Good Practices for the Green Supply Chain Modeling

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Abstract

The supply chain is among the factors that have contributed in climate change, whether through the set of environmental impacts resulting from its activities of transport, manufacturing, distribution etc., and due to the enormous number of worldwide companies, which continues to increase, and which involves further negative impact on the environment. The purpose of this paper is to provide the researcher and decision maker with a set of good practices of green supply chain modeling, and some discussions. Indeed, many scholars have carried out theoretical studies in this sense, by dealing with a set of methods and tools; but have not provided an overview of the best practices to be taken into consideration in order to achieve optimal modeling. The proposed framework is the focus of analysis in this paper. Firstly, this paper proposes a brief literature review on the main keywords of this paper, then at the end a conclusion with some direction for future research.

Keywords
Environment, green, supply chain, good practices, modeling.

1. Introduction

Currently, logistics has become a major concern for the entire process of a company, due to its primordial role throughout the main phases: procurement, production, and distribution. The modeling of a supply chain (SC) is one of the main lines of supply chain (SC) topic research. "Modeling is a process of representation which allows obtaining an approximate image of real system following an abstraction phase. This process facilitates the study and understanding of systems "(Labarthe O., 2006).. Many literature reviews on green supply chain modeling (GSCM) have been conducted as part of some research work (Soda, S., Sachdeva, A., Garg, R.K., 2016), (Govindan, K et al, 2015). Furthermore, when it comes to modeling the green supply chain (SC), a set of elements could be introduced such as cleaner production, waste minimization and recovery, recycling (reverse logistics), and green purchasing, etc., also improving environmental performance (Ming K. et al, 2017).
This present work consists first of all in establishing a summery literature review showing the evolution of research in the supply chain (SC) modeling area, then a general framework providing some good practices for modeling the green supply chains (SC), and lastly a conclusion with directions for future research.

2. Insights of Green Supply Chain Modelling

For a company, SC modeling could be considered as a set of methods and tools to be integrated into all or certain activities, such a way to improve performance and efficiency or solve problems, as well as the availability of necessary resources. Then, the environmental aspect further complicated the modeling of SC given the difficulty of integrating it on the one hand, and the enormous environmental constraints resulting from the SC on the other hand. Different models of GSCM are proposed in literature (Ghadimi, P., Wang, C., Lim, M., 2019), with the aim to identify problems, control processes and provide solutions, especially problem related to environmental issue, in particular reduction of carbon emission and its cost, (Hariga, M., As' ad, R., Shamayleh, A, 2017) propose to minimize carbon emission, operational cost, as well as environmental pollution

aspect, using mathematical modeling. In another way(Ji, X., Wu, J., Zhu, Q., 2016) suggest analytical modeling to minimize resource consumption and pollution emission from transportation, by providing transportation strategies to help stakeholders, also eco-efficiency is stated in some research works (Ahmed, W., Ahmed, W., Najmi, A, 2018).

While other researchers have focused their work on the design, (Chen, Y. et al, 2017) proposed Mathematical programming (linear programming), a multi-objective closed-loop SC design (MCSCD), by taking into account cost and environmental concerns in the solar energy industry in terms of sustainability perspectives. (Arena, U., Mastellone, M.L., Perugini, F., 2003) also chose design modeling of products to reduce consumption of materials/energy, also their negative effects on the environment throughout its life cycle. A multi-objective optimization mathematical model is presented by (Nurjanni, K.P., 2017) to minimize cost and environmental pollution by a trade-off between environmental and financial issues. Finally, customer awareness is among the critical environmental issues, (Heydari, J., Govindan, K., Jafari, A.,. 2017)develop an analytical model to improve sustainable consumption by encouraging customers to return used products by giving discounts or direct payments in exchange the return of products at the end of their life. The entirety of those research works, leads to a research question «What preliminary practices are being implemented, before establishing a green supply chain model?" The aim of this paper is to provide researcher and supply chain managers by some good practices in modeling the green supply chain.The table 1 below represents a body of work that promotes positive practices within the green supply chain.

Table 1: Some exampl of green supply chain' good practces

Research work	Domain	Good practice
(Manaktola and Jauhari, 2007) **(Tarí et al., 2010)**	-Industry -Tourism	Propose to conduct studies for energy and water saving
(Yang et al., 2013) **(Chan et al., 2012).**	-Shipping -General(companies in different field)	Propose to manage the supply chain in order to meet the requirements of suppliers in terms of increasing resource efficiency, reducing energy consumption, or decreasing emission discharge.
(Jabbour et al., 2014) **(Green et al., 2012)**	-General(companies in different field) -Manufacturing	Propose to improve green performance
(Wu et al., 2014)	-Manufacturing	Propose to develop new knowledge and solving problems regarding the green product and green process.
(Almeida et al., 2019)	-Manufacturing	Propose to implement various environmental practices(like Life Cycle Assessment) which lead to economic value

3. Material and Methods

Firstly this paper reviews systematically the literature on GSCM then presents some examples of models of green SC with different overviews and lastly proposes a collection of practices in the context of GSCM. A literature review is carried out, considering as insights based on shortlisted papers (conference papers, and some articles), and theses derived from ISI Web of Science, Scopus, and others. As keywords "Green Supply Chain Modeling" and "Green supply chain", "supply chain modeling" in all fields) aiming to include only relevant papers on GSCM (figure 1). Keywords were used by combining logical operators in searches ("OR", "and") by abstract, title, keyword. The main journals are: ''Transport. Res. Transport Environ'', ''Journal of Cleaner Production''. The period of search is 2003 to 2019. Figure 1 below shows the main elements of this article:
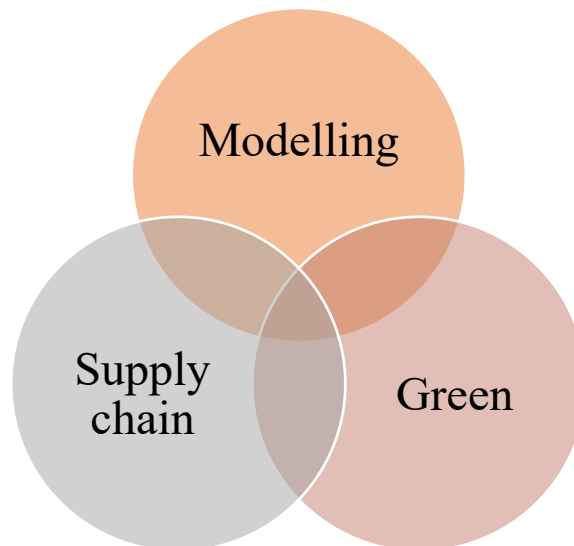

Figure 1. The main elements of the paper

4. Results and discussion

Several researchers have agreed that the modeling of SCs is divided into three main categories, organizational modeling, analytical modeling, simulation modeling (Labarthe O., 2006), (I.Ben Kahla –Touil, 2011), (K.Eddoug, S.Lissane El Haq, 2015), (F.Gouiza, 2016). We propose in the following figure a set of good practices to be integrated in modeling the green SC, which allows researchers to give a typical modeling framework to their studied SC, whatever the field of application, or the type of studied SC, and also taking into account all the environmental constraints. Modeling often comes after the design of the SC; it is the basis of modeling, the reason this work addresses practices by linking them to design.

Research works on SC modeling is often linked to transport, whether to optimize it or minimize costs, the addition of the environmental axis has obviously revealed a set of research topics among which CO2 reduction is the most treated. On the other hand, manufacturing, to reach a greener product, it is crucial to implement environmentally friendly practices like reverse logistics, optimizing water consumption, etc.

The relationship with suppliers has a direct impact on the SC, in terms of requirements and contracts, therefore it is important to ensure that this relationship is based on agreements regarding the environmental axis, the same for customer.as the last process of the SC, distribution must also comply with environmental requirements, in order to achieve an ideally green product delivery, as suggested in figure 2, transport, packaging, storage site are the main elements to be taken into account, as well as being in compliance with customer expectations and regulation.
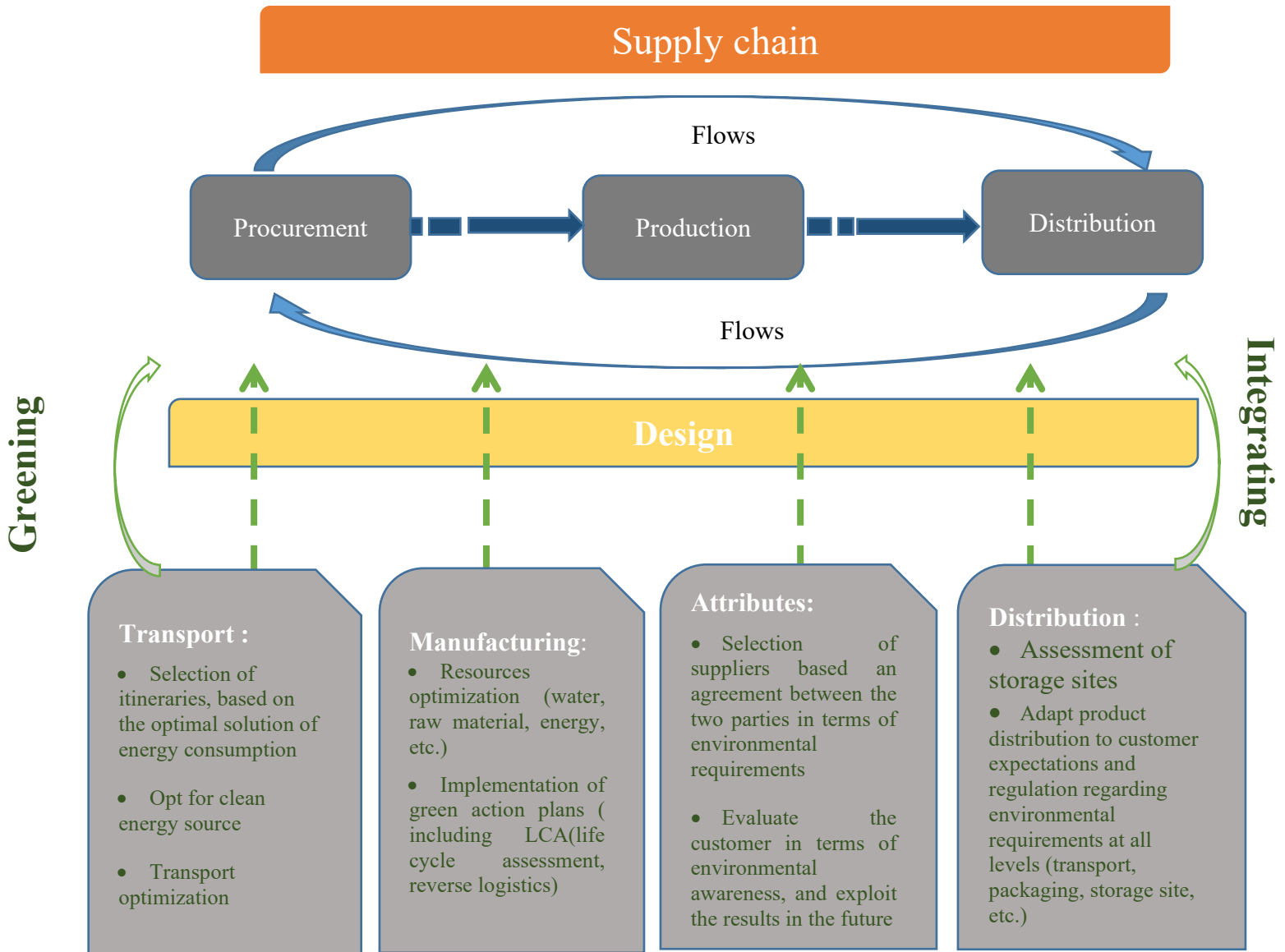

Figure 2. General framework of GSCM (good practices).

5. Conclusion

The modeling of a SC has always made more attention in many sectors and fields. In this paper, we presented a review of green supply chain modeling literature, and then we gave some examples of some models of SCs, with

different aims, also a set of good practices of green supply chain proposed in literature. Then a general framework is proposed, providing some good practices for green supply chain modeling, based on a set of tools and approaches of proposed models, also modeling perspectives according to some areas. We suggest as future works:

- *To focus on the standardization of green supply chain modeling, regardless of the type of the studied supply chain, or the used method;*
- *To carry out more studies that combine the two dimensions sustainability and greenness.*

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