

A Review of Research Methodologies Linking Green Supply Chain Practices and Green Supply Chain Performance

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Abstract— The objective of this paper is to explore the peer-reviewed literature on green supply chain practices and green supply chain performance with the intention of characterizing the research methodologies used in these areas of research. In line with this objective, the constructs “Green Supply Chain Practices” and “Green Supply Chain Performance” were identified. As indicated by the literature already published there seems to be certain set of methodologies which have mostly been used and that too frequently. Accordingly, there is a need to do a more detailed study that can pinpoint particular research methodologies that are usually used in research related to green supply chain practices and green supply chain performance. This paper attempts to achieve the aim by using a keyword search for identifying papers related to green supply chain practices and green supply chain performance. Finally the methodologies used are summarized in order of their usage in order to characterize the research methodologies used in linking green supply chain practices and green supply chain performance. This will help newer research work to flow in the right direction without reinventing the wheel and also it will act as a ready reference for newer research work to practicing managers.

Keywords— *Green Supply Chain Practices; Green Supply Chain Performance; Review; Research Methodologies*

1. Introduction

The Rio Declaration on Environment and Development, which is an updated version of the Stockholm Declaration of 1972, published general principles for future international action on environment and development. The agenda 21 of the Earth Summit, 1992 lays down an action plan for the next hundred years along with a framework for dealing with the environment and development issues [34]. Accordingly, Global warming has raised alarming concerns all over the world due to the adverse effects it has been having on the environment. Nations all over the world are posed with the immediate issue of reducing this adverse impact on the environment which is predominantly due to the anthropogenic activities [33].

Supply chains are also not free from these anthropogenic activities. Hence, activities of supply chains need to be managed in order that they do not adversely impact the environment. Activities aimed at achieving this goal are termed as green supply chain practices. The research problem here is to identify the research methodologies usually used in researching the linkages of green supply chain practices are green supply chain performance.

There is a growing body of literature that has studied Green Supply Chain Management (GSCM) Practices, GSC Practices; and GSC Performance. However, there is a need to have a summary of research methodologies used in reaching the linkage of green supply chain practices and green supply chain performance. This will help in characterizing the research methodologies in this area. This paper addresses this need in a suitable way by referring to thirty-two papers published in peer-reviewed journals in the recent past.

2. Review of Literature

On the basis of a key word search on the constructs “Green Supply Chain Practices” and “Green Supply Chain Performance” using the research library database namely Science Direct, the papers published in scholarly peer-

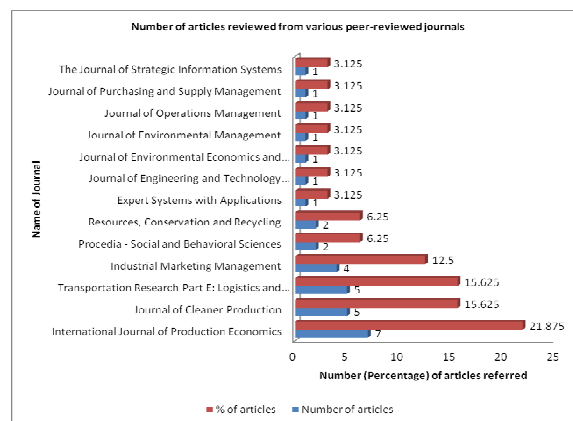


Figure 1. The number of articles which were reviewed from various peer-reviewed international journals

reviewed international journals were obtained. The Figure 1 depicts the journal wise distribution of articles published in various peer-reviewed international journals which were obtained by using a key word search.

It is very evident from this distribution that the maximum number of related articles on Green Supply Chain Practices and Green Supply Chain Performance appeared in International Journal of Production Economics (7 articles making 21.875 %) followed by Transportation Research Part E: Logistics and Transportation Review (Further the year wise distribution of the articles obtained and referred is shown in the Figure 2.

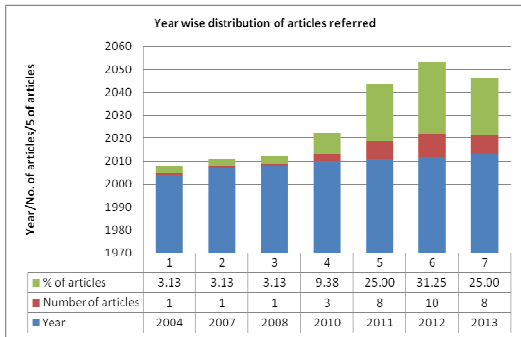


Figure 2. Year wise distribution of the articles referred

Though the articles obtained were specifically related to green supply chain practices and green supply chain performance, the articles also seemed to be having other parallel themes of topics which were dealt with. On going through the obtained articles, it was possible to identify and classify the articles topic wise as shown in the Figure 3.

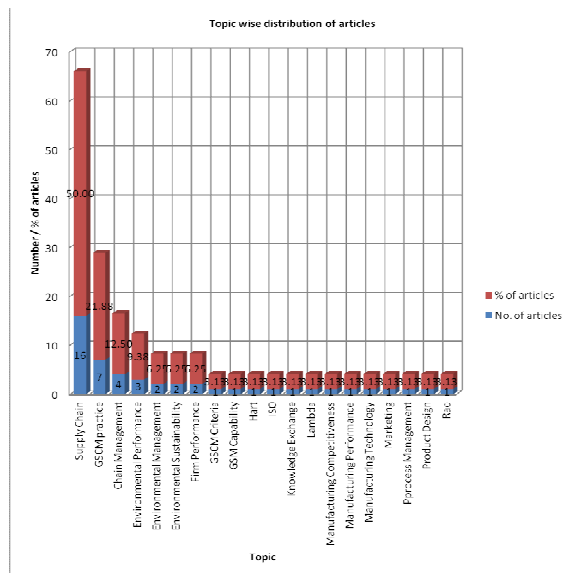


Figure 3. Topic wise distribution of the articles reviewed

3. Methodology

Papers published in scholarly peer-reviewed international journals were obtained from the available research library database namely Science Direct, which is known to be suitable from the subject point of view. In order to assure that the appropriate articles are referred, a filter was used as shown in the Table 1. The Table 1 is organised in three columns namely the type of filter used; the description of the filter used; and total number of articles obtained.

Table 1. Filter used to assure that appropriate articles were referred

Type of filter used	Description of filter used	Total number of articles
Substantive, methodological articles.	Searching all the articles using the keywords “Green Supply Chain Practices” and “Green Supply Chain Performance” such that they appear in the title or abstract or keyword section. At least one of the keywords must appear in the searched article.	32

A careful study of the articles enabled to tabulate the method of analysis and also the methodology used in these articles as shown in the Table 2.

Table 2. A summary of methodology and method of analysis used in the referred articles

Ref. No.	Author(s) and year of publication	Methodology	Method of analysis
[1]	Susana G. Azevedo, Helena Carvalho, V. Cruz Machado; 2011	1. Case study- Multiple 2. Theoretic al framework	1. Individual case-study analysis 2. Cross-case analysis 3. Grounded theory
[2]	Qinghua Zhu, Joseph Sarkis, Kee-hung Lai; 2013	Empirical study	Path analysis is used to test the developed theoretical model.
[3]	Qinghua Zhu, Joseph Sarkis, Kee-hung Lai; 2007	1. Empirical study 2. Case study of Dalian Diesel Engine Plant.	Principal Components Factor Analysis, Regression Analysis.

[4]	Qinghua Zhu, Joseph Sarkis; 2004	Empirical study	Moderated hierarchical regression analysis, Factor Analysis, Correlation Analysis.
[5]	Ru-Jen Lin; 2013	1. Tools 2. Empirical study	Fuzzy set theory and DEMATEL (decision making trial and evaluation laboratory) method to form a structural model to find out the cause and effect relationships among criteria.
[6]	Francesco Testa, Fabio Iraldo; 2010	Tools	Heckman sample selection procedure; Correlation analysis; Binary Probit Modeling and Ordered Probit Modeling.
[7]	Pietro De Giovanni, Vincenzo Esposito Vinzi; 2012	Empirical study	Confirmatory Factor Analysis, Structural Equation Modeling, PLS Path Modeling, ANOVA, Correlation analysis.
[8]	Chung-Shan Yang, Chin-Shan Lu, Jane Jing Haider, Peter Bernard Marlow; 2013	Empirical study	Exploratory Factor Analysis, SEM.
[9]	Ricky Y.K. Chan, Hongwei He, Hing Kai Chan, William Y.C. Wang; 2012	Empirical study	CFA, Lindell and Whitney's (2001) marker-variable technique, SEM.
[10]	Kuo-Jui Wu, Ming-Lang Tseng, Truong Vy; 2011	1. Tools 2. Empirical study	Fuzzy set theory, DEMATEL (decision making trial and evaluation laboratory) method, Cause-and-Effect diagram.
[11]	Toshi H. Arimura, Nicole Darnall, Hajime Katayama; 2011	Empirical study	Univariate Probit Analysis.

[12]	Shaofeng Liu, Dulekha Kasturiratne, Jonathan Moizer; 2012	1. Concepts , framework 2. Theoretical study 3. Empirical study	Hub-and-spoke integration model to integrate green marketing and sustainable supply chain management from six dimensions: product, promotion, planning, process, people and project (called the 6Ps).
[13]	Stephan Vachon, Robert D. Klassen; 2008	Empirical study	CFA, Correlation analysis.
[14]	Ming-Lang Tseng, Anthony S.F. Chiu; 2013	1. Tools 2. Case study 3. Empirical study	Fuzzy set theory, Grey Relational Analysis (GRA).
[15]	Ezutah Udony Olugu, Kuan Yew Wong; 2012	Case study	Fuzzy logic, Visual Basic.Net Programming.
[16]	Seyed Mostafa Mirhedayati an, Majid Azadi, Reza Farzipoor Saen; 2013	Case study	Fuzzy logic, NDEA (Network Data Envelope Analysis).
[17]	Stefan Hoejmose, Stephen Brammer, Andrew Millington; 2012	Empirical study	Correlation analysis, Regression analysis.
[18]	Qinghua Zhu, Yong Geng, Joseph Sarkis, Kee-hung Lai; 2011	Empirical study	Exploratory Factor Analysis, Cluster Analysis.
[19]	David Styles, Harald Schoenberger, Jose-Luis Galvez-Martos;	1. Empirical study 2. Conceptual 3. Framework	The assessment framework is demonstrated through application to three retailers.

	2012		
[20]	Qinghua Zhu, Joseph Sarkis, Kee-hung Lai; 2012	1. Empirical study 2. Theory development	Factor Analysis, Cluster Analysis, ANOVA.
[21]	David Styles, Harald Schoenberger, Jose-Luis Galvez-Martos; 2012	1. Empirical study 2. Theory development	Information gathering and summarizing.
[22]	Y.H. Venus Lun; 2011	1. Model building 2. Case study 3. Model testing 4. Theory development	A GMP model that consists of the key elements of GMP is proposed and firm performance indicators are formulated to provide a foundation for the adoption of GMP. Hutchison Port Holding (HPH) is selected as the case to illustrate the application of the proposed GMP model in a real life situation. DEA (Data Envelope Analysis) is used.
[23]	Tzu-Yun Chiou, Hing Kai Chan, Fiona Lettice, Sai Ho Chung; 2011	1. Conceptual framework 2. Empirical study	CFA (Confirmatory Factor Analysis). SEM (Structural Equation Modeling).
[24]	Ru-jeu Lin, Chwen Sheu; 2012	1. Empirical study 2. Model building	CFA (Confirmatory Factor Analysis), SEM (Structural Equation Modeling).
[25]	Iuri Gavronski, Robert D. Klassen, Stephan Vachon, Luis Felipe Machado do Nascimento; 2011	1. Theoretical model development 2. Empirical study	Correlation analysis, Regression analysis.
[26]	Federico Caniato, Maria	1. Framework 2. Empirical study	Exploratory, empirical, multiple case study.

	Caridi, Luca Crippa, Antonella Moretto; 2012	3. Case study-Multiple	
[27]	Chi Kin Chan, Y.C.E. Lee, J.F. Campbell; 2013	1. Tools 2. Model development 3. Case study	Synchronization, genetic algorithm, multi-objective programming.
[28]	Stefan Schrettle, Andreas Hinz, Maike Scherrer - Rathje, Thomas Friedli; 2013	1. Conceptual framework 2. Theoretical study	Theory building.
[29]	Viet Dao, Ian Langella, Jerry Carbo; 2011	1. Conceptual framework 2. Theoretical study	Theory building.
[30]	Chen-Lung Yang, Shu-Ping Lin, Ya-hui Chan, Chwen Sheu; 2010	1. Empirical study 2. Model building	CFA, Multiple Regression Analysis.
[31]	Ivete Delai, Sérgio Takahashi; 2013	Literature review-Exploratory	Content Analysis- Qualitative
[32]	Arun Sharma, Gopalkrishnan R. Iyer, Anuj Mehrotra, R. Krishnan; 2010	1. Literature review 2. Framework development 3. Proposed Model	Content Analysis

4. Analysis of the research methodologies used

The usage of various research methodologies in literature linking green supply chain practices and green supply chain performance is depicted in Figure 4. It reveals that the most frequently used methodology is empirical study (68.75 %) followed by case study (25 %) followed by tools (15.63 %) followed by model building (15.63 %) followed by frameworks (12.5 %) followed by the theory development (9.38 %) followed by theoretical study (9.38

%) followed by conceptual frameworks (9.38 %) followed by theoretical framework (6.25 %) followed by literature review (6.25 %) followed by conceptual (6.25 %) followed by model testing (3.13 %).

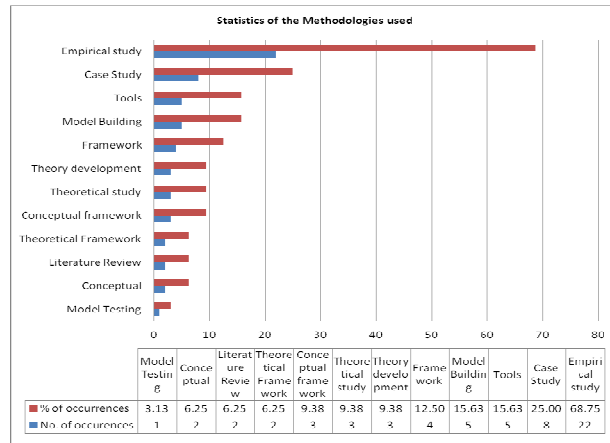


Figure 4. Statistics of the research methodologies linking green supply chain practices and green supply chain performance

5. Conclusion

As far as researching the peer-reviewed literature linking green supply chain practices and green supply chain performance is concerned, maximum relevant articles used an empirical study; followed by case studies; followed by tools; followed by model building; followed by framework; followed by theory development; followed by theoretical study; followed by conceptual framework; followed by theoretical framework; followed by literature review; followed by conceptual work; followed by model testing. In short the range of research methodologies include empirical work at one end of the spectrum right through model testing at the other end of the spectrum.

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