local circumstances. There is a need for empirical research investigating the relationship between the design process employed and the success of the implementation effort. There is also a need for additional research on the role of existing initiatives (adapted from Wouters and Sportel 2005) in the development of a corporate SPMS, the role of SPMSs in individual performance appraisal (Searcy 2009c), the number of indicators to include in a SPMS, and the differences in developing indicators for large, medium-sized, and small corporations. The role of political negotiation in science-oriented indicator development initiatives (Rametsteiner et al. 2011) is largely unexplored. This is a key gap since the political dimensions of creating indicators are rarely explicitly recognized despite the fact that they are essential in getting the indicators implemented and used (Rametsteiner et al. 2011). Although substantial research has been conducted on sustainability indices at the national level (see, for example, Bohringer and Jochem 2007), there have been relatively few efforts to design composite indices at the level of the individual corporation or sector. This may be due to a number of reasons, particularly the lack of publicly available corporate data needed to design an index. In cases where an index has been developed (Krajnc and Glavic 2005a, b; Searcy et al. 2007; Singh et al. 2007), they have lacked data or have employed linear aggregation techniques even though research suggests geometric aggregation techniques result in the minimum loss of information (Zhou et al. 2006). Moreover, correlation, sensitivity, and uncertainty analyses are rarely conducted on either indicators or indices. No detailed criteria have been developed to assess the methodological strength of the selected indicators and indices. Similarly, there is a lack of research on non-prescriptive criteria to guide trade-offs between conflicting sustainability objectives (adapted from Hahn et al. 2010). In the case of both indicators and indices, research has focused on short time horizons and little has been done to address cumulative impacts, a point highlighted by Lenzen et al. (2004). This is a particularly important oversight given the explicit long-term focus of sustainability. These issues underscore the need for additional research on the design of a corporate SPMS.

Implementation and Use of a Corporate SPMS

Beyond the design of a corporate SPMS, two key challenges are ensuring that it is integrated into mainstream business processes and that it is actually used as a part of corporate decision-making processes. While a limited number of existing studies provide some insight into the implementation and use of a corporate SPMS, research in this area is still in its embryonic stages.

Virtually all of the papers focused on the development of a corporate SPMS acknowledge the importance of implementing the system, but few provide specific details on how this may be done. One paper that is explicitly focused on the implementation of a corporate SPMS is Searcy et al. (2006). In the paper, the authors present a sustainability "indicator integration model" for a major Canadian electric utility. As Searcy et al. (2006) note, "the purpose of the model is to help structure thinking and discussion about the integration of the indicators" with existing business infrastructure at the company. The model is designed to mimic a feedback control system and is based on eight key elements: (1) stakeholder input (2) goals, (3) processes, (4) leadership, (5) resources, (6) results, (7) assessment, and (8) management review. Although it was developed in consultation with internal and external experts, the indicator integration model had not yet been applied in the case company. Moreover, given that the model was developed as a part of a single case study, Searcy et al. (2006) note that caution must be exercised in applying it to other contexts. The development of the indicator integration model drew heavily on the literature on integrated management systems (IMS). Building on the research on IMS, Jørgensen (2008), Oskarsson and von Malmborg (2005), and Rocha et al. (2007) also discuss the integration of sustainability into existing management systems. Although each of these authors highlight that IMSs can support corporate management of sustainability issues, they do not specifically discuss integrating SPMSs in detail.

The study of the actual use of corporate SPMSs is also gaining increased attention. A recent pilot study by the International Institute for Sustainable Development (IISD) explored the use of corporate sustainability indicators in three key areas: Board-level decision making, strategic management, and supply chain management (Searcy 2009c). Based on a review of corporate sustainability reports and interviews with 15 corporate experts, the study highlighted that relatively little is known about how sustainability indicators are used in practice. Palme and Tillman (2008) discussed the use of sustainability indicators in three Swedish water utilities. The study highlighted that the use of the indicators varied widely. In one utility, the indicators were well-established aides to monitoring, planning, and benchmarking, while in another utility there was relatively weak interest in the indicators.

As the authors noted, the utility that widely used the indicators had established an environmental management system (EMS) and sustainability targets. The utility that had weak interest had not established an EMS, did not have sustainability targets, and feared that the indicators would become an administrative burden. Adams and Frost (2008) discussed the use of sustainability indicators as they related to corporate sustainability reporting. In the paper, the authors explored the use of sustainability indicators in decision-making, planning, and performance management. The findings were based on interviews with experts at three Australian and four British companies. The paper indicated that the organizations were integrating environmental indicators into risk management decision-making, strategic planning, and performance measurement. Social indicators were also increasingly being integrated into those areas (Adams and Frost 2008). However, while insight into the many potential uses of indicators was provided, details were relatively scarce. Conceptual research by Hezri and Dovers (2006) and Gudmundsson (2003), provides additional insight on the potential use of sustainability indicators, such as their direct, conceptual, and symbolic use, though it is important to note that neither of these papers is specifically focused on use of a SPMS in corporations.

The existing literature underscores the need for additional research on the implementation and use of corporate SPMSs. While the need to successfully implement a SPMS is widely recognized, few studies explicitly focus on this critical issue. Additional longitudinal case studies and empirical research are required to investigate the factors affecting the success and failure of SPMS implementation. Questions remain on the extent to which data is reasonably available, how the data should be analyzed, the costs of implementing a SPMS, and the extent to which the published studies have contributed to improved sustainability performance in the corporations and sectors under study. Furthermore, although a limited number of studies have explored the use of corporate SPMSs, several gaps remain in this area, including exploring the role of a SPMS in corporate accountability, identifying the sustainability indicators that are particularly useful in management decision-making, linking indicators to clear goals and targets, and integrating SPMSs with sustainability reports (Searcy 2009c). These gaps highlight the lack of emphasis on the transitions between design of a corporate SPMS to the implementation and use of the system. If a SPMS is to be a meaningful component of a corporation's information system, these issues must be addressed.

Evolution of a Corporate SPMS

The evolution of a corporate SPMS has not been widely discussed in the literature. Guiding principles to measure and assess progress toward sustainability, such as the Bellagio Sustainability Assessment and Measurement Principles (IISD 2009; Becker 2004), are well-established. The Bellagio Principles highlight that sustainability assessments should be adequately scoped and should be based on a guiding vision, a conceptual framework, indicators, transparency, effective communication, broad participation, and capacity development (IISD 2009). However, these principles do not provide specific guidance on the evolution of a SPMS at the corporate level. Likewise, the broad topic of sustainability assessments has been the subject of much research, but there is little specifically focused on corporate SPMSs.

The importance of continuously improving a corporate SPMS is widely acknowledged (see, for example, Searcy et al. 2005; Staniskis and Arbaciauskas 2009), but there are relatively few publications that provide specific insight into how this might be accomplished. In a paper presenting the results of a case study on a Canadian electric utility, Searcy et al. (2006) presented a sustainability "indicator assessment model". The model was developed as a part of the "indicator integration model" discussed in the previous section and was based on the premise that "the feedback obtained from a regular assessment is necessary to drive both the improvement of the indicators themselves and the integration of the indicators" with existing business infrastructure (Searcy et al. 2006). As the authors note, "the continued relevance of the indicators must periodically be confirmed, obsolete measures should be deleted, and new indicators should be created to address" changing requirements (Searcy et al. 2006). Searcy et al. identified nine key steps to guide the evolution of a system of sustainability indicators: (1) confirm usefulness of indicators, (2) determine level of assessment, (3) conduct assessment, (4) evaluate findings, (5) communicate findings, (6) develop integration plan, (7) integrate findings, (8) monitor system, and (9) review and improve. The nine steps were linked to the plan-do-check-act cycle of continuous improvement. To further guide the assessment process, a number of questions to be asked during any review were suggested. Exploratory research on evaluating sustainability performance instruments has also been conducted by Ramos and Caeiro (2010). As the authors note, their approach "aims to evaluate how appropriate a set of sustainability indicators is and allow an evaluation of overall performance-monitoring activities and results" (Ramos and Caeiro 2010). To achieve this aim, Ramos and Caeiro developed a conceptual framework based on the concept of meta-evaluation. To support the framework, 12 key good-practice factors were suggested for performance of the sustainability indicator system and an additional 9 good-practice factors were suggested for the performance of the individual and aggregate indicators at the implementation

and operation/action stage. As the authors explain, the "key good-practice factors could be viewed as the basis for a checklist, providing aspects that an SDI initiative should be able to cover, though they must be adapted to each particular indicator system" (Ramos and Caeiro 2010). While Ramos and Caeiro (2010) note that the conceptual framework may be applicable to sustainability indicator systems at the local level, this was not explored in the paper.

While the guidelines suggested in the studies above provide a useful starting point, there is a need for considerable research on the evolution of corporate SPMSs. Empirical work on the evolution of corporate SPMSs that is supported by new longitudinal case studies that address the entire life-cycle of a SPMS are required. Research is needed to explore issues associated with the ongoing usefulness of a SPMS, how a SPMS adapts to changing corporate requirements over time, the key factors that enable or inhibit the evolution of a SPMS, and the process employed to guide updates to the system. Addressing these questions will help explicitly recognize that performance measurement is a dynamic, evolutionary process and that all corporate SPMSs must evolve over time. Given that much of the research on corporate SPMSs is static in orientation, action on these issues is urgently needed.

Future Research Directions

A summary of the key gaps in the published literature is provided in Table 1. It should be noted that the summary provided in Table 1 is illustrative, not exhaustive. Moreover, it is recognized that the gaps highlighted in Table 1 have been researched to varying degrees in the existing publications. However, there is a need for further research on all of the identified gaps. Overall, the literature review highlights the need for further research in the design, implementation and use, and evolution of a corporate SPMS. Critically, it also highlights that future research must go beyond studying each of these contexts separately and that focus must move toward a more integrated approach. While there are many excellent studies in the literature that deal specifically with one phase of design, implementation, use, or evolution of a SPMS, there are few that simultaneously address all of these phases. There is a need for longitudinal case studies that document and reflect on the entire life-cycle of the system. But, there is also a need for research on a number of fundamental questions that go beyond single case studies. There is also an overarching need to better connect the practice-oriented research on corporate SPMSs to theory.

To advance the knowledge and practice of corporate sustainability performance measurement, this section proposes 65 research questions for corporate SPMSs. The questions are organized around the framework presented in Fig. 2. Building on a point made by Bourne et al. (2000), it is important to note that the framework is conceptual and there may be some overlap between the areas of research suggested. The framework is intended to structure thinking and discussion around the key questions future research on corporate SPMSs must address. It is recognized that there may be debate on the placement and wording of certain questions. With that in mind, the framework organizes the proposed research questions around the key stages in the development of any corporate SPMS, namely design, implementation and use, and evolution. Within each key stage, the questions are further organized into two main categories. These categories explicitly address the fundamental gaps in the existing knowledge base highlighted in Table 1. Several of the gaps identified in Table 1 are addressed by multiple research questions. While each key stage in the development of a SPMS is discussed separately in the following sections, it is important to stress that future research must explicitly focus on the interrelationships between these stages. This point is one of the underlying themes in the proposed research questions.

Design of a Corporate SPMS

Issues associated with the design of a corporate SPMS have been well-represented in the literature. Many example sets of sustainability indicators have been published at both the individual corporation- and sector-level. The process used to develop the indicators, including the indicator selection criteria and the applicable conceptual framework, is described in many of these publications. However, several areas related to the design of a SPMS require further research. As Fig. 2 highlights, there is a need for research on addressing both procedural and contextual issues associated with the design of a corporate SPMS. For example, procedural issues include investigating the effectiveness of existing design processes, exploring the role of political negotiation in indicator design, and determining how cumulative impacts can be addressed in a corporate SPMS. Example contextual issues that must be addressed include the development of SPMSs applicable to multiple corporate levels and the impact of existing initiatives on the development of the SPMS. There is also a clear divergence in perspectives on whether or not corporate SPMSs should incorporate composite indices and further research is needed on this issue. With that in mind, Table 2 presents a list of 25 illustrative research questions focused on SPMS design. The questions explicitly focus on addressing the gaps noted above. Ten questions focus on procedural issues. The remaining 15 questions focus on contextual issues.

Table 1 Summary of the key gaps in the literature

Research area	Illustrative key gaps
Design of a corporate SPMS	Enhancing indicator design processes to better accommodate local circumstances
	Evaluating the effectiveness of the published indicator design processes
	Studying the use of composite indices in a corporate SPMS
	Elaborating the role of political negotiation in indicator design
	Investigating how cumulative impacts can be addressed in a corporate SPMS
	Identifying criteria for evaluating the methodological strength of a SPMS
	Clarifying the extent of stakeholder involvement in the development of a SPMS
	Exploring the design of SPMSs that are applicable to multiple corporate levels
	Elaborating the accommodations that must be made for large, medium-sized, and small corporations
	Investigating the role of SPMSs in performance appraisals
	Studying the factors that determine the optimal number of indicators in a SPMS
	Exploring the time horizon that should be covered by indicators in a SPMS
	Studying the impact of existing internal and external initiatives on the development of a SPMS
	Clarifying responsibilities in the development of a SPMS
	Studying the costs required to design a SPMS
Implementation and use of a corporate SPMS	Studying the factors that influence successes and failures in SPMS implementation
	Exploring processes for integrating a SPMS with existing corporate infrastructure
	Addressing the transitions between design, implementation, and use of a SPMS
	Studying the impact of the design process used to develop a SPMS on the implementation of a SPMS in practice
	Identifying the key gaps in existing data collection systems
	Developing trade-off criteria to guide decisions related to conflicting objectives
	Studying how a SPMS is used to guide decision-making in corporations
	Exploring how a SPMS is viewed by internal and external stakeholders
	Studying the linkages between the use of a SPMS and actual improvements in a corporation's sustainability performance
	Identifying which indicators are most useful in decision-making
	Exploring the role of the SPMS in corporate accountability
	Investigating how the use of SPMSs differs by sector
	Exploring the relative use of financial and non-financial indicators
	Studying the use of SPMSs in sustainability reporting
	Investigating the costs of operating and maintaining a SPMS
Evolution of a corporate SPMS	Studying the entire life-cycle of a SPMS
	Exploring how a SPMS adapts to changing corporate requirements over time
	Clarifying the process of updating a corporate SPMS
	Identifying criteria for removing obsolete indicators from the SPMS
	Clarifying the extent of stakeholder involvement in updating a SPMS
	Investigating the frequency of updating a SPMS
	Determining the influence of benchmarking on updating a SPMS
	Investigating how an assessment process can encourage further integration of the SPMS with existing business infrastructure
	Studying the factors that influence the success of a corporate SPMS
	Identifying the factors that inhibit or enable the evolution of a SPMS

Implementation and Use of a Corporate SPMS

As shown in the literature review, preliminary efforts to address the implementation and use of corporate SPMSs have been made. However, several gaps remain in the existing knowledge base. For example, implementation issues that must be addressed include investigating the factors affecting the success and failure of SPMS

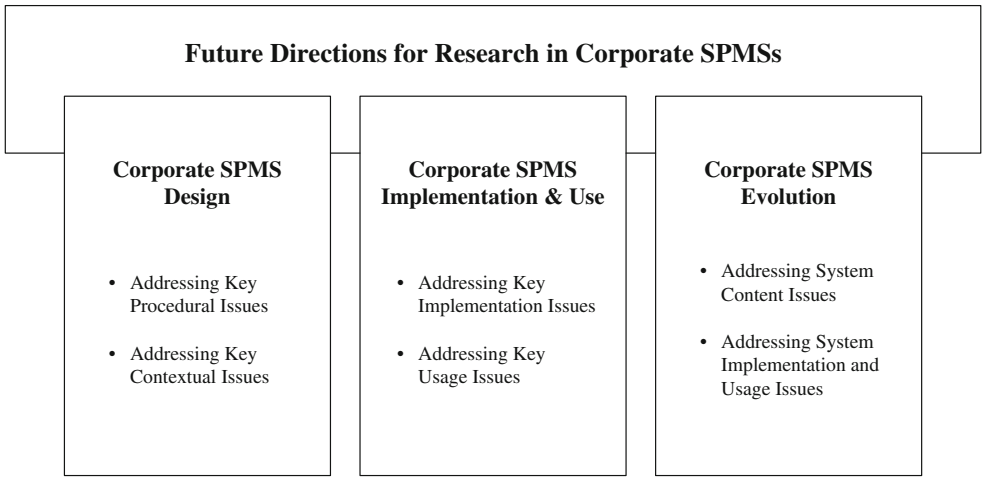

Fig. 2 Future directions for research in corporate SPMSs

Table 2 Illustrative research questions for the design of a corporate SPMS

Research area	Illustrative questions
Addressing key procedural issues	How do the published indicator design processes facilitate or impede the implementation of an effective corporate SPMS?
	What are the most appropriate methods for weighting, normalizing, and aggregating composite indices in a corporate SPMS?
	How can indicator design processes be developed to accommodate correlation, sensitivity, and uncertainty analyses?
	How can the issue of internal political negotiation be reflected in indicator design processes?
	How can the issue of emergence be addressed in indicator design processes?
	How can corporate SPMSs be designed to accommodate cumulative impacts?
	What are the criteria for determining the methodological strength of a corporate SPMS?
	Who is responsible for leading the design of corporate SPMSs?
	When is the appropriate time to involve external stakeholders in the design of a corporate SPMS?
	What published models have proven most effective for integrating sustainability issues into the Balanced Scorecard?
Addressing key contextual issues	What are the key differences in designing a SPMS for large, medium-sized, and small corporations?
	What is the motivation for corporations to incorporate composite indices into a SPMS?
	To what extent are corporate SPMSs data-driven vs. theory-driven?
	What factors determine the optimal number of indicators in a corporate SPMS?
	What is the appropriate time horizon to be covered by the indicators in a corporate SPMS?
	How can the measures incorporated into a SPMS be integrated into performance appraisals at the individual and business unit levels?
	To what extent should a corporate SPMS incorporate standardized indicators that may be used for benchmarking purposes?
	How have the suggested sector-level indicators influenced the development of SPMSs in individual corporations?
	How long does it take to design a corporate SPMS?
	How much does it cost to design a corporate SPMS?
	What factors determine the level of involvement of external stakeholders in the design of a corporate SPMS?
	To which levels of a corporation does a SPMS typically apply?
	How do corporations identify the best leverage points for integrating the SPMS with existing business infrastructure?
	What is the role of existing internal performance measurement systems in the development of new SPMS?
	How can linkages between corporate SPMSs and broader public policy goals and programs be strengthened?

implementation, determining how existing internal systems can be used to leverage the implementation of a SPMS, and identifying key gaps in existing data collection systems. Several issues associated with the use of a SPMS also require additional research, including identifying the indicators that are most useful in decision-making, exploring the relative use of financial and non-financial indicators, and investigating how the use of SPMSs differs by industry sector. Research is similarly needed to address the gaps between the design, implementation, and actual use of a corporate SPMS in practice. Table 3 presents a summary of 25 key research questions concerning the implementation and use of a corporate SPMS. Ten questions focus on addressing key implementation issues. The remaining 15 proposed research questions focus on addressing key usage issues.

Evolution of a Corporate SPMS

Research on the evolution of a corporate SPMS is underrepresented in the literature. This is a critical gap, since regular assessment of a SPMS is needed to ensure its continuing applicability and usefulness (adapted from Kennerley and Neely 2002, 2003). Figure 2 highlights that the evolution phase of a corporate SPMS requires addressing research questions associated with both the content of the SPMS and the implementation and use of the SPMS. For example, system content issues include determining how the review of the SPMS should be structured and identifying criteria for removing obsolete indicators from the SPMS. Implementation and use issues include investigating how an assessment process can encourage further integration of the SPMS with existing business

Table 3 Illustrative research questions for the implementation and use of a corporate SPMS

Research area	Illustrative questions
Addressing key implementation issues	How do corporations assess the success or failure of a SPMS?
	What are the critical success factors in implementing a corporate SPMS?
	What are the factors that influence failure in implementing a corporate SPMS?
	How can a SPMS be integrated into business management?
	What is the most effective process for managing the transition from SPMS design to implementation?
	How can existing internal management systems be used to leverage the implementation of SPMSs?
	Are sustainability indicators designed specifically for the company more likely to be implemented than generic sets of standard indicators?
	Does the use of structured indicator selection criteria increase the likelihood for successful implementation of a corporate SPMS?
	Does the use of a structured conceptual framework increase the likelihood for successful implementation of a corporate SPMS?
	What are the key gaps in existing data collection systems for a corporate SPMS?
Addressing key usage issues	Does involvement in the SPMS design process increase the likelihood that employees will use the indicators and indices in the system?
	Are SPMSs designed in consultation with external stakeholders more likely to be used in internal management decision-making than those that are not?
	How can conflicts between individual indicators in a corporate SPMS be made more transparent?
	How have SPMSs changed the way managers manage the corporation, if at all?
	How do the views of corporate managers and employees towards a SPMS differ, if at all?
	What steps have corporations taken to improve their performance on sustainability indicators?
	What indicators do managers find most useful in decision-making at the strategic, operational, and project levels?
	How, and with which results, have sustainability indicators been used in corporate decision making, education, benchmarking, and other activities?
	How does the use of sustainability indicators differ by sector?
	To what extent are corporations using the sustainability indicators published in the peer-reviewed literature?
	Are non-financial indicators less likely to be used in management decision-making than financial indicators?
	Does the size of the corporation influence the likelihood that non-financial indicators will be used?
	What sustainability indicators are currently being externally reported by corporations?
	How do corporations determine which sustainability indicators to report on externally?
	What is the cost of operating and maintaining a corporate SPMS?

Table 4 Illustrative research questions for the evolution of a corporate SPMS

Research area	Illustrative questions
Addressing system content issues	What are the criteria for determining if an indicator is obsolete and should be removed from a corporate SPMS?
	What is the process for introducing new indicators into the corporate SPMS?
	What are the key steps in the evaluation and assessment of a corporate SPMS?
	To what extent should external stakeholders be involved in the evaluation and assessment of a corporate SPMS?
	To what extent should the evaluation and assessment of a corporate SPMS focus on external benchmarking?
	How often should a corporate SPMS be reviewed?
	How do changing strategic priorities influence the structure and content of an established corporate SPMS?
Addressing system implementation and usage issues	How can evaluation and assessment processes be used to drive further integration of a SPMS with existing business infrastructure?
	Does evaluation and assessment of a SPMS improve corporate commitment to the SPMS?
	How does implementation and use of a corporate SPMS contribute to improved corporate sustainability performance?
	How do you keep a corporate SPMS relevant and useful over time?
	How does a delay in feedback affect the implementation and use of a SPMS?
	What are the key factors for evaluating and assessing the success of a corporate SPMS?
	What are the key factors that enable the evolution of a corporate SPMS?
	What are the key factors that inhibit the evolution of a corporate SPMS?

infrastructure and exploring how you keep a SPMS relevant and useful over time. In this light, Table 4 provides a summary of 15 illustrative research questions for the evolution of a corporate SPMS. Of the 15 questions proposed, 7 focus on addressing system content issues. The remaining 8 questions focus on system implementation and usage issues.

Conclusions

Over the last decade, many excellent contributions to research on corporate sustainability performance measurement have been made. However, research on corporate SPMSs continues to evolve and work remains in developing SPMSs that meet the needs of business. The paper highlighted that there is a particular need for additional research in the design, implementation, use, and evolution of corporate SPMSs to simultaneously advance both the knowledge and practice domains of corporate sustainability performance measurement.

Based on a review of literature drawn from a wide variety of publications, 65 research questions to help guide future work were presented. The questions were organized around a framework that divided them into six categories. As the framework highlights, the questions on the design of a corporate SPMS were structured around addressing procedural and contextual issues. Several research questions organized around the implementation and use of a corporate SPMS were provided. Finally, the framework focused questions on the evolution of a corporate SPMS on issues associated with the content of the SPMS and its implementation and use.

Continued progress in the areas highlighted in the paper is essential given the crucial role SPMSs play in a corporation's overall sustainability program. It is important to reemphasize that corporate sustainability is fundamentally a complex problem and there are no approaches that universally apply. Corporations are faced with differing stakeholder demands, continually shifting priorities, and a multitude of alternatives to address their sustainability challenges. In recognition of these realities, corporations must develop approaches to sustainability that are suited to their local contexts. This requires tailored policies, plans, and programs linked to clear sustainability goals and targets. To assess the success or failure of a corporation's sustainability initiatives and whether or not it is making progress on its key economic, environmental, and social goals, an SPMS designed to meet the unique needs of the corporation is necessary. Moreover, the SPMS must fit seamlessly with existing organizational infrastructure and must evolve over time to meet the changing internal and external situations faced by the corporation. The proposed research questions explicitly recognize these issues and

highlight the areas that must be addressed to advance research on the practical and theoretical aspects of corporate SPMSs.

It is recognized that some of the questions presented in the paper may require further refinement and that additional questions are possible. For example, the paper did not address corporate sustainability performance measurement at the market-level nor did it focus on the issue of instituting mandatory indicators in some or all industry sectors. These topics, and others, provide a source for many other potential research questions. For example, future research on market-level sustainability performance measurement could focus on the benefits corporations obtain from being listed on the Dow Jones Sustainability Index (DJSI), the steps corporations have taken to be listed on the DJSI, and possible improvements to the DJSI, among other topics (see Fowler and Hope (2007) for further details). Future research on instituting mandatory indicators could explore the desirability of such an action, how it would help overcome corporate reluctance to disclose low levels of performance, the specific indicators on which corporations would be expected to report, and how the requirement to report would be enforced, among other issues. It is therefore important to emphasize that no set of research questions will ever be comprehensive. The research questions presented in this paper are therefore intended to help provide a needed starting point for further thinking and discussion about the challenges and opportunities associated with corporate sustainability performance measurement. Nonetheless, one particular challenge will be to approach future research on corporate SPMSs in an integrated manner, rather than through the somewhat fragmented approaches that characterize much of the published work. This will help encourage researchers to consider the difficult transitions from design through implementation through operation and, ultimately, through the evolution of a SPMS.

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