Inside Out: The Interrelationships of Sustainable Performance Metrics and Its Effect on Business Decision Making: Theory and Practice

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Abstract

There has been an increasing interest in the use of decision-making models to achieve sustainability goal in recent decades. However, a systematic review of performance metrics, which are an important element of decision-making models to evaluate the outcomes regarding firm's economic, environmental and social performance, is lacking. This study provides critical reflections on the current state of literature and industry development regarding sustainable performance metrics and offers concrete suggestions to guide future research. This study contributes to existing studies by (1) exploring the interrelationship between sustainable triple-bottom performance in the decision making process; (2) integrating corporate governance mechanism into decision making process for sustainable consideration; and (3) conducting a comparison between academic theory and industry practice regarding the performance metrics proposed and employed.

Keywords: Business Decision Making; Corporate Governance Mechanism; Performance Metrics; Sustainable Supply Chain Management

1. Introduction

Business decision-making and sustainable supply chain management (SSCM) are both relatively established research fields. The former conceptualizing as "a locus of innovation, planning tools, heuristic logic, or market device" (Hacklin and Wallnofer, 2012, pp. 166). The latter exploring "the management of material, information and capital flows as well as cooperation among companies along the supply chain, taking goals from the three perspectives of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements" (Seuring and Muller, 2008). With customers' expectations and demands rapidly changing, companies targeting a customer base with high awareness of all three perspectives of sustainability need careful consideration of these in their business decision-making. Unfortunately, one of the most challenging aspects of decision-making to achieve sustainability, is that elements of the process are beyond the reach of companies' control (Gimenez and Tachizawa, 2012). A high level of environmental performance achieved by one firm can be brought to nothing by its supply chain partners' poor environmental/social performance (Faruk et al., 2001). For example, Apple, Samsung and Sony who has invested heavily in its Corporate Social Responsibility (CSR) development face child labour claims due to the poor performance of its supply chain partners (Wakefield, 2016). The problem arises where the two parties have different interests and asymmetric information, such that the one player cannot directly ensure that the other player is always acting in mutual best interests, particularly when activities that are useful to the one player are costly to the other, and where elements of what the other player does are costly to observe. This asymmetric information problem exists between the companies and its partners in the value chain. The extant literature has documented the important role of governance mechanisms, which are defined as a set of arrangements "that coordinate all stakeholder interests to ensure that the decision-making is more scientific and safeguards all corporate interests" (Li et al., 2014), see also Gillan, 2006; Jensen, 2002; Zingales, 1998, in reducing asymmetric information problems. Therefore, to meet with the newly developed sustainability requirements, firms have recognized the need to not only guide their business decision internally through governance mechanisms but also extend their traditional business making decision process beyond the firms' boundary to involve their supply chain partners through external governance mechanisms. This prompts questions about how sustainability should be measured into different levels of management decision-making through the value chain and supply network to achieve sustainable production from upstream relationships to sustainable consumption from downstream relationships.

To operationalize the triple bottom line (economic, social and environmental perspectives) （Elkington, 1997; Seuring and Müller, 2008） and to interpret the interrelationships between these perspectives and to guide decision-making processes,

clear metrics of “performance are needed in order to judge the efficacy of any decision on the resulting sustainability performance” (Hutchins and Sutherland, 2008). Against this backdrop, the authors hereby extend the existing literature by investigating how the academic literature address the decision-making process in the context of sustainable supply chain management and identifying the gap between the academic literature and industrial practices regarding sustainability related factors that influence decision makers aiming to fulfil strategic sustainability goals. Current research has been conduct regarding the performance indicators applied for decision-making regarding sustainability (Seuring and Müller, 2008; Hutchins and Sutherland, 2008; Hervani et al., 2005, Bai et al., 2012). However, this study identifies little existing research that examines the interrelationship between the triple perspectives, especially from the lens of triangulation between theoretical and practical viewpoints. Thus, the authors contribute to the extant literature by comparing the performance metrics proposed by scholarly research and employed by industry. More specifically, the authors aim to answer three questions: what are the metrics of performance suggested by the academic literature and what is the interrelationship between these? Has industry used these metrics? What is the impact of governance mechanisms on decision-making models that focus on corporate sustainability performance?

In doing so, this study attempts to follow a systematic review method to identify the performance metrics across a broad range literature of business decision-making processes and their use within industry. Although some previous reviews (Koh et al, 2016) can be found, this systematic review distinguish itself from previous reviews by demonstrating its in-depth rigour of the methodology adopted and also the new research directions proposed as a result of the triangulation between theory and practice to comprehensively understand the interrelationship between the triple perspectives. A major debate of this study is that a significant proportion of current business model building research assume there is an implicit or explicit win-win situation between three sustainable perspectives: economic, social and environmental, however this may not exist. More specifically, current literature argues that by investing in social and environmental perspectives, the company can realise better economic performance. Even if there might be short-term conflict, a long-run win-win situation exists. However, this study suggests that instead of turning a blind eye on the interrelationship between the three sustainable perspectives by assuming a win-win situation for all cases, it is practical to go inside the box and test the interrelationship among these perspectives before building business decision models; a reverse causality from improved economic performance to improved environmental and social performance or a negative relationship between economic performance and environmental and social performance might exist, which have significant implications in the building of decision-making models. As such, the authors urge the examination of this interrelationship under different governance mechanisms and

conditions and call attention to the contingency perspective in future study.

The unique points of this study also involve a content analysis of annual reports, sustainability reports and corporate reasonability reports of the top 50 listed manufactures selected from FTSE 250 companies. Consequently, this study contributes to both the academic and professional communities. For researchers, the authors summarize current knowledge and suggest some directions for future research. For professionals, this study can be used to guide what performance metrics can be implemented by businesses.

The structure of this study is as follows. The next section provides a summary of the methodology and outlines the research protocol adopted to identify the systematic review sample papers. The results of the search and initial analysis are presented, followed by a discussion of the findings. Finally, conclusions are drawn, with implications for management practice and further academic research.

2. Methodology

This study applies a systematic review approach to provide a comprehensive literature review. Systematic review is a rigorous review methodology originally developed mainly within medical research and first outlined for the field of management and organization studies by Tranfield et al (2003). By adopting a scientific, transparent and replicable process, systematic reviews differ from more traditional approaches to literature reviews. Through exhaustive searches of published work, with a clear audit trail of the decisions and actions taken, the aim is to reduce bias and error (Tranfield et al., 2003). The principle aim is to draw a balanced understanding of research in a specific field without selecting for publication field or location, and to obtain a reliable overview of a subject that cannot be achieved by a single non-longitudinal study (Tranfield et al., 2003). As outlined by Thorpe (2005), a systematic literature review should provide: transparency - each search of the available research studies is recorded (Denyer and Neely, 2004), clarity - a clear, stepped series of searches is presented (Tranfield et al., 2003), focus, - unify research and practitioner communities (Leseure et al., 2005), equality - studies are reviewed on their own merits with no distinction between the nature of journals (Pittaway et al., 2004), accessibility – the reviews are made available outside of the specialist in the forms of searchable database with broad coverage (Pittaway et al., 2004).

Following the procedures laid out by recent systematic review (Dekkers et al., 2013; Fogliatto et al., 2012; Keupp et al., 2012), the authors applied two stages of search strings. Step one involved identifying potential relevant papers, the authors selected keywords related to the topic of sustainability. Sustainability is a broad concept (Hubbard, 2009). The triple bottom line, of environmental, social, economic

sustainability is a central concept to help operationalize sustainability (Elkington, 1997, Seuring and Müller, 2008). As such, three search strings ("environmental sustainability" AND "management", "economic sustainability" AND "management", and "social sustainability" AND "management") are searched using 2 databases: Scopus and Web of Science, using key word search of ["Environmental sustainability AND management"], ["Economic sustainability AND management"] and ["Social sustainability AND management"] within title, abstract and keyword fields (Table 1). The sample period covers from January 2007 to March 2016, to ensure this study reflect the recent development in this field.

The choice for Scopus and Web of Science is due to the fact that each of the two databases are documented to have extensive coverage for peer review journals (Meho and Yang, 2007). As of 5th May 2016, Thomson Reuters Web of Science had covered more than 12,000 of the high impact research journals and contains over 90 million records. By January 2016, Elsevier's Scopus has covered over 21,500 peer-reviewed journals and over 60 million records.

Table 1: Search String

Stage 1	Stage 2 (based on the Stage 1 database)
Search String 1: Environmental sustainability AND management	Search string 4: Supply chain
Search String 2: Economic sustainability AND management	
Search String 3: Social sustainability AND management	

Both databases are searched individually with the selected keywords. Only published peer-reviewed journal articles were considered. Equally, As argued by Newbert, (2007), David and Han (2004) and Gosling and Naim, (2009), the authors considered that by restricting the search to peer-reviewed journals, the quality control of search results was enhanced due to the peer review process to which articles published in such journals are subject to prior to publication. This step generated a total 34,442 articles in English (16, 564 articles in Scopus and 17, 878 articles in Web of Science). After deleting duplicates, the total number of unique articles in is 17, 416. The process of is illustrated in Figure 1.

Following the previous step, the authors further searched the papers identified for reference to Supply Chains as indicated in Table 1 in order to broadly capture the potential list of studies that might be related to the authors' research questions. This resulted in 1074 unique articles. To further improve the quality of papers being reviewed the authors excluded journals where the 5-year impact factor was less than

3.0 for science journals and 1.0 for social science journals. As noted by Moed (2010) impact factors vary between disciplines, with science journals often having higher impact factors than those in the social sciences, by setting these levels the authors intend to capture only research published in highly rated journals. After excluding all articles with 5-year impact factor less than the journal's exclusion criteria, 546 unique articles remained.

The penultimate step of the review consisted of reading the titles, abstracts and key words of all unique citations with one criteria: remove papers with abstracts that describe content not relevant to the research topic. The process of initial review by title, abstract and key words, follows the two-tier methodology proposed by Keupp et al. (2012) and Denyer and Neely (2004) to reduce subjective bias, encourage transparency and enhance validity. To achieve this, the authors organized themselves into two groups that undertook the review independently of each other. The use of a two-phase review process is identical in purpose to the expert panel used by Tranfield (2003) and Leseure et al. (2005). The review began with a general agreement on the inclusion/exclusion criteria for the purpose of excluding non-relevant papers according to the authors' views of supply chain sustainability and decision-making performance metrics. This resulted in 132 articles remaining.

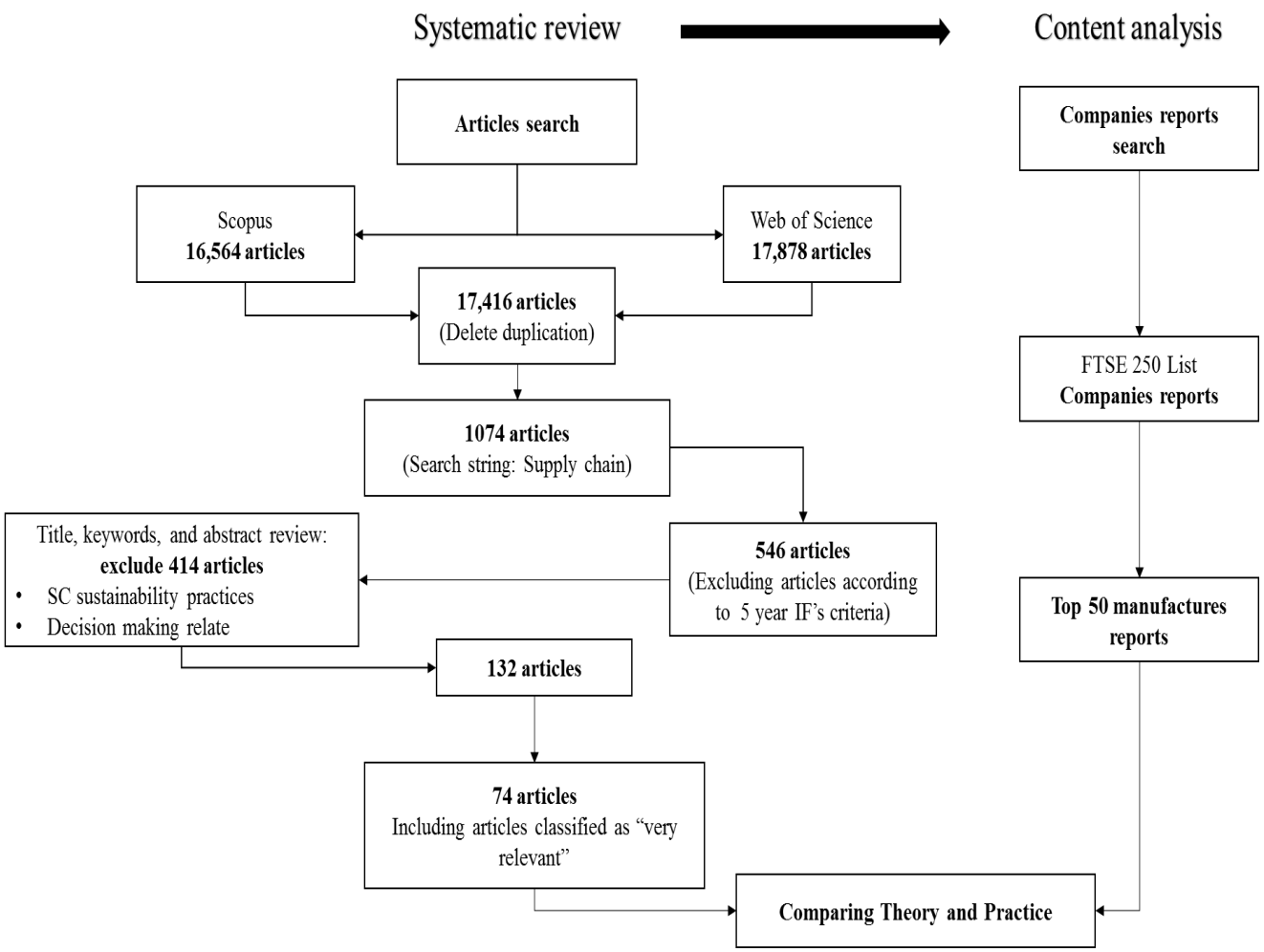

Figure 1: The Methodology Overview

These 132 articles were read in full by the authors to grade as "limited relevance", "somewhat relevant" and "very relevant" as such to identify their direct relevance to the research questions. This resulted in 74 articles been classified as "very relevant" to the authors' research.

By applying these systematic principles, this review has sought to gather all relevant research in the field, so as to make sense of it, encourage openness and enable validity in research repetition (Tranfield et al., 2003). Collection of all relevant research at a point in time also provides the foundations for new research questions to be posed. However, this method is not without its limitations. Challenges encountered in this study were similar to the limitations highlighted by Pittaway et al (2004) and Leseure (2005). The key word search of "sustainability" is ambiguous, resulting in publications from journals from multiple disciplines as well as topics outside the scope of this study. Synthesizing a broad range of topics, industry and outcomes was challenging. Action oriented discussions on precise definitions of the search terms,

inclusion and exclusion criteria, contributed to the authors' efforts in finalizing the list of papers relevant to this study. In addition, there were risks associated with filtering papers based on their abstracts. As highlighted by Pittaway et al (2004), much depends on the quality of the written abstract, and consequently some relevant papers may have been mislabelled and excluded for the final list. To mitigate part of this risk, papers whose abstracts indicated that it may fall into category either "somewhat relevant" or "very relevant" were read in detail to determine whether or not they belong to the later.

3. Findings and Discussion from the Systematic Literature Review

The authors' analysis found 74 papers clearly focused on supply chain practices/mechanism to facilitate the decision-making process in the context of sustainability. The distribution by journal is shown in Table 2. The Journal of Cleaner Production is clearly the leading journal in this context as evidenced in our results. This finding is noteworthy due to the fact that this journal is not listed in the Academic Journal Guide 2015, which is widely used as a reference for UK business school researchers, whilst its impact factor is respectfully high in its own right. One can argue that the interdisciplinary nature of sustainability triadic complexity, has led to journal(s) that appreciate this lens.

Figure 2 presents the distribution of publications in this domain over time, indicating a research field that has grown rapidly in the last decade.

Table 2 Ranking of journals by number of publications

Journal title	Number
Journal of Cleaner Production	16
International Journal of Production Research	6
International Journal of Production Economics	5
International Journal of Physical Distribution and Logistics Management	4
Supply Chain Management-an International Journal	4
Ecological Economics	2
International Journal of Logistics Management	2
International Journal of Operations & Production Management	2
Journal of Business Ethics	2
Journal of Environmental Management	2
Journal of Supply Chain Management	2
Resources Conservation and Recycling	2
Resources Policy	2
Technological and Economic Development of Economy	2

Transportation Research Part E-Logistics and Transportation Review	2
Bioresource Technology	1
Business Strategy and the Environment	1
Corporate Social Responsibility and Environmental Management	1
Decision Sciences	1
Energy Conversion and Management	1
Energy Policy	1
Environmental Science and Technology	1
European Management Journal	1
Food Policy	1
IEEE Transactions on Engineering Management	1
Industrial Marketing Management	1
International Journal of Life Cycle Assessment	1
International Journal of Sustainable Transportation	1
Journal of Operations Management	1
Journal of Purchasing and Supply Management	1
Omega (United Kingdom)	1
Production Planning & Control	1
Renewable and Sustainable Energy Reviews	1
Transportation Research Part D: Transport and Environment	1

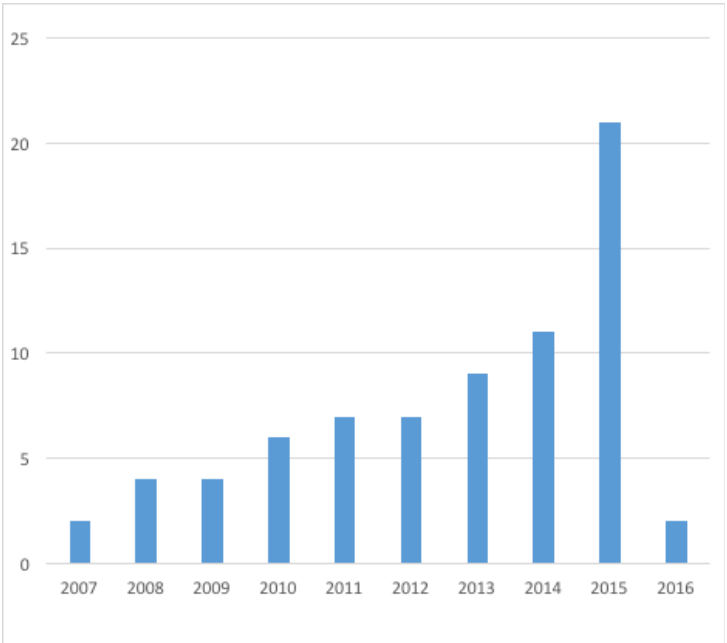

Figure 2: Time distribution of sample publications

The authors then categorized these papers into a number of key themes based on the

fundamental nexus of the debate on the interrelationship between sustainable performance metrics in business decision-making models. These are discussed below:

3.1 Triple-bottom line perspective:

The number of papers regarding sustainability within the supply chain management discipline has grown significantly during the last decade. The economic perspective, within the subject, is the most documented performance metric, which almost all of the sample papers mention. However, most consider traditional accounting measurements of focal companies such as cost, revenue, and profitability to guide the economic business decision (Taticchi et al., 2015). Only a few consider profit-sharing indicators for the supply chain partners. As suggested by Taticchi et al., (2015) a future economic sustainability performance indicator should emphasize the importance of a cooperative relationship, instead of a competitive relationship with separate units measuring using traditional accounting methods, between the value chain partners to facilitate information share in their efforts to improve their overall sustainability performance. Due to the comparative nature of the study and the limited information disclosure of the sample companies, the triple-bottom line perspective the authors focused on is at the operational level (company level) performance metrics instead of the country-level macroeconomic sustainable performance metrics, though the authors have seen a sound progress towards this path (Vahabzadeh 2015; Vachon and Mao 2008).

It is worthwhile to note that most papers in the authors' sample have made a concerted effort to advance environmental measurements. Measurements include, but not limited to carbon emission (Koh et al., 2013; Lake et al., 2015; Gadema and Oglethorpe, 2011; Fichtinger), natural and material resources usage (Liu st al., 2012; Pimentel et al., 2016; Wu and Pagell, 2011) and waste generated from products and materials (Nagurney et al., 2015; Verghese, 2010; Bai and Sarkis, 2014). Hassini et al., (2012) suggested that although there is no obvious shortage of environmental metrics, it is still challenging to know when to use which one and how to decide between these. A more fine-grained industry-oriented performance metrics should be studied and developed to answer this call. Over the sample period, the authors saw a diversified sample of industries across different institutional background including: the construction minerals industry in China (Chen et al., (2015); US hospital industry (Kumar et al., 2008), U.S. Diaper production case (Adhitya et al., 2011); Brazilian energy sector (Matos and Silvestre, 2013); automotive suppliers (Subramoniam, 2009); Food industry (Gadema and Oglethorpe, 2011) and fashion industry (Li, 2014).

A comprehensive list of indicators to measure social performance is proposed by the UN in "Indicators of Sustainable Development: Guidelines and Methodologies (2007)" and a growing number of authors has started to use it as a guide to conduct their work.

However, there exist a gap between theory and implementation to operationalize the social performance metrics in decision-making related to supply chains. A more detailed comparison with social measurements currently employed by UK top companies is presented in the next section. Among the sample literature, the authors observe an increasing application using a more holistic concept of corporate social responsibility (CSR) to acknowledge the importance of social aspect to guide business decisions, see Hutchins and Sutherland (2008); Morali and Searcy (2013); Li et al. (2014). Hutchins and Sutherland (2008) made a significant advance by including measures of social sustainability into business decision-making practice by proposing several measures such as labour equity, healthcare, safety, and philanthropy, which are discussed in their social Life Cycle Assessment (LCA) model that not only provide insight into the mapping of corporate inputs and outputs into measures of social performance but also demonstrate corporate actions can be used to effect positive social change. Vachon and Mao (2008) attempt to link supply chain strength to sustainable social welfare in a country-level analysis and conclude that the number and quality of the suppliers and customers in a country (supply chain strength) is positively linked to a country's sustainable development.

Table 3 outlines the performance measures of the three perspectives of the triple bottom line as identified within the selected literature.

335 Table 3: Sustainable measurements discussed in the literature

Sustainability perspective	Code	Measurements
Economic	E1	Costs (Metta and Badurdeen, 2013, Chaabane et al., 2012, Wang and Hsu, 2010, Adhitya et al., 2011)
	E2	Revenues (Metta and Badurdeen, 2013, Chaabane et al., 2012, Choudhary et al., 2015, Adhitya et al., 2011, Awudu and Zhang, 2012)
	E3	Profit sharing (Chaabane et al., 2012, Wang and Hsu, 2010, Adhitya et al., 2011)
	E4	Creating sustainability value (relates environmental and social) (Pimentel et al., 2016, Zhang and Awasthi, 2014, Huq et al., 2014, Awudu and Zhang, 2012)
Environmental	EN1	Emission reduction/ climate change (Tseng and Hung, 2014; Koh, et al., 2013; Lake et al., 2015; Gadema and Oglethorpe, 2011; Elghali, et al., 2007)
	EN2	Natural sources' usage (energy efficiency) (Elghali, et al., 2007; Cucchiella and D'Adamo, 2013, van Hoek and Johnson, 2010)
	EN3	Waste reduction (Nagurney et al., 2015; Harms et al., 2013, Erol et al., 2011)
	EN4	Used product or material 's disposal (Erol et al., 2011, Subramoniam et al., 2009)
	EN5	Use of recycle materials (Harms et al., 2013, Erol et al., 2011, Rostamzadeh et al., 2015)
	EN6	Choice of suppliers by considering the environmental criteria(Shen et al., 2013, Rostamzadeh et al., 2015, Sarkis and Dhavale, 2015)
Social	S1	Degree of job localisation (Koh et al., 2013; Harms et al., 2013)
	S2	Human rights (Harms et al., 2013, Muduli et al., 2013)
	S3	Employee CSR training (Koh et al., 2013; Muduli et al., 2013)
	S4	Health care and safety (Hutchins and Sutherland, 2008; Muduli et al., 2013)
	S5	Degree of purchasing localisation (Koh et al., 2013; Subramoniam et al., 2009)
	S6	Labour equity (Hutchins and Sutherland, 2008)
	S7	Community (compliance, volunteer, charity, and ethic) (Koh et al., 2013; Hutchins and Sutherland, 2008)

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Conceptually sustainability considers the interrelationships between environmental, social, and economic objectives. Increasingly, research tries to integrate all the three perspectives. It must be emphasised that interrelationship and integration of the triple perspectives are two very different concepts. The former, which is the focus of the study, emphasises on the complex interactions amongst the perspectives, whilst the later focuses on the combinatorial effects. The combinatorial effects of the integration of the triple perspectives have already been theorised and demonstrated (e.g. See Koh et al, 2016).

Little is understood about the interrelationship of the triple perspectives. Among the selected papers examining the issue, they tend to follow a win-win paradigm, which means economic, environmental and social perspectives can be achieved simultaneously. This key assumption often serves as a foundation to build the proposed business model. More specifically, they tend to assume that there is causal relationship in that improved environmental and social performance lead to sound economic performance. Only a few recognise there might be a short term negative relationship among the trade-off of the three perspectives. Such a win-win paradigm also assumes a long term positive relationship could be achieved.

Interestingly, the results from a boarder range of sustainability literature reviewed in the study seem to be less supportive of such win-win assumption. Therefore, the authors call for further research to examine this key assumption underpinning the sustainable business model building.

Generally, there are two strands of research supporting this win-win paradigm. One suggests that the managerial skills of a company with improved social and environmental performance is transferable to the company's economic activities (Waddock and Graves, 1997, Frooman, 1997, Schuler and Cording, 2006). As a result, the stakeholders reward companies with such 'good management skills' through activities such as investment, consumption and higher productivity from employees. Hence, the economic performance is realised. Similarly, another set of research based on the stakeholder theory suggests that the mutual trust and cooperation with stakeholders reduces the negotiation and contracting costs, both implicit and explicit, and serve as control mechanisms that significantly reduces the likelihood of managers' opportunistic behaviour and pushing them to adopt a long-term orientation (Jones, 1995; Choi and Wang, 2009; Eccles, Ioannou and Serafeim, 2014). The stakeholder theory thus implies that a company with improved environmental and social practices should realize lower costs of managing stakeholder relationships and therefore, should earn better economic performance than firms with bad social and environmental practices, vis-à-vis poorly managed stakeholder relationship (Jones, 1995). Furthermore, by addressing the claims of stakeholders, managers can increase the efficiency of their organization's adaptation to external demands and hence increase

economic performance.

On the contrary, two strands of theories and empirical studies suggest a negative relationship between environmental and social performance and economic performance. One theory suggests that managers who practice environmental and social activities neglect to take opportunity cost of such actions into account and consequently, sacrifice more profitable activities for the company (Schuler and Cording, 2006). Over time, such activities result in poor economic performance. The other theory is based on agency cost theory state that managers engage in environmental and social practices for their own personal interests because it is difficult for owners to monitor the behaviour of managers (Schuler and Cording, 2006). As such, this theory implies that managers, who direct resources toward social and environmental projects, fail to put resources to their highest productive use and, over time, fail to maximize the company's economic performance.

Unlike the previous findings of either a positive or a negative causal relationship from environmental and social practice to economic performance, affordability theory, suggests a totally reverse causality. This theory claims that only firms with adequate economic performance can afford to pursue the costly social and economic activities. As a result, the causality of affordability model is that improved economic performance leads to environmental and social practice. Carroll (1979) argue that by managing wisely for economic, then legal, then ethical domains, managers can then disperse resources to philanthropic activities to be a good corporate citizen. Schuler and Cording (2006) suggest that companies such as Anheuser-Busch, Coca-Cola, Eli Lilly, Philip Morris, and Target etc., devoting a portion of their pre-tax income to fund various philanthropic projects, is a group of companies fitting this category.

Therefore, the debateable win-win or trade-off assumption underpinning the business model building must be examined before a robust model could be proposed. To be more specific, whether environmental and social activities for a particular company or industry really lead to improved economic performance need to be carefully interpreted. More interestingly, it is not simply a question of whether considering social and environmental perspectives in business decision making lead to improved economic performance; the literature has already shown that this can be achieved and have already been demonstrated by (Koh, et al, 2016), it is a matter of how, why and what types of interrelationships exist to support such business decision making leading to a win-win paradigm, vis a vis to avoid failure. In another word, what makes those assumption work and those leading organisations successful in achieving improved performance considering all triple perspective.

One opposition for such radical thinking may go as follows: if the authors succeed in understanding a reverse causality from better economic performance to social and

environmental performance, does this to justify sacrificing environmental and social welfare to economic benefits and therefore is it futile to concentrate on the social and environmental aspects. This objection rests on a common tendency to confuse an explanation of causes with a justification or acceptance of results (Diamond, 1998). Understanding is more often used to try to alter an outcome than to repeat or perpetuate it. “This is why psychologies try to understand the minds of murders and rapists, why physicians try to understand the cause of human disease. Investigators do not seek to justify murder, rape and illness. Instead, they seek to use their understanding of a chain of cause to interrupt the chain” (Diamond, 1998, pp. 28). With this critical lens in mind, the authors attempt to advance prior research by extending not only the conditions in which the win-win assumptions can be understood which test repeatability, but also the behavioural discourse in terms of potential pitfalls and sacrifices in the trade-off in order to achieve a balanced and just outcome for sustainable business decision making.

The authors interpret this equivocal results of these theories and empirical studies by recognising that not all groups of stakeholders have similar reaction to company environmental and social activities: one groups positive reaction may cause a negative response from another group, confounding these activities and impact on economic performance. For instance, a firm's practice to donate local communities in which its stores operate may be praised by their local employee but criticized by distant shareholders. Thus, a more fine-grained analysis of a particular group is required so as to fully understand this relationship. More generally, a contingency perspective of business model building that states that the economic performance required conforms to levels of environmental and social activities for certain firms at points in time should be called for. That is to say, more research into any causal relationship with moderator effect (under what circumstance) and mediating effect (in what ways) is necessary to understand this relationship and integrate into business decision-making models.

Such moderating and mediating effects in business decision-making processes are related to a board literature of corporate governance mechanisms. Though there are various definition for this concept, it generally includes a set of arrangements that “coordinate all stakeholder interests to ensure that the decision-making is more scientific and safeguards all corporate interests” (Li et al., 2014), (see also Gillan, 2006; Jensen, 2002; Zingales, 1998). These sets of arrangements can be at formal institutional level such as legal and political system (Campbell, 2007) or informal institutional level such as cultural beliefs and norms (Joyner and Payne, 2002), at firm level, such as ownership structure (Johnson and Greening, 1999), at group level such as board structure (Sanders and Carpenter, 1998), board demography (Daily et al., 2003), board social capital (Hillman and Dalziel, 2003), and at individual level, such as CEO age (Godos-Díez et al., 2011), gender (Bear et al., 2010), qualification (Abdul

and Ibrahim, 2002), experience (Bear et al., 2010) and political ideology (Chin et al., 2013). As such, the authors recommend that greater scholarly attention needs to be accorded to incorporating the multi-level corporate governance mechanism into model building and how multiple configurations of the corporate governance mechanism interact and combine to impact firm decision-making processes regarding sustainable supply chain management from the perspective of moderating and mediating effects. More generally, the authors suggest that business decision-making and corporate governance mechanism in the context of sustainable supply chain management research should employ multi-theoretical lens as reviewed above and apply sophisticated qualitative and quantitative methods such as instrumental variables and the Heckman (1979) two-stage estimation approach to enable a deeper and finer-grained analysis of the casual relationship.

3.2 The difference between academic theory and industrial practice

To answer the question, whether industry uses the performance metrics suggested by academia, the top 50 manufactures from FTSE 250 were selected for analysis. The UK has a mature policy environment towards sustainability and extensive reporting requirements that do not exist in less mature economies. Firms listed on the London Stock Exchange represent a broad spectrum of industries that function in multiple markets. By comparing the difference between the theory and practice of such a market, the authors seek to identify where gaps exist and where efforts need to be focussed from both a theoretical and practitioner perspective. The results of this study can serve as an indicator for other emerging or less developed markets of the impact of these differences on sustainability, decision-making and supply chain management across different sectors. Such differences can also provide the foundation for further academic research and the groundwork for managerial practice for both developed and developing economies.

To collect this data, multiple data sources are used, including Annual Reports (AR), Corporate Responsibility Report (CRR), and Sustainability Report (SR). This study focuses on the financial year 2015 because this provided the most up to date information for each company. The reports were download directly from the companies' website and the sample companies are presented in Table 4. The companies have been anonymized in the table and subsequent analysis.

498 Table 4: Sustainability Report Disclosure for Sample Companies

	Companies	Industry	Sustainability Report (SR)	Corporate Responsibility Report (CRR)
Aerospace, Building Materials, Automotive, Technology, Plastic, Engineering	A1	Military		Individual CRR
	A2	Aerospace, defence	SR in AR	CRR in AR
	A3	Building materials	Individual SR	CRR in AR
	A4	Technical products and services		CRR in AR
	A5	Plastic products		CRR in AR
	A6	Automotive Aerospace	SR in AR	
	A7	Building materials		CRR in AR
	A8	Technology		CRR in AR
	A9	Building materials	Mentioned in AR	
	A10	Manufacturing		CRR in AR
	A11	Packaging and Paper	Individual SR	
	A12	Aerospace, Defence, Energy, Marine		Individual CRR
	A13	Engineering		Individual CRR
	A14	Building materials	SR in AR	
Food, Beverage, Tobacco	F1	Beverages		CRR in AR
	F2	Food		Individual CRR
	F3	Tobacco	Individual SR	
	F4	Soft drink	Individual SR	
	F5	Food	Individual SR	
	F6	Food		CRR in AR
	F7	Food		CRR in AR
	F8	Tobacco		Individual CRR
	F9	Beverages	Individual SR	
	F10	Dairy Products		CRR in AR
Chemical, Medicine, Pharmacy	CH1	Pharmaceuticals	SR in AR	
	CH2	Chemicals	Individual SR	
	CH3	Pharmaceuticals		CRR in AR
	CH4	Biotechnology		CRR in AR
	CH5	Pharmaceuticals	SR in AR	
	CH6	Pharmaceuticals		Individual CRR
	CH7	pharmaceuticals		CRR in AR
	CH8	Pharmaceuticals	SR mentioned in AR	
	CH9	Medical	Individual SR	

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Table 4 Continued

Cluster	Companies	Industry	Sustainability Report (SR)	Corporate Responsibility Report (CRR)
Mining, Oil, Gas, Natural Stone	M1	Mining	Individual SR	
	M2	Mining	Individual SR (2014)	
	M3	Mining	Individual SR	
	M4	Oil and gas	Individual SR	
	M5	Chemicals		CRR in AR
	M6	Steel, Mining		CRR in AR
	M7	Mining	SR in AR	
	M8	Mining	Individual SR	
	M9	Chemicals	SR in AR	
	M10	Mining		CRR in AR
	M11	Natural stone and concrete hard landscaping	SR in AR	
	M12	Mining	SR in AR	
	M13	Oil and gas	Individual SR	
Consumer Goods	C1	Fashion	SR in AR	
	C2	Consumer	Individual SR	
	C3	Consumer goods	Individual SR	
	C4	Consumer goods	Online	CRR in AR

In the authors' sample, almost all of companies disclose the sustainability issues with around 32% of companies having separate sustainability reports and 12% having separate corporate responsibility reports. The remaining companies disclose sustainability issues in annual reports. Comparing companies disclosing sustainability issue in the annual reports, companies with individual CRR or SR reports tend to be more concerned with sustainability practice since they can reveal the sustainability issue in more details within separate reports while the companies reporting sustainability in annual reports merely put sustainability issues in strategic section with limited actionable practices. It is noteworthy that the industry with greater proportions of sustainability disclosed practices is Consumer Goods Industry with 4 out of 4 has separate sustainability reports, following by Mining, Oil and Gas, Nature Stone Industry with 7 out of 10, which is justified by heavy marketing schemes regarding sustainability from Consumer Goods industry and the resource consumption nature of Mining and Oil and Gas industries.

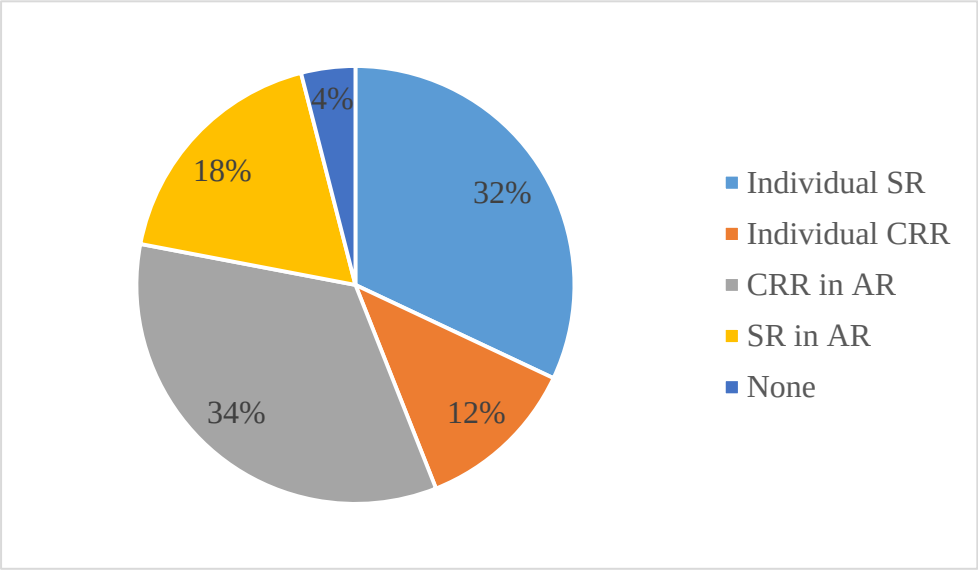

Figure 3: Distribution of companies' SR and CRR disclosure

The authors categorized the measures identified from the systematic review, Table 3, to examine, which performance metrics have been used in the company's report sustainability performance. All the companies receive a score of 0 or 1 on each of corresponding economic, environmental and social measures, 1 means the company did disclose the information otherwise it is 0.

The results presented in Table 5 show that all the metrics identified in the literature are used by at least company. Only three metrics are reported by all the firms researched, EN1, emissions reduction/climate change; S4 Health and Safety; S7, community. This prevalence is almost certainly due to statutory reporting requirements. The majority of all the metrics identified in the literature were reported on by the majority of the selected companies. It is interesting to note that three of the metrics were reported by less than half the companies. S1, Degree of job localisation was reported by only 10 firms, this perhaps reflects the multinational nature of these companies. S6, labour equity was reported by only 16 companies and E4, creating sustainability value was reported by only 20 companies. These represent the largest gaps between theory and practice within the companies researched.

In order to visualise the level of reporting against each of the perspectives of sustainability the results from Table 5 were graphed as presented in Figure 4. The x-axis and y-axis are the aggregated scores against the disclosed perspectives. The environmental and social metrics have been combined into a single scale to allow for clear comparison with the more traditional economic metrics. Each quartile of these figures represents a different profile of reporting against the three perspectives. The High-High quartile represents companies that report the majority of all three

perspectives' performance metrics. The Low – Low quartile identifies companies that report a minority of both economic, social and environmental metrics potentially identifying companies that report only to comply with statutory requirements. The High – Low quartile represents companies that reported against more than half of the environmental and social metrics but a half or less of the economic metrics, suggesting firms that are interested in demonstrating a wider commitment to sustainability. The Low – High quartile represents firms that used the majority of economic metrics but a minority of social and environmental metrics.

All four firms in the Consumer Goods industry are in the High – High quartile, reporting against the majority of both economic and social and environmental metrics, this perhaps reflects consumer pressure to demonstrate strong sustainability credentials in this sector. In the Mining, Oil and Gas and Natural Stone sector all companies report a high number of social and environmental metrics, however three slip into the High – Low quartile by reporting on only two economic metrics. In the Food, Beverage, and Tobacco industry sector companies paid attention on the social and environmental aspects, probably due to the nature of business, but nearly half of the companies disclose fewer economic measurements from the perspective of the academic literature. The picture is more mixed in both the Chemical, Medical and Pharmaceutical sector and the Aerospace, Building Materials, Automotive, Technology, Plastics and Engineering sector. This probably reflects the highly diverse nature of the companies within these two sectors.

It is heartening to note that majority of metrics identified in the academic literature are used by at least some companies within the authors' sample. In all sectors the majority of companies report against a wide range of social and environmental metrics suggesting that companies see the benefit of reporting on these or are obliged to do so for regulatory reasons. The Consumer Goods sector with all companies in the High – High quartile could be said to be most closely following the triple bottom line approach reporting extensively on all three perspectives.

The classification into the quartiles outlined above presents to both practitioners and academics a simple method for identifying the balance struck by firms in reconciling the trade offs between economic and social and environmental aspects of their decision-making.

588 Table 5: A Comparison of Measurements Employed Industry Reports and in
589 Academic Literature

Industry	**Code of companies**	**Economic**				**Environmental**						**Social**						
		E1	E2	E3	E4	EN1	EN2	EN3	EN4	EN5	EN6	S1	S2	S3	S4	S5	S6	S7
Aerospace, Building materials, Automotive, Technology, Plastic, Engineering	A1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
	A2	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	0	1
	A3	1	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1
	A4	1	1	0	0	1	1	0	0	1	0	0	1	1	1	1	0	1
	A5	1	1	0	0	1	1	1	1	1	1	0	1	1	1	0	0	1
	A6	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1
	A7	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	0	1
	A8	1	1	0	0	1	0	1	0	0	0	0	1	1	1	1	0	1
	A9	1	1	0	0	1	1	1	1	0	0	0	1	0	1	0	0	1
	A10	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1
	A11	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
	A12	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1
	A13	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
	A14	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1
Food, Beverage, Tobacco	F1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1
	F2	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	1	1
	F3	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	1
	F4	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
	F5	1	1	0	0	1	1	1	1	1	1	0	1	1	1	1	0	1
	F6	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1
	F7	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1
	F8	1	1	0	1	1	1	1	0	0	1	0	1	1	1	1	0	1
	F9	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1
	F10	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
Chemical, Medicine, Pharmacy	CH1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0	1
	CH2	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1
	CH3	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	0	1
	CH4	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	1	1
	CH5	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1
	CH6	1	1	1	1	1	1	0	0	0	0	0	1	1	1	1	0	1
	CH7	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	0	0
	CH8	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	1
	CH9	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1
Mining, Oil, Gas, Nature Stone	M1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1	1	1
	M2	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
	M3	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	0	1
	M4	1	1	0	0	1	1	1	1	1	0	0	1	1	1	0	0	1
	M5	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1
	M6	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	0	1
	M7	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
	M8	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1
	M9	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	0	1
	M10	1	1	0	0	1	1	1	1	1	0	0	1	1	1	1	0	1
	M11	1	1	0	1	1	1	1	0	0	0	0	1	1	1	1	0	1
	M12	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
	M13	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1
Consumer Goods	C1	1	1	1		1	1	1	0	1	1	1	1	1	1	1	1	1
	C2	1	1	1	0	1	1	1	0	1	1	0	1	1	1	0	0	1
	C3	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1
	C4	1	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1

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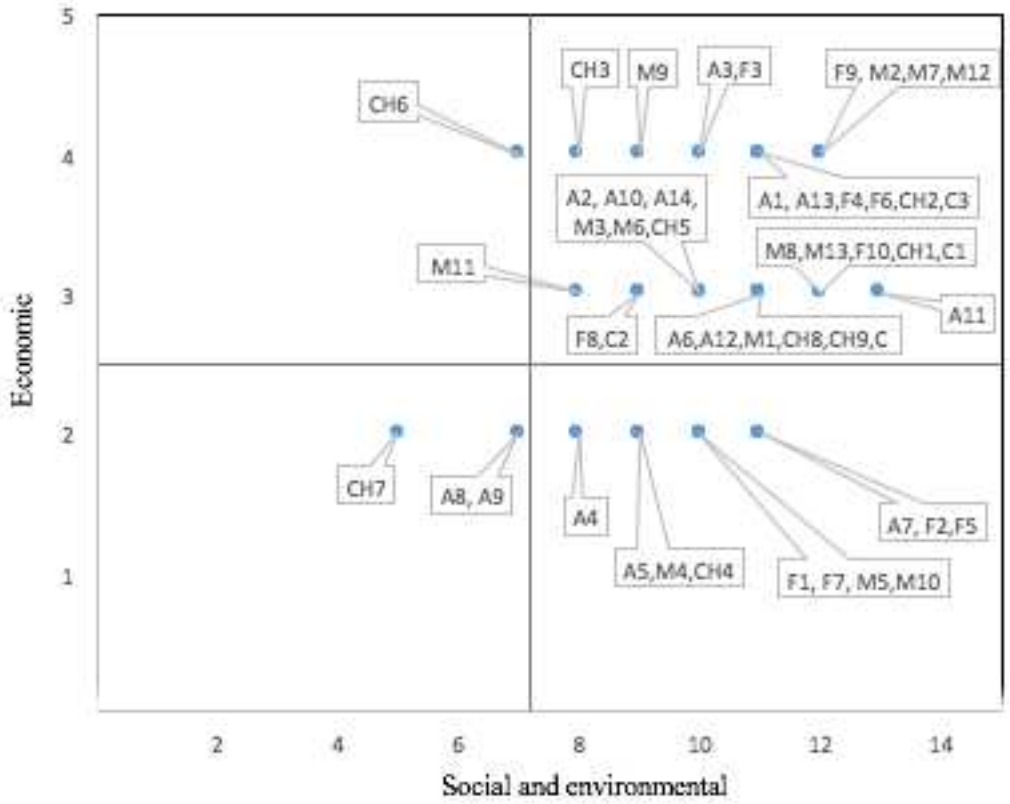

Figure 4 Distribution of performance metrics employed by industries

4. Conclusion and Future Research

To conclude, this study has provided a critical review of the status of performance metrics employed in business decision-making for sustainable supply chain management.

Adopting a rigorous systematic review methodology (Pittaway et al., 2004), this study started with 17416 articles as the baseline and they were filtered down to 1074 articles within the supply chain literature. The 1074 articles were reviewed and further filtered down to 74 articles that were analysed in depth. The review of these scientific papers were triangulated with the annual reports of the Top 50 companies in the FTSE250. This combined approach of theoretical and practical lens forms the basis of this in-depth review.

The authors found, that notwithstanding the fact that many researchers have examined social and environmental perspectives in supply chains, a gap still exist between the desirability of sustainability results and its implementation in reality for improved business decision making. This often occurs when the sustainable performance metrics in theory and practice are unclear and lack applicable governance mechanism to guide the business decision-making process. This study has tried to fill this gap by

615 providing a review of the existing knowledge to highlight the need for further
616 research in these areas.
617
618 In addition, the win-win paradigm assuming positive outcome as a result of adopting
619 sustainability practices was questioned. Consistent with the views of many
620 researchers, work has been done to understand the integration of the triple
621 perspectives, but little research can be found examining the interrelationship between
622 the triple perspectives. The authors propose future research to develop innovative
623 metrics that encourage cooperative relationships, instead of competitive relationships,
624 and to rethink traditional accounting methods and thus improve the sustainability over
625 the whole value chain.
626
627 Future research should not only consider the three perspectives in isolation, but
628 consider the interrelationship between the perspectives to provide a better
629 understanding of a balanced decision-making process in order to achieve a win-win
630 outcome or optimised trade-off choice between Triple Bottom Line (TBL)
631 sustainability factors, particularly under different corporate governance mechanism.
632 Given varied formal institutional level governance mechanisms such as legal and
633 political system and ownership structures, and informal institutional level governance
634 mechanisms, such as cultural beliefs and norms, board structure, board demography,
635 board social capital, and individual factors, such as CEO age, gender, qualification,
636 experience, and political ideology the modelling of these will be complex but if
637 successful will contribute to the development of more sustainable supply chains.

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