Towards Sustainable Supply Chain Management in Agricultural Sector

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Abstract

In recent years several contributions have been provided concerning sustainable supply chain management (SSCM), ranging from theoretical analysis of the topic to practical applications across several industrial sectors. The scope of SSCM has been extended towards various industries and supply chain, not only domestic supply chain but also global supply chain. Transnational companies play important roles in global supply chain: they create business opportunities and entrepreneurial activities along the supply chain but they also arise several issues. Environmental damage, food safety concern, social and sustainability issues have and still a major topic for both domestic and global supply chain management. Many of these issues are driven by external factor such as standards and regulations, as well as customer and market demand.

Even if SSCM has been a rather discussed topic in the last few years, few contributions are available for sustainable supply chain management in the agricultural sector. This paper is aimed at providing an extensive literature review on the practice of supply chain management and sustainability in agriculture sectors, in order to identify the extent of the discipline in this field and to highlight area that need further research.

Keywords : \textit{Sustainable Supply Chain Management, Literature Review, Agriculture}

I. Introduction

Globalization and internationalization of companies led to investments in different parts of the world due to various reasons such as low cost labor, low cost materials, relaxed regulations, strategic locations, partnership and alliance, and access to raw materials. Companies extend their boundaries according to the incentives and infrastructures where the investments are made. Besides that, strategic location and time differences also account for deciding investments in certain areas. As part of operations, supply chain management holds an important position in maintaining the flow of the materials to the processing units up to supplying finished goods to the end consumer (Chopra, 2000, 2004, 2007). As a consequence of globalization, global supply chains are typically characterized by greater use of transportation with obvious implications on the environment and induce local behaviors that sometimes may not be socially sustainable (e.g., use of low cost labors). These factors are urging stakeholders to take sustainability into account due to both rising concern of national and international regulations and an ever growing attention of end consumers of the implications on sustainability.

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In the last decade, there have been raising concerns on environmental damage, depleted resources, exploitation of child labor, endangered species, and global warming. These concerns have shifted the traditional way of managing manufacturing and operations in general of most firms in the world so to become more concerned with the triple bottom line (Elkington 1998, 2004), thus guaranteeing both economic, social and environment sustainability of operations. In response to this growing concern, the number of papers that discuss sustainability has increased in the last decade by quintuple-fold (Linton et.al 2007).

Even if growing attention has been paid on sustainable supply chain management in different sectors, limited contributions has been considered especially for agricultural sector. The aim of this paper is to provide a comprehensive literature review on sustainable supply chain management in agriculture so to identify the extent of the discipline in this field and to highlight areas that needs further research.

The article consists of six sections, where in introduction we discussed some academic background that reinforced our proposed research. In the next section, the research methodology and objective detailed. The third and fourth sections provide extensive literature review on the seminal topic of sustainable supply chain management and its relationship with agriculture and development, while sections five and six are dedicated to the discussion and further development of the paper.

II. Research Methodology

To provide an extensive literature review, we must understand the concept of literature review itself. A broad definition provided by Shuttleworth (2009) describes literature review as a critical and in-depth evaluation of previous research. Another generic definition of literature review is both a summary and explanation of the complete and current state of knowledge on a limited topic in the academic and journal articles. The reasons underlying for the utilization of literature review are various. Bourner (1996) explains that literature review aims to:

- Identify gaps in the existing literatures
- Avoid reinventing the wheel
- Carry on from where other have already reached
- Identify other people working in the same area
- Increase breadth of knowledge in the subjected area
- Identify seminal works in the certain research area
- Provide intellectual context of own work
- Identify opposing views
- Identify methods relevant to the work

To serve our purpose, we limited the literature review to the supply chain on agriculture products. We believe that the agricultural supply chain play an important role in understanding the concept of sustainable supply chain as agricultural supply chain employs numerous actors in the chains from farmers to consumers with significant impact to economic, social and environmental performances. To broaden our research, we conducted the literature review based
on two approaches: thematic approach and coverage approach. According to thematic approach, contributions were identified and analyzed according to specific topic they address.

By means of coverage analysis, we show the evolution of the topics over time (i.e. longitudinal analysis), in terms of research methodologies applied and in terms of assessment. In the longitudinal analysis, we illustrate the numbers of articles available from the early stage of discussion up to recent years. We also show the extent to which different scientific disciplines have addressed the topics. With this approach, we aim to provide an overall picture of how research evolved and what are the current research trends. Secondly, by analyzing the adopted we aim at providing readers with a complete overview of what previous researchers have considered and carried out.

III. Sustainability: An Overview

3.1. Sustainability and its extension

Sustainability has been a very discussed and debated topic. Overtime literature has addressed sustainability under different perspectives. One earlier and most quoted interpretation of ‘sustainability’ is from the perspective of ‘sustainable development’ in the sense that of “[development that] meets the needs of present without compromising the ability of future generations to meet their own needs” (WECD, 1987). Starik and Rands (1995) define sustainability as […] the ability of one or more entities, either individually or collectively, to exist and flourish (either unchanged or in evolved terms) for lengthy timeframes, in such a manner that the existence and flourishing of other collectivities of entities is permitted at related levels and in related systems. Shrivastava (1995) describe sustainability as the potential for reducing long – term risk associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management. Another concept came from Hoexter (2006) refers sustainability as issues in balancing exchange between humanity and nature, holistic systems thinking, long time horizon / responsible for the future, efficiency / conservation, fairness / equity, biomimicry and biophilia, and linking and re – valuing the local and global. Epstein (2008) mentions that sustainability must be an integral component of corporate strategy where sustainability strategies should be supported by proper management control, performance measurement and reward systems. This means that sustainability can create financial value for a corporation through enhanced revenues – e.g. thanks to increased sales due to improved corporate reputation for being sustainable, and lower cost – e.g. due to process improvements and a decrease in regulatory fines (Epstein (2008) pp. 22).

From the seminal definition provided by OECD, sustainability is also widely associated the implementation or fulfillment of the three pillars of sustainable development or the so-called Triple-Bottom-Line (3BL) with the emphasis on environmental, social and economical performance for the improvement of quality of life of human being. Similar to OECD, Sustainable Seattle provides definition of sustainability as long term, cultural, economic and environmental health and vitality, while World Business Council of Sustainable Development (WBCSD) pointed out that sustainable development involves the simultaneous pursuit of economic prosperity, environmental quality and social equity where companies aiming for sustainability need to perform not against single, financial bottom line but against triple bottom
line. Elkington (1998, 2004) pointed out the concept of sustainability as the intersection of the three components (Fig. 1) - the term itself has been enriched with different concepts: the *five capital framework* (natural, social, human, manufacturing and financial) (Parkin et. al. 2000); *risk management, transparency, strategy and culture* (Elkington, 1998; Shrivastava, 1995; Starik and Rands, 1995; Sarkis, 2001; Epstein and Roy, 2003) and *ethics, governance, business relationships, community involvement / economic development, value of product and services, and employment practices* (Epstein and Roy, 2003; Stokes and Tohamy, 2009). Though contributions mentioning the concept of 3BL are flourishing, yet the integration between the three dimensions is not fully accomplished. Literatures shows the lack of discussion concerning the interaction between the three components in triple bottom line where it is evident that research is still dominated by green / environmental issues (Seuring and Muller, 2008 pp. 1699). This reflects also in terms of limited attention towards sustainable supply chain not limiting to environmental issues.

![Fig. 1. Sustainability as intersection of 3BL performance](image)

Although it seems that most of academicians agreed on concept of the 3BL, still sustainability remains debatable topic and needs further development. Earlier, Costanza and Patten (1995) interpreted sustainability as the *predictions* basing on today’s action to implemented in the future and hopes to reach sustainability, i.e keeping the harvest rates below rates of natural renewal should lead to sustainable extraction system. Another example comes from Sutton (2000): sustainability is not about the integration of social, ecological and economical issues nor is it about widespread consultation, nor is it about improving quality of life but it is about sustaining something, […] however, it is not possible to achieve a desired level of ecological or social or economical sustainability (separately) without achieving at least a basic level of all three forms of sustainability, simultaneously. Another different interpretation of sustainability provided by Milne, Kearins and Walton (2006) stating that sustainability as a journey evokes images of organizational adaption, learning, progress and a movement away from a business-as-usual practices.
In this work, we consider the perspective of sustainability according to the mainstream of 3BL, thus by being sustainable, companies or organizations can and will gain higher economical performance and sustain its position in the competition by practicing and managing both social and environmental performances in daily operations.

3.2. Interacting Agriculture and (Sustainable) Development

The agricultural sector provides an important contribution in the development of a country or a region due to its contribution in both economic and environmental development. Agricultural products become main goods in daily activities, sources of employment for millions of people across the globe and it accounts as a key element in elevating countries out of poverty (United Nations, Millennium Development Goals, 2000). Furthermore, Food and Agriculture Organization (FAO) in 1994 explains the importance of agriculture for sustainable development. They state that Sustainable development is the management and conservation of the natural resource base and orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, preserved water, plant and animal genetic resources, is environmentally non-degrading, technical appropriate, economical viable and socially acceptable. A more environmentally orientation interpretation comes from the United Nation of Environmental Protection (UNEP) which defines sustainable development as the development which improves people’s quality of life, within the carrying capacity of earth’s life support system. This definition is also supported by the World Conservation Union (IUCN). Yet, the interpretation sometimes is mixed with sustainable growth and sustainable use where all terms are different.

As the backbone of the development in most of the developing countries, agriculture holds important roles in deciding the stability of the economy of the country itself. Statistical figures show that 70% of the world population lives in rural areas and only 38% of the land in the world is used for agriculture cultivation, depleting from time to time, due to industrial expansion and human population growth (World Bank, 2010). Statistical data also shows that, consumption of food and agricultural products are fluctuated last decades. The typical annual rate of consumption during the period of 1990 – 2007 is ranging 0.39% to 0.67% across the globe, excluding food crises period (1995 – 2002) where the consumption recorded negative growth of -0.45% (FAO Database 2010).

Harwood (1990) defines sustainable agriculture as a system that can evolve indefinitely toward greater human utility, greater efficiency of resource use and a balance with environment which is favorable to humans and most of species. Based on this explanation, we can interpret that the adoption of sustainable agriculture will create enough impact for humanistic development. Another interpretation of sustainable agriculture comes from Conway and Barbier (1990) that describe sustainable agriculture as the ability to maintain productivity, whether we are considering a field, farm or nation while Arinquez et al, (2007) mentioned that agriculture is the key for rural development of the world. Similarly to Conway and Barbier, Kasem and Thapa (2010) mention the importance of sustainable agriculture development in country level as the policy itself proves to be the crucial component for the economic growth of the country. On the organizational level, Lang (2010) shows that in reaction to the increasing sales in organic food
by 20 – 25% during the 1996 – 2001 period which is consider ever-expanding\textsuperscript{[3]}, the Community Supported Agriculture (CSA) became very active in producing organic agricultural products by practicing sustainable agriculture in the daily operations. From the environmental point of view, the practice of sustainable agriculture is essential in preserving biodiversity on the planet. Ronald and Adamchak (2010) mentioned that there are two things that can be implemented in keeping growing population feed in an ecological manner – genetic engineering and organic farming. Ronald and Adamchak (2010) specify organic farming, which in this case is considered as the sustainable agriculture, as an ecological based farming method that avoids or largely excludes the use of synthetic fertilizers and pesticides. As much as possible, organic farmers rely on crop rotation, covers crop, compost and mechanical cultivation to maintain soil productivity and fertility, to supply plant nutrients, and to control weeds, insects and other pests. Similarly, Horrigan et. al (2002) that mention the importance of sustainable agriculture for environmental, economic profitability and social economic equity for the society. Marsden et. al (1999) mention that sustainable agriculture and sustainable supply chain also play an important role in rural development, while Reganold et al (1990) showed that conventional farming methods often increase the rates of erosion by depleting the organic matter in soil and thus, sustainable agriculture practices can help to preserve soil structure. Smith (2008) also stresses the importance in improving sustainability in mainstream agriculture and international supply chain.

To increase market share and to address the problem for food safety and arising concern of social and environmental issues, nowadays firms that work in agriculture sector are aware that the implementation of sustainability is inevitable. The volume of the sustainable agriculture products has increase overtime. The percentage of consumers, with typical European consumer, also varies over time, shows some significant differences between organic consumers and conventional consumers whereas the numbers of organic products tends to increase due to the fact of increasing health awareness from consumer perspective (Knickel et al. 2002). Moreover, Knickel et. al (2002) also shows that consumer preference has shifted into healthier products produced by sustainable agriculture that come from sustainable supply chain (pp.11).

IV. Towards Sustainable Supply Chain Management in Agricultural Sector

4.1. Thematic Approach

In this section, attention is focused on literature’s coverage on how the topic developed in the sustainable supply chain area. With this approach, we expect to identify the current research mainstream as a baseline for understanding the whole picture. We divided the section into two parts; the first one discusses the sustainable supply chain management from different points of view and within various sectors. Then, in the second part, we conduct a literature review on sustainable agricultural supply chain. Articles were collected using the specific keywords. To make it more specific, we limit the keyword of finding up to \textit{agricultural supply chain}, \textit{agricultural supply chain and sustainable development}, and \textit{sustainable agricultural supply chain} and agreed to make this as topics of discussion. With this approach, we hope to find some interlink between literatures that connect our interests.
4.1.1. Sustainable Supply Chain Management (SSCM)

Recent contributions have focused attention on the relationship between sustainability and supply chain management (leading to the definition of SSCM). There is wide interpretation and definition on SSCM, thus we take into account the perspective of Carter and Rogers (2008), by defining SSCM 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 process for improving the long-term economic performance of the individual company and its supply chain. Another definition of SSCM also provided by Seuring and Müller (2008) refers to SSCM as the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development i.e. economic, environmental and social, into accounts which are derived from customer and stakeholder requirements. Amounting evidences point out the increased attention of sustainable supply chain management in the literature as the numbers of papers discussing the topic are multiplying (see coverage analysis section). Several contribution supported this evident, for example Pedersen (2009) shows that companies and other business entities must address sustainable supply chain management related to triple bottom line of economics, social and environmental components to maintain the performance of the firms, where Carter and Rogers (2008) believes that firms that strategically undertake SSCM will achieve higher economic performance than firms that pursue only one or two of the three components of the triple bottom line.

Similar to Carter and Rogers (2008), Rao and Holt (2005) mention that the practice of greening in different stages of supply chain will lead to an integrated greening (sustainable) supply chain, which ultimately leads to competitiveness and economic performances. Sustainability in supply chain management, often associated with the scarcity of resources and limited fuel, drives top management in corporations to design a more effective and efficient supply chain (Beamon 2008). Similar to Beamon (2008), Zhu et al (2008) show that due to serious depletion of raw materials and environmental regulations, companies in China start to adopt best practices in the operation and manufacturing of their products and consider being a closed loop system in the effort of reducing environmental damage. Svensson (2007) also shows that the scarcity of natural resources in the future will force business practices and research to acknowledge the circumstances and conditions derived from supply chains based upon renewable and/or recycled resources. Reuter et. al (2010) state that sustainable supply chain in terms of global supplier management must be managed carefully to reduce risks. Research on sustainable supply chain management has been extended toward various sectors such as manufacturing (e.g. Zhu and Sarkis, 2008; Pagell and Wu, 2009; and Seuring et al, 2009), purchasing activities (e.g. Carter et. al. 1998; Chen, 2005; Green and Morton, 1998; and Min and Gale, 2001), hotel and tourism sector (e.g. Ozturen, 2009 and Goodman, 2000), food industry (e.g. Elkington, 1998; Aiking and De Boer, 2004; Hamprect et. al, 2005; Ilbery and Maye, 2005; and Rimmington et. al. 2006) and oil and gas sector (e.g. Matos and Hall, 2007).

However, in reality the integration between economic, social and environmental performance seems to be hard to fulfill. Zaklad et.al (2003) aforementioned that sustainable supply chain must balance the business process improvement, enabling technology and social system transformation whereas sometimes firms put less attention to one of the three
components. A survey conducted Harvard Business Review on 2010 shows that most companies tend to disregard the sustainable performances of its supply chains, mostly from 3rd tier suppliers and further back to the initial chain, showing that there is lack of attention towards holistic sustainable supply chain management\(^4\). This issue needs to be address in the future since SSCM has to take into account a wider range of issues and, therefore, look a longer part of the supply chain and there is a much increased need for cooperation among partnering companies in SSCM (Seuring and Müller, 2008) and more holistic approach of thinking and visualization, incorporating more economic, social and environmental aspects (Dakov and Novkov, 2008).

4.1.2. Sustainable Agricultural Supply Chain (SASC)

Departing from the insight of Seuring and Müller (2008), we had taken into consideration the supply chain of agricultural products from the initial stage of the supply chain whereas Linton et. al (2007) also give consent that supply chain considers the product from the initial processing of raw material to the delivery to the customers. Supporting these two opinions, Auroi (2003) mention the important role of peasants, small farmers and consumer associations on fair trade for improving sustainable supply chain management in the globalized market.

Achieving sustainability in agricultural contexts means meeting three challenges that are (a) profit – strengthening the viability and competitiveness of the agricultural sector; (b) planet – the ecological challenge of promoting good environmental practices; and (c) people – the social challenge to improve the living conditions and economic opportunities in rural areas. Responding to the three challenges, the role of policy and regulation such as Common Agricultural Policy (CAP) is important for improving sustainable agriculture that meets the interests of both markets and the governments while maximizing the function of the supply chain in that sustainable agriculture should be improved leading to a fairer distribution of cost and benefits (Veerman, 2004; Peeters, 2010; Brigstoke, 2004).

From the perspective of Nisbet et al (2005), we emphasize that sustainable agriculture practices in agricultural supply chain also help to minimize environmental impact and provide public reassurance through countermeasures both in situ and off-site of the chains. Coherent with Nisbeth et al (2005), Pretty et. al. (2008) conducted a multi-year assessment research on several agricultural supply chains on different commodities such as peas, spinach, tomatoes, tea and oil palm in various countries whereas the multi-year assessments were conceived as the way to understand and demonstrate progress towards more sustainable agricultural supply chain. Pretty et. al. (2008) reported that there are increases of acceptance and adoptability of sustainability indicators in agricultural supply chains that included on social and environmental performance. Similar to Pretty et. al (2008), Jöhr (2004) also share the positive impacts of Sustainable Agriculture Initiative (SAI) that initiated by Nestlé, Danone Group and Unilever towards sustainable agricultural supply chain by increasing environmental awareness, share knowledge, tracing and monitoring throughout entire supply chain and encourage sustainable agriculture while earlier Grimsdel (1996) mentions mutual awareness to reach sustainability.

In term of employment opportunities, a research by Thornley, Rogers and Huang (2008) showed that the impact of bio-energy plant on level of employment in the rural area is greater than conventional energy plant. They also showed that not only employment on agricultural
harvesting is increased, but also on transportation, processing of feedstock, staffing in thermal conversion plant, and employment within the equipment supply chain. This finding implied sustainable agricultural supply chain creates greater economical impact by providing employment opportunities on rural society compared to conventional agricultural supply chain.

Not only from the triple bottom line performances point of view, from the biological experiment, sustainable agriculture supported by sustainable agricultural supply chain has been proven to provide healthier and safer products and help to preserved the nature as well as biodiversity compare to conventional agricultural practices (Soulsby and Fuller, 2004; Johansson, Paul and Finlay, 2004) and minimize the overuse of water (Rambeau et. al. 2004) for example by the usage of modernized irrigation tanks (Anbumozhi, Matsumoto and Yamaji, 2001).

Technological issues also become a crucial part in sustainable agricultural supply chain development over the years. Cleaver and Schreiber (1994) noted that the lack of technology use in agriculture hindered the sustainability manner in agriculture practices while Sigrimis, Antsaklis and Groumpos (2001) believed that the advancement of sensing, information, automation and control technologies must be fostered in the field of agricultural production and supply chain management operations. According to Rao (2007), another key feature to achieve sustainable agricultural supply chain is the implementation of information and communication technologies (ICT) whereas ICTs offer a wide range of opportunities for institutionalizing knowledge management in agricultural development. The application of ICTs, however, differentiated by the models of the supply chain namely open loop, closed loop and spatial data network.

4.2. Coverage Analysis

The aim of the coverage analysis is to examine the evolution of the considered topics over time, in order to understand the phenomenon and trends of researches in the selected literatures. We divided the section into 3 sub-sections that are Longitudinal Analysis, Research Methodologies Used, and Assessment. In longitudinal analysis, we provide a timeline of existing contributions correlated with the topics that we discussed in the previous section. In order to achieve this goal, we adopted Scopus tools from Science Direct to search and wrap up our findings on the keywords contained in abstract, title and keywords of an article. Scopus also the largest database of peer-review literature and quality and quality web sources with smart tool to track, analyze and visualize research[5]. The selection of the software and tools is based on the user-friendly feature provide by Science Direct, enabling us to resume a comprehensive database of related articles.

Longitudinal Analysis

Longitudinal analysis is based on the evolution of topics over time and the fields study discussing SSCM and SASC. The number of contribution is increasing rapidly in recent years, showing the increasing attention towards the topic. The significant increase for SSCM happened during the 2002 – 2004 period where the number of literatures increases almost twice, while the number of available contributions for SASC faces a rather moderate increase during the same
time span. Overall, figures show a positive trend and covers of the various field of study (see fig. 1 and fig. 2).

**Figure 1. The Evolution of Topics over time**

![Graph showing the comparison of the distribution of papers for both SSCM and SASC](image)

Note: 1. SSCM = Sustainable Supply Chain Management  
2. SASC = Sustainable Agricultural Supply Chain

*Figure 1 shows the comparison of the distribution of the papers for both SSCM and SASC using the Scopus tool for the period of 1994 – 2011*

Next, we map the articles containing sustainable combining with supply chain management to overview the distribution of fields of study of the considered contributions. We found a total of 797 articles (N = 797) resulting from the two mentioned keywords. The field study of Engineering shows the highest frequency of distribution with 326 articles followed by Business, Management and Accounting with 256 articles. The Environmental Sciences share 178 articles, the Social Science with 83 articles and Agricultural and Biological Science with 61 articles. There is also high number of articles on the application on information technology (Computer Science) in supply chain as it’s represented by 119 articles.

Then, we composed the following keywords sustainable and agricultural and supply chain to find out the distribution of the papers discussing this topic. About 80 articles (N = 80)
found contain the keywords equal to almost 10% of the total sustainable supply chain papers. Most of the articles are distributed under the field study of Environmental area with 31 articles followed by Agricultural and Biological Science with 25 articles, Social Sciences (21), and Energy (9). We can see that environmental issue become the highest concern in the field whereas sustainable agricultural supply chain is seldom misinterpreted as environmental issue.

Figure 2. The Variety of Fields Study for SSCM and SASC

![Figure 2. The Variety of Fields Study for SSCM and SASC](image)

Figure 2 shows the variety of field of study for the two research interests, SSCM and SASC from Scopus database as per February 2011

In figure 2, from SSCM perspective, we can see that the literature is highly diffused in engineering, management, social sciences, energy and environmental sciences meaning SSCM is widely researched in those fields of studies while obviously in SASC, Agricultural and Biological and Environmental Sciences become the major discussions in the literatures.

Research Methodologies Applied

In this section, we concentrate our research on sustainable agricultural supply chain issues. We found among the 80 papers available, case study dominates current literatures (50% of the papers adopt this methodology). Then assessment papers are found (accounting for more
than 30% of the papers) then the reminders are modeling papers. In the assessment and concept papers, survey methodology is widely adopted with 85% of the papers adopting this approach compared to only 15% that used direct interview. This implies that case study is the most preferably approach used by the scientists in agricultural area while there is moderate numbers in conceptual and modeling papers that need further development in the future.

Assessment

The environmental issue is the crucial part in both sustainability and supply chain. There are several ways to calculate environmental impact and specifically green house gasses emission in the supply chain; yet life cycle assessment is amongst the distinguish methodologies and widely used by scientific communities (e.g. Hanegraaf, Biewinga and Van Der Bijl, 1998; Hagelaar et.al, 2004; Van Berkel, 2002; Hagelaar and Van der Vorst, 2002; Seuring, 2004; Fredga and Mäler, 2010). In this section, we exclude the evaluation of social performances since we found that only few publications mention how to measure social performance in SASC. To find out what kind of methodology that is applicable in the agricultural sector, we refine our research by inserting two methodological’ keywords, i.e sustainable agriculture and life cycle assessment and sustainable agriculture and carbon footprint. The aim of this investigation is to evaluate the extent of adoption of the methodology. We found out that life cycle assessment is the most adopted methodology in agriculture sector since up to 59 articles use LCA methodology compared to carbon footprint methodology with only 9 articles. The longitudinal research also shows that LCA has been developed and used since 1998 while carbon footprint usage begins at 2007.

Table 1. The comparison of methodologies used in agricultural sector

<table>
<thead>
<tr>
<th>No</th>
<th>Components</th>
<th>Life Cycle Assessment</th>
<th>Carbon Foot Print</th>
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<tbody>
<tr>
<td>2</td>
<td>Numbers of Articles</td>
<td>59</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Subject Area</td>
<td>Environmental Science (34); Agricultural and Biological Science (13); Energy (9); Engineering (6); Economics (5); Social Science (3)</td>
<td>Environmental Science (5); Agricultural and Biological Science (4); Social Science (4); Engineering (2); Economics (1)</td>
</tr>
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</table>

Surprisingly, after we add supply chain keyword in our research, we found out that both methodologies are rarely used in the sustainable agricultural supply chain. The keywords sustainable and agricultural / agriculture and supply chain and life cycle assessment only produce 5 results while the second methodology only produced 1 result. This leads to the fact that few contributions considering the utilization of both methodologies in the supply chain, especially for agricultural products. In order to understand the holistic environmental impact of the supply chain, we believe that it would be better to use the methodologies in each echelon from the initial stage up to the final agricultural product.
V. Discussion

The provide result provide evidence that, there is not much literature review available in discussing sustainable agricultural supply chain. Of all the topics covered by the publication, most researchers believe that sustainable agricultural supply chain can be reach if each echelon of the chain adopts sustainable practices in their operations. While globalization plays important roles in promoting sustainable supply chain management, market preference and health concern also become key drivers for sustainability (Pagan and Lake, 1999; Goodland, 1997). We want to highlight that only few articles discuss the flow of agricultural products from one echelon to the other in a sustainable way. We find that this issue can be interesting to be explored in the future. For example, La Trobe and Acott (2000) mention the issue of unsustainable transportation of food and agricultural products around the world due to globalization while Corner and Foulds (2004) stressed the importance in addressing sustainability in the transportation of agricultural products.

In most agricultural supply chain’s cases, transportations are typically managed by land vehicles. The adoption of different transportation modes depends mostly on infrastructures, availability of spare parts, and cost of petroleum. For typical agriculture supply chain, combinations of transportation’s means are needed. For example, from a farm perspective, most farmers use land and water vehicles to bring their harvest to collector since the operational cost for air transportation is very high. This typical transportation mode goes along the way up to the processing companies and if the market is localized, then land vehicles are used for retailers and/or wholesalers. For cross boundaries transportations, ships are more likely to be used for transportation of goods. Either from self consciousness, or market demand, greening the fleets seems to be rational for most of the firms these days. This could be an issue whether managing transportation mode could create significant impact on company’s performances.

Another interesting issue is limited the number of publication in SASC discussing Decision Sciences (1 literature) while in SSCM there are over 100 literatures in that field of study. This fact proves evidence that seemingly the focus of SASC mostly on the practical application on how to reach sustainability compares to the decision on how to create better policy to reach sustainability. Further exploration in this area will be important and specially within decision sciences.

VI. Conclusion

Sustainable agricultural supply chain is an evolving topic. It has significant impact to economic, social and environmental performances. It represents initial echelon, which are farmers that hardly mention in most supply chain cases and importantly contribute in poverty alleviation in the world. Yet, the topic seems to be limited and still uncharted areas are available to be explored. In modern days, sustainable agricultural supply chain is not solely about practicing farm cultivation but also about warehousing, transportation, good practices in manufacturing and agriculture and also about managing what it is best for the survival of companies as well as preserving environment and diversity. Compare to other supply chain in this world, agricultural supply chain play an important roles in the social performance that is seldom touched in scientific discussion. To conclude, our work contributes to address a specific
topic that rarely discuss in sustainable supply chain management area and to provide a comprehensive literature review for sustainable agricultural supply chain that to our knowledge, has been only partially addressed in the current literature. We hope that our work contributes to the development of sustainable agricultural supply chain and creating a better understanding of the SASC concept.

Limitations

In the end we would like to address some limitation in the paper. First, the area is limited to agriculture. Research can be extent to agro – food supply chain that may provide a different result. Yet we consider this interesting for us to be specific, due to the fact that not much of references available in the literature that discuss specifically on agricultural supply chain. Secondly, the utilization of specific journals in supply chain may offer an alternative result. However, considering the topic that we discuss, we found that publications are on sustainable agricultural supply chain are not focus in specific journals and therefore, we taking into consideration to include all possible journals in our research. Thirdly, the keywords findings could enriched to transportation, vehicles, or value chain to make significant differences. Finally, the utilization of search engines other that Scopus will provide different results which might be interesting to explore in the future.

Implications

The implications of this research extended to companies, researchers and practitioners that are interest in agricultural supply chain topic. Understanding the development of themes and topics over the last decade will enable us to view SASC approach from holistic point of view from each echelon to another and not partially limited to certain echelon. Further implication can be extended towards governmental level in creating a better policy for reaching sustainable agricultural supply chain.

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117. www.unescap.org
118. www.fao.org
119. www.worldbank.org
120. www.wbcsd.org
121. http://sustainable-seattle.org

Note
[1] Research conducted by Harvard Business Review on October 2010. Results shows that in 1st tier, the concern of business entities regarding sustainable performance of their suppliers reach 33% while in 3rd tier suppliers, concern only reach 10%. Research also conducted on financial bodies.


[3] The terminology between sustainable development, sustainable growth and sustainable use sometimes create confusion since they are used interchangeably and often interpreted for the same meaning, where in fact they are different from each other (http://www.unescap.org)

[4] Extracted from Lang (2010) which is based from McIlvaine-Newsad et al. (2004) in the paper titled Direct from Farm to Table : Community Supported Agriculture in Western Illinois.


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