Sustainable Supply Chain Management: Taxonomy, Gaps, and Future Directions

Completed Research Paper

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Abstract

Over the past few decades, there have increasing concerns about the negative impacts of business activities on the environment and society. Business activities have been straining earth's rare resources, producing massive air, water, and land waste, and creating undesirable social consequences. There has been growing amount of research about sustainability as well as an increasing number of companies that show efforts to integrate sustainability into their operations. However, the accumulative literature is still maturing at the micro levels and is currently fragmented. The existing studies reside in the level of understanding the phenomenon and building theories. In particular, there is limited understanding of the role of Information Systems / Information Technologies (IS/IT) in sustainable supply chain management (SSCM). This paper aims to illustrate the landscape of SSCM literature via the provision of taxonomy of existing studies in the SSCM area. The proposed taxonomy identifies key elements of existing SSCM studies including theoretical lenses, dimensions of Triple Bottom Line, unit of analysis, context, level of analysis, research design, outcome, and IS/IT aspects. Guided by the taxonomy, we highlight a number of knowledge gaps and identify future research directions.

Keywords: Sustainable Supply Chain Management, Taxonomy, Gaps, Future Directions

Introduction

There is no single company that can operate and survives by itself. It depends on a network of interconnected businesses that aims to provide products and services to end customer. The management of this network is called supply chain management (Cetinkaya et al. 2011). Supply chain management consists of storage and movement of raw materials, work in process inventory, and finished goods from point of origin to point of consumption. The movement of products and services to where they are most valued are mostly driven by economic goals. However, there are also the environment and social implications. For example, transporting goods contributes to pollution and congestion. Food production requires earth's rare resources: land and water. Additionally, the economic objective to obtain profit as much as possible by reducing cost may potentially conflict with worker's right in the form of underpayment, inadequate working condition or child labor. There is growing recognition of the importance of efficient and effective supply chain by considering negative impacts to the environment and society. This resulted in growing pressure from the governments, customers, shareholders, and other parties for the supply chain to be sustainable (Morali and Searcy 2012; Gopal and Thakkar 2016)).

There are several other factors driving the emergence of sustainability practices. As customer becoming more aware of sustainability issues, companies feel the need to have a positive image by engaging in environmentally and socially responsible behaviour (Morali and Searcy 2012; McPhee 2014). They also want to discourage the government to introduce other costly regulations related with sustainability (Porter and Linde 1995). This leads to a growing number of studies in the area of sustainable supply chain management (SSCM) as well as an increasing number of companies that show efforts to integrate sustainability into their activities. However, the accumulative literature is still maturing at the micro levels. The existing literature resides in the level of understanding the phenomenon and building theories. Various aspects of the supply chain have been analysed, some by using theories adapted from other disciplines. In particular, limited studies have given adequate attention to the IS/IT aspect within the SSCM.

This study presents a comprehensive taxonomy of SSCM literature and serves as an enhancement to previous literature-based studies (e.g. Seuring and Müller 2008; Carter and Rogers 2008; Ashby et al. 2012). Both Seuring and Müller (2008) and Carter and Rogers (2008) include papers published until 2007 only. Ashby et al. (2012) provide a more comprehensive coverage of the literature published between 1983 and 2011. While these previous studies have offered useful insights into the development of studies in the SSCM area, a more updated review is necessary since the SSCM studies are growing quite substantially in the last few years. As shown in Figure 1, our review indicates that 65% of papers included in this paper were published after 2011. Furthermore, none of these previous studies presented comprehensive taxonomy covering all key aspects in the SSCM literature neither did they consider the IT/IS aspect. This paper, therefore, enhances those previous studies by including papers that have not been covered previously and proposing a more comprehensive taxonomy to illustrate the current landscape of SSCM literature and to improve the understanding of existing SSCM studies. Guided by the proposed taxonomy, the knowledge gaps have been identified and future directions are proposed.

In the next section, we briefly define the term SSCM and then describe the methodology used in our literature search and analysis. Then we present and explain the SSCM taxonomy. Finally, we outline a number of gaps identified from our literature analysis, propose recommendation for future research and conclude the paper.

Sustainable Supply Chain Management (SSCM)

There are various definitions of sustainability in supply chain management. Most of them were derived from sustainability development concept by World Commission on Environment and Development as 'development that meets the needs of the present without compromising the ability of future generations to meet their needs' (Linton et al. 2007). (Carter and Rogers 2008) proposed another definition of sustainability in SCM as "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving long-term economic performance."

Definition from Carter and Rogers (2008) addresses social, environmental, and economic goals in the business processes. This concept is well known as Triple Bottom Line which is first coined by John

Elkington (1999). The Triple Bottom Line states that business should consider three dimensions in their business processes including profit, people, and the planet. Profit is the traditional measures of profit and loss in business, while planet and people relate to how environmentally and socially responsible one business is. It is the goal of sustainability concept to simultaneously integrate social, environment, and economic in business (Gold et al. 2009).

Methodology

This study followed systematic literature review approach proposed by Webster and Watson (2002). The literature review process started with searching in the leading journals. This methodology was chosen due to its generalizability which can be applied to a systematic literature review in any field. The complete steps are as follow:

1. Identifying leading journals in information systems and supply chain management.
2. Conducting the search by using "Sustainable Supply Chain Management", as a keyword.
3. From scanning the papers retrieved from the previous step, the additional keywords were collected. They were: supply chain sustainability, triple bottom line, green supply chain, corporate social responsibility, environmental management, social sustainability, resource-based view, Green IS/IT and Information Systems/Information Technology. The accumulated search from this set of keywords in the aforementioned journals resulted in 3879 papers.
4. The next step is setting the criteria for inclusion of the papers. The criteria include those papers that 1) investigate SSCM in organisational context; 2) have a management rather than technical or political focus; and 3) are written in English. Papers which do not meet the criteria were excluded.
5. The next step was reading the abstracts of the papers. This step filtered the papers to 35 relevant papers.
6. The number of relevant papers was considered small so that we expanded the search process by combining searching in individual journals with research databases.
7. We read the abstracts and applied the inclusion criteria to select relevant papers. As Webster et al. (2002) suggested, the review stopped when no new concepts were found. The total relevant papers were 97. These papers were read and analysed thoroughly.

The distribution of publishing year of the papers can be seen in Figure 1. As shown in the figure, the number of papers in SSCM is increasing which indicates the growing interest in this area.

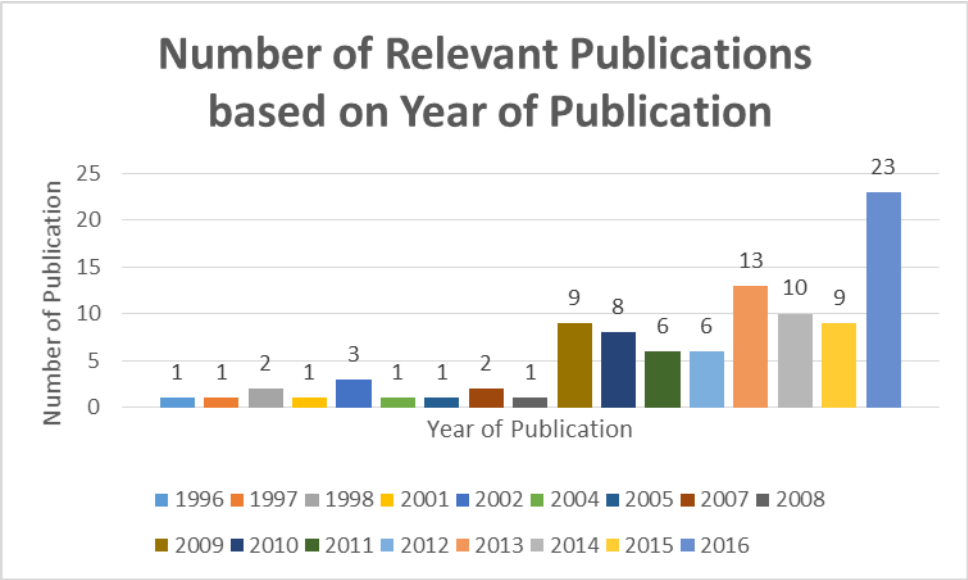

Figure 1. Number of Relevant Papers by Years

Taxonomy

The first level in the taxonomy of SSCM studies consists of theoretical lenses, dimensions of Triple Bottom Line, units of analysis, contexts, levels of analysis, strands, outcomes, and IS/IT aspects. The complete taxonomy can be seen in Figure 2.

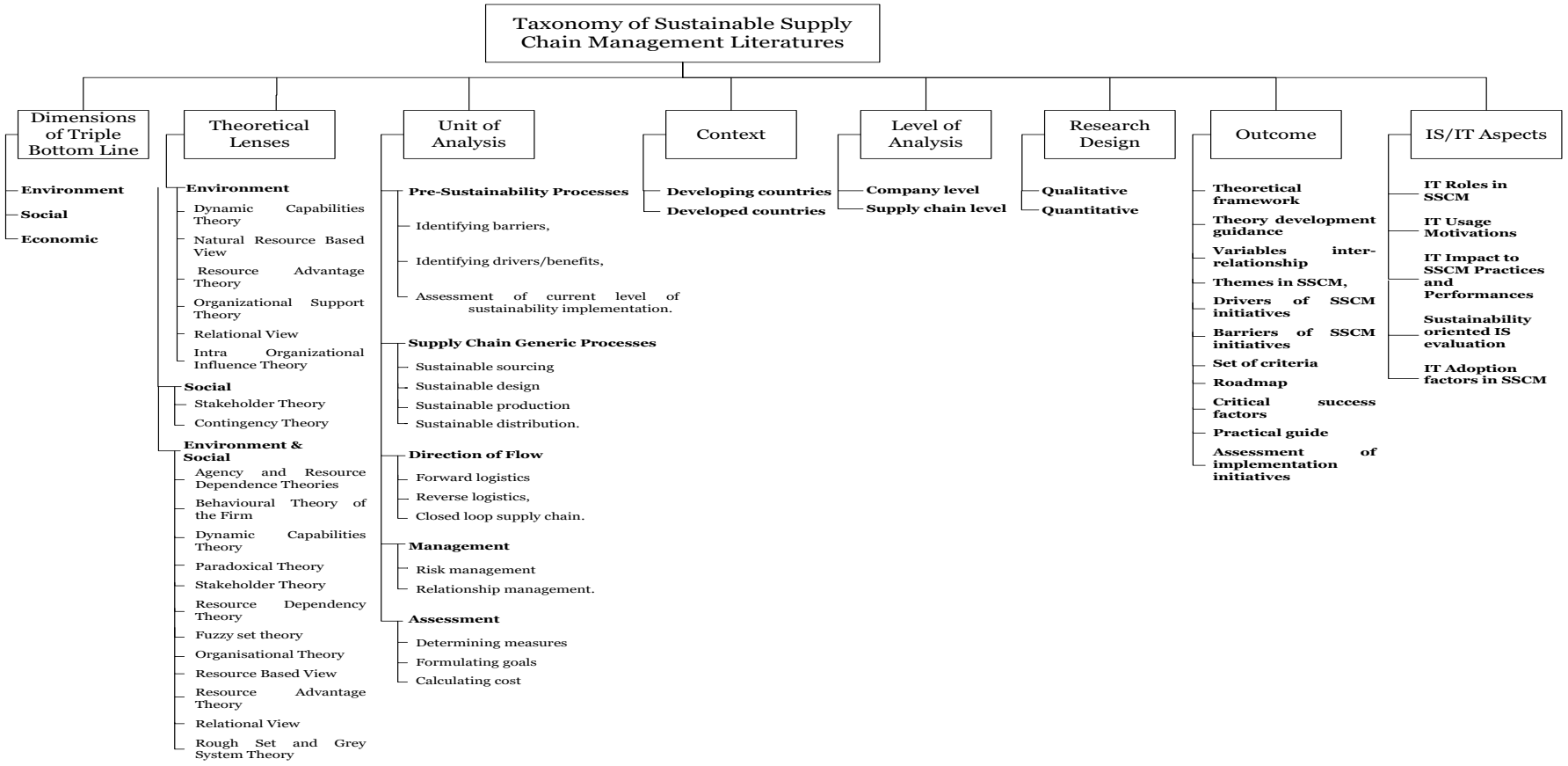

Figure 2. Taxonomy of Sustainable Supply Chain Management Literature

❖ *Dimensions of Triple Bottom Line*

The economic dimension is inherently embedded in most paper. Consequently, papers in SSCM were either emphasized on environment (Cantor et al. 2012; Carter et al. 1998; Golicic and Smith 2013; Green et al. 1996; Hassan et al. 2016; Nair et al. 2016; Pagell et al. 2004; Wichmann et al. 2016); social dimension (Mani et al. 2016; Rodriguez et al. 2016; Thornton et al. 2013); or both (Matthews et al. 2013; Pagell and Wu 2009). Mostly, papers focused on environment aspect of the TBL while social aspect was discussed in a much smaller number of papers.

❖ *Theoretical Lenses*

Various theoretical lenses have been used in analysing SSCM phenomenon. Some of them were used to analyse the environment dimension of the TBL while a very limited number of literature investigate theory usage in examining social dimension of the TBL. Several of them used the word "sustainability" without specifically mentioned which dimension they were referring to when using the aforementioned word. Following the same justification as in the Dimensions of TBL section, this paper distinguishes the literature based on its focus on environment, social, or both.

The recap of theories used in the SSCM realm can be seen in Table 1. It consists of the theoretical lenses, along with references in papers and the focus in TBL dimensions. Based on this table, we can conclude that Stakeholder theory is the most utilised theory used to address both social and environmental aspects in the SSCM field.

Table 1. Various Theoretical Lenses used in SSCM Literature

TBL Dimensions	**Theoretical Lenses**	**References**
Environment	Dynamic Capabilities Theory	(Wong 2013; Reuter and Foestl 2010)
	Natural Resource Based View	(Masoumik et al. 2014)
	Resource Advantage Theory	(Golicic and Smith 2013
	Organizational Support Theory	(Cantor et al. 2012)
	Relational View	(Theiben et al. 2009)
	Intra-Organizational Influence Theory	(Wichmann et al. 2016
Social	Stakeholder Theory, Contingency Theory	(Thornton et al. 2013)
Environment and social	Agency and Resource Dependence Theories	Hajmohammad and Vachon 2012
	Behavioural Theory of the Firm	(Kirchoff et al. 2016; Pagell and Wu 2009);
	Dynamic Capabilities Theory	(Foerstl et al. 2015)
	Paradoxical Theory	(Matthews et al. 2013)
	Stakeholder Theory	(Thornton et al. 2013; Busse 2010; Montabon and Pagell 2016; Markman and Krause 2016);
	Resource Dependency Theory	(Foerstl et al. 2015)
	Fuzzy Set Theory	(Govindan et al. 2013
	Organisational Theory	(Gopal and Thakkar 2016)
	Resource Based View	(Pullman et al. 2009; Paulraj 2011)
	Resource Advantage Theory	(Paulraj 2011)
	Relational View	(Paulraj 2011
	Rough Set and Grey System Theory	(Bai and Sarkis 2010)

❖ *Units of Analysis*

- **Pre-Sustainability Processes**

Pre-sustainability processes are set of activities which take place before the actual implementation of sustainability practices. For examples, some studies focus on identifying barriers (Carter and Dresner 2001; Rauer and Kaufmann 2015); identifying drivers/benefits (Rath 2013; Vijayan et al. 2014); and assessment of current level of sustainability implementation (Ahmed and Sundaram 2012).

- **Supply Chain Generic Processes**

Supply chain generic processes consist of sustainable sourcing, sustainable design, sustainable production, and sustainable distribution (Singhry 2015). One widely researched area in sustainable sourcing is supplier selection (Bai and Sarkis 2010).

- **Directions of Flow**

The direction of flow is defined by the direction of goods, services, and information throughout the supply chain. The literature is divided into three directions, namely, forward logistics, reverse logistics (Luitel et al. 2014; Vijayan et al. 2014), and both directions referred to as closed loop supply chain (Govindan et al. 2015; Koppius et al. 2014; Yu 2016). Forward logistics is the most common topic in this theme. Thus, unless mentioned otherwise, most papers reviewed were examining forward logistics.

- **Management**

The management aspect commonly discussed in the SSCM literature are risk management (Tate et al. 2010) and relationship management (Bansal and Mcknight 2009). Relationship management received wide attention since sustainability requires close relationship and collaboration with other members of supply chain.

- **Assessment**

Assessment aspect in SSCM literature consists of measures, goals, and cost. Several studies discussed how to measure sustainability practices and emphasized on developing goals that consider environmental and social besides economic performance (Carter et al. 1998). Some other literature also discussed the cost of conducting sustainability practices (Pullman et al. 2009).

❖ *Contexts*

The studies of sustainability in SCM have been conducted in both developing and developed countries. The sustainability initiatives are dominantly conducted in developed countries such as Canada (Bansal and Mcknight 2009; Morali and Searcy 2012); USA (Pagell et al. 2004; Pullman et al. 2009; Thornton et al. 2013; Wichmann et al. 2016); German (Carter et al. 1998); United Kingdom (Green et al. 1996; Preuss 2005); and Netherlands (Bommel 2011). Studies about sustainability in developing countries are small in number. Several examples are the United Arab Emirates and China (Pagell et al. 2004; Thornton et al. 2013; Zhu and Sarkis 2007); Ecuador (Rodriguez et al. 2016); Malaysia (Hassan et al. 2016; Vijayan et al. 2014; Zakaria et al. 2016); and India (Gopal and Thakkar 2016; Kumar and Rahman 2016; Mani et al. 2016). Overall, the implementation level in developing countries is minimum just for the sake of regulation compliance while companies in developed countries have the greater initiative to move beyond that.

❖ *Levels of analysis*

Studies in SSCM have two levels of analysis, namely: company level (Golicic and Smith 2013) and supply chain level (Foerstl et al. 2015). In the company level, studies focused on internal processes and motivations in focal companies. The supply chain level studies assessed sustainability across the supply chain and mainly studied how the focal companies can persuade their suppliers and customers to implement sustainability practices (Gimenez et al. 2012). Other studies focused on collaboration among supply chain members to achieve sustainability (Busse 2010; Theiben et al. 2009).

❖ *Research Designs*

Studies in SSCM mostly employed qualitative research design via interview, observation, and document analysis (Kirchoff et al. 2016). Few papers exist that employed quantitative research design (Zhu and Sarkis 2007). One paper utilized mixed methods approach (Pullman et al. 2009).

❖ *Outcomes*

Most of the outcomes of the papers in SSCM literature are theoretical in nature. For examples, (Rodriguez et al. (2016) proposed a theoretical framework to identify resources needed for supplier development in enhancing social sustainability. Matthews et al. (2013) suggested alternative theory development in SSCM by problematizing current assumptions in SSCM, while Zhu and Sarkis (2007) investigated the relationship between institutional pressures and green supply chain practices and performance. Other studies addressed different aspects such as themes in SSCM (Tate et al. 2010), drivers and barriers of SSCM initiatives (Foerstl et al. 2015), a set of criteria to measure sustainability performance of a supplier (Kannan and Tan 2002), and a roadmap to guide transformation towards sustainable business management (Ahmed and Sundaram 2012). A very limited papers proposed theoretical contribution and then validated it by empirical study. One example is a study by (Ageron et al. 2012) that proposed a theoretical framework in sustainable supply management and validated it via questionnaires sent to French companies. There are other few papers that offer practical guide and assessment of implementation initiatives (Jefferson et al. 2014; McPhee 2014).

❖ *IS/IT Aspects*

Most of the papers in SSCM literature only use IS/IT as a software for research data analysis, such as Lisrel (Paulraj 2011). Only small number of studies have explored IS/IT as the focal point in the SSCM realm. A number of them studied the roles of IS/IT in SSCM, which can be classified based on (Dao et al. 2011) that consists of Automate, Informate, Transform, and Infrastructure. The most significant role of IS/IT identified is to provide information sharing capability among supply chain partners to ensure traceability and transparency in either forward or reverse logistics (Informate) (Schniederjans and Hales 2016). Another prominent topic of IS/IT in SSCM is the impact of IS/IT to SSCM practices and performances. All literature found are showing positive impact of IT/IS to SSCM practices and performances, in terms of improved collaboration among supply chain partners (Schniederjans and Hales 2016), enhanced sustainability capabilities (Dao et al. 2011), sustained economic growth and reduced GHG emissions (Dedrick 2010), and various operational benefits that ultimately lead to better economic and environment performances (Schniederjans and Hales 2016). In addition, Piotrowicz and Cuthbertson (2009) recommend organizations to include sustainability objectives in IS evaluation while Tong et al. (2012) investigated factors that affect the IS/IT adoption in SSCM practices.

Gaps in SSCM Literature and Future Direction

In general, current research in SSCM is focused on understanding the emerging phenomenon of sustainable supply chains management and developing theory while not informing practice significantly. There is a lack of research in term of tangible outputs such as model or framework to inform sustainable practices. There is also a lack of research explaining how IT can contribute to sustainability effort in SCM. This section outlines the gaps that exist in each category of the taxonomy along with future directions about how to address these gaps. Identifying gaps and recommending future directions are crucial to guide interest in researching this area.

❖ *Dimensions of TBL*

Compared to environmental dimension, social dimension is significantly limited. Numerous studies adopted Triple Bottom Line as a measurement for sustainability while only environment dimension is measured. Even when both were discussed, the emphasis was on environmental rather than social practices/principles. Studies on social dimension mostly focused on specific practices or areas rather than a comprehensive view. This is due to the ambiguity to measure the benefits of the social dimension while environment dimension provides more tangible benefits. Even in the case of managers who acknowledge the relevance of considering social aspect, many of them have little to no knowledge about how to materialise social aspect in various activities (Maignan and Hillebrand

2002).

The literature in SSCM has been measuring the relationship between environmental and economy and between social and economy dimensions separately and calculating the effects on different scales. Far too little attention has been paid to the interaction between environment and social as well as the inter-relationship among the three dimensions. There is an indication of synergy between these two important dimensions of sustainability although there is no indication on how to achieve it in the key areas of supply chain. The analysis of the link between both environment and social dimensions to firm's performance has been relatively scanty.

More work is required to explore how to integrate all three dimensions in measuring sustainability in SCM. Furthermore, future research should aim to explore social dimension including how to support and measure it. More research is also required to analyse the link between environmental and social performance to economic performance.

❖ *Theoretical Lenses*

Various theoretical lenses have been employed in analysing sustainability in SCM. Each theory was used based on certain justifications. However, there is no comparison about all those theories used in SSCM. Future studies analysing and comparing different theories used in SSCM could lead to better use of those theories. Furthermore, since SSCM is multidisciplinary in nature, employing theories from more diverse fields is a promising area of interest.

❖ *Units of Analysis*

A supply chain consists of numerous activities and processes. Some activities and processes have received significant attention including sustainable supplier selection and waste reduce/reuse. However, certain aspects have received limited to none attention. In particular, the cradle to cradle concept in SSCM has not been explored much. This concept requires companies to take responsibility to the full life cycles of their products which is also called closed loop supply chain. Unfortunately, only a handful studies (e.g Zhu et al. (2008) and Govindan et al. (2015)) address closed loop supply chain concept. There is also a deficiency of research that investigates the alignment of various supply chain functions and strategies towards sustainability objectives as the majority of studies focus on sustainability in one or several supply chain functions. Future research should aim to address these areas. Future research should aim to develop benchmarks for sustainability in the supply chain, develop a comprehensive model of closed loop supply chain that can inform practice, as well as the alignment of various supply chain functions with sustainability objectives.

❖ *Contexts*

The number of SSCM studies that consider developed countries as the context is way higher than those in developing countries. Future studies could be taken in developing sustainable initiatives at the national level by considering unique features of each country. Future research to compare the implementation of SSCM in both developed and developing countries would be useful to propose recommendations about how each country can learn from the others to propel their SSCM implementation level.

❖ *Levels of Analysis*

One company can only be as sustainable as its supply chain. In contrast, the research to date has tended to focus on analysing sustainability in the boundary of one focal company. This limited their ability to examine the sustainability of the entire supply chain. Furthermore, many companies marketed themselves as environmentally proactive by simply having environmental management systems (EMS). However, this is not entirely true, since EMS are often limited within the organizational boundaries, instead of the whole supply chain (Ashby et al. 2012). More information on the perspective of the entire supply chain would help us establish a greater degree of accuracy on this matter. This is important since the sustainability of a company depends on its supply chain.

❖ *Research Designs*

The majority of the existing research utilised qualitative approach. More quantitative studies in the

themes of decision-making approaches, optimisation, and risk analysis have potential to provide a novel contribution to the field. The emergent phenomena such as big data analytics also have possibilities to unleash new potential.

- ***Outcomes***

No studies are found that provide a detailed benchmark on sustainability initiatives. Organisations evaluate their sustainability practices internally but are not able to compare their performance to competitors nor to conclude how close they are to being truly sustainable. At the organizational levels, the assessment and implementation of sustainability were carried out without benchmark which led to the absence of literature in this area. A comprehensive benchmark can bring high impact in this area.

- ***IS/IT Aspects***

The role of IS/IT in affecting and enabling sustainability in supply chain management remains under-explored. To the best of our knowledge, there is no study investigating how to support the formulation, execution, and monitoring the sustainability implementation, nor there is an IS or IT that explore how to combine the environment and social dimensions in supply chains. There is also not enough empirical evidence to generalize the effect of IT/IS in SSCM.

Further investigation on examining and shaping the role of IT in the formulation, communication, execution, monitoring, and controlling the sustainable practices in business is strongly recommended. Considerably, more work will need to be done to determine how IT can support the social dimension in business practices. Further studies investigating available technologies in implementing sustainability, for instances, the use of big data, internet of things, and E-Commerce would be very useful. The use of various decision-making tool and optimisation model could also be beneficial in this field. Further investigation into various IS/IT aspects in SSCM is strongly recommended.

Conclusions

The separation of sustainability from SCM, in general, implying that business and research are disregarding environment and social consequences of their operations and at worst, engaging in non-sustainable or irresponsible behaviours. Supply chain must be managed based on goals and concerns beyond the financial bottom line. This requires changes in supply chain management by omitting the separation of sustainability from SCM practices and engaging in sustainability in day to day basis as well as long-term commitment. This change requires extensive and comprehensive research, and first of all, knowledge about what has been done in the field and pointer to the right direction to move further. This study aims to draw the landscape of ongoing literature by constructing a comprehensive taxonomy of literature in the SSCM realm. The proposed taxonomy consists of attributes such as theoretical lenses, dimensions of Triple Bottom Line, unit of analysis, context, level of analysis, research design, outcome, and IS/IT aspects. In each of these themes, gaps are identified and future directions are presented. Other studies from different fields (for example Human Resources, Environment, or Management) could offer different perspectives. Nevertheless, we believe this study still make a foundational contribution as the latest taxonomy of in SSCM literature as well as providing guidelines for future research in this potential area.

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