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A STUDY ON THE GREEN SUPPLY CHAIN PRACTICES AMONG THE SMES IN KARNATAKA

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Abstract: Going "green" is not just the "in thing" these days – it is the "inevitable thing", so to speak. What is more, it has become imperative to go green in all spheres of activity, including economic activity. Man's greed and avarice led him to take Mother Nature for granted. Before long, he realised that it was better to work with rather than against, Mother Nature. Man learnt the hard way after unusually heavy rains led to the flooding of rivers and the rivers inundated large cities. Deserts began to receive rains and geographies reputed for receiving heavy rainfall saw the rainfall they usually receive dwindle. Supply chain management has become a crucial issue with the major stakeholders associated with the industry, including governments, national and international and the people across the globe. This is not surprising given the implications of supply chain management for the environment. Already the world is paying the penalty for ignoring it – in the form of the severe damage inflicted and still being inflicted by the industry on the fragile environment. Not surprisingly, these days, the phrase green supply chain management (GSCM) is talked about much more than mere supply chain management. Green supply chain management conveys how innovations in supply chain management and industrial purchasing may be considered in the context of the environment. This study explains the practices and implementation of green supply chain and environmental performance among select manufacturing units located in India. Implementation of green supply chain management practices in turn implies implementation of seven practices including green-procurement, green-logistics design, green-product design, green-manufacturing, waste management, operational performance and vendor management.

Keywords: Green Supply chain, Green procurement, Green logistics, green product design, Green manufacturing, Environmental performance and waste management.

INTRODUCTION

The green supply chain management (GSCM) is a powerful way to differentiate a company from its competitors and it can greatly influence the plan success. With increased awareness to corporate responsibility and the requirement to meet the terms with environmental policy, green supply chain management (GSCM) is becoming increasingly important for Indian manufacturers. Companies that have adopted GSCM practices with a focus on distribution activities have successfully improved their business and environmental performance on many levels. Today's also some of remaining companies have not adopted green supply chain management, due to this environmental performance index (EPI) ranking of India is not good. Today's environmental performance index (EPI) of India and the major four activities of the green supply chain management; namely green purchasing, green manufacturing, green marketing and reverse logistics.

Green Supply Chain Management

GSCM can be defined as the integrated environmental logic into the Supply Chain Management. It includes all the stages of the production process: design, raw material purchasing, manufacture, delivery and, after its useful life, end-of-life management of the product. (According to David Kiger)

Some companies have found in GSCM a very interesting opportunity to keep earning money and taking care of the planet at the same time. They have been able to call consumers' attention to green products and services, and increasing profits thanks to it. In fact, several organizations have demonstrated the existence of a link between upgraded environmental production and positive gains.

Green supply chain management for a firm is the set of supply chain policies held, action taken, and relationships formed in response to concerns related to the natural environment and with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firms goods and services

GSCM= Green purchasing + Green manufacturing /materials management + Green Distribution / marketing +Reverse logistics

Green marketing includes environment-friendly packaging, environment-friendly distribution and so on. They are all initiatives that might improve the environmental performance of an organization and its supply chain (Rao, 2003). Management of wastes in green marketing such as reverse logistics and waste exchange can lead to cost savings and enhanced competitiveness (Rao, 2003). Many of these initiatives involve compromises between various logistics functions and environmental consideration in order to improve the environmental performance of an organization (Wu and Dunn, 1995).

Green Supplychian Management Review

Sunil Luthra, Vinod Kumar, Sanjay Kumar and Abid Haleem attempt to develop a structural model of the barriers to implementation of GSCM in Indian automobile industry (Sunil, Vinod, Sanjay, & Abid, 2011). They identify some barriers and contextual relationships among the identified barriers. They classify the barriers according to the dependence and driving power with the help of MICMAC analysis. Further, they suggest a structural model of barriers to implementation of GSCM in the Indian automobile industry using Interpretive Structural Modelling (ISM) technique.

Green supply chain management has emerged as an important organizational philosophy to minimise environmental risks, argue the researchers (Diabat & Govindan, 2011). They design a model of the drivers affecting the implementation of green supply chain management. They use an Interpretive Structural Modelling (ISM) framework for the purpose. They identify the various drivers of the green supply chain management (GSCM) by using the GSM literature and consulting industry experts. They validate the model on a case study involving a manufacturing unit.

The researchers remind that manufacturing industries began to focus on green concept in their supply chain management only lately (Govindan, Kaliyan, Kannan, & Haq, 2014). The intention was to focus on environmental issues. All the same, they have a tough time identifying barriers that hinder the implementation of green supply chain management. The researchers focus on identifying the barriers in the backdrop of effectiveness of procurement. They identify 47 barriers after perusing literature and interacting with industry experts. They supplemented their efforts by conducting a questionnaire-based survey of various sectors of the industry. They identify critical barriers by resorting to an analytic hierarchy process. They top it off with a sensitivity analysis to examine priority ranking stability.

Owing to the ever-rising scarcity of natural resources and increasing concern in the market for 'green' products and processes, decisions concerning environmental issues have turned crucial for managements of manufacturing organisations (Mudgal, Shankar, Talib, & Raj, 2010). Green business practices are not easy to adopt and implement, no thanks to the presence of numerous barriers. The researchers set out to identify and analyse the said barriers. The researchers undertook a survey to rank these barriers.

Environmental sustainability and green environmental issues have been increasingly gaining the attention of researchers and supply chain practitioners, according to the researchers (Luthra, Garg, & Haleem, 2014). The researchers attempt an analysis of green supply chain management (GSCM) practices in the Indian automobile industry. They identify six main GSCM practices (with 37 sub practices) and four expected performance outcomes

(with 16 performances) accruing from the implementation of GSCM practices after reviewing the literature on the subject. They infer that environmental, economic, social and operational performances improve once the GSCM practices are implemented.

The researchers in their empirical study of green supply chain management (GSCM) practices in the micro, small and medium enterprises (MSMEs) in India, remark that the literature on the subject does not explain why green practices are yet to figure prominently in supply chain management although external and internal pressures obtain (Mohanty & Prakash, 2014). These MSMEs have been associated with green supply chain practices only to a limited extent – limited by the role they play — like suppliers and distributors. The researchers conclude that Indian MSMEs face a higher level of pressure from external stakeholders to adhere to GSCM practices. As for internal pressures, the researchers cite that on-the-job training forces MSMEs in India to adopt GSCM practices.

Dubey, R and Ali, S.S examine the antecedents of Indian firms into green manufacturing practices and their impact on the performance of the extended supply chain (Dubey & Ali, 2015). The output of the factor analysis they undertook validates the findings they gleaned from literature review. The factor analysis output indicates that total quality management (TQM), supplier relationship management (SRM), R & D and technology and lean manufacturing practices are vital determinants of Indian firms into green manufacturing practices that impact the extended supply chain performance. The output proves that TQM and R & D and technology are vital determinants of the performance of the extended supply chain. However, their investigation does not support SRM and lean manufacturing practices from the perspective of the respondents.

RESEARCH GAP

The researchers have made valid observations. The following research gaps were identified and are listed as below

- Basically, there is a reluctance of industry to embrace state-of-the-art technology for the "greening" exercise, fearing the financial implications of such an act.
- Most of the studies have been conducted with regards to GSCM practices in large firms located in North India.
- Much of these studies are related to firms in automobile sector.
- None of the studies conducted so far are related to SME's.
- In this backdrop, this research is conducted with regards to GSCM practices in select firms under SME's across five different sectors and explores innovative ways of dealing with these problems.

Thus a research gap has arisen and the present study bridges this gap

OBJECTIVES OF THE STUDY

The objectives of the study are:

1. To examine the green supply chain practices in select firms.
2. To analyse the relationship between green supply chain management practices and firm performance in select firms.

Hypotheses of the study

H_1: *The view that given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand is independent of the sectors the firms belong to.*

H_2: *Association between the view that GSCM achieves waste reduction through improved efficiency, minimising damage to environment is independent of the sectors the firms belong to*

RESEARCH METHODOLOGY

This study is explorative and descriptive in its nature and uses the 'fact-finding' survey method. An empirical study was conducted in the small and medium enterprises located in Peenya industrial area Bangalore India (Zikmund, 2003) . Interview schedules specially designed for the purpose were administered to the respondents for collection of primary data. Being a structured / directive interview, the interview was conducted with a detailed standardised schedule. Given the qualitative

nature of the values the variables elicit from the respondents, they lend themselves ideally to statistical tools like chi-squared test and Factor Analysis.

Sampling Technique and Size

Given the rather limited number of firms with exposure to GSCM practices operating in the area, purposive sampling under the non-probability method has been deployed to select the industrialists. Applying exposure to GSCM practices as the criterion, the researcher selected 30 firms that have been into GSCM practices. This criterion, according to the researcher, is the most appropriate one for the present study. What is important is the typicality and the relevance of the sampling units to the study and not the overall representativeness to the population. Thus it guarantees inclusion of the relevant elements in the sample. The samples were collected from the following companies.

List of Companies

Engineering	1. Triveni Engineering & Industries Ltd
	2. Ace Designers
	3. Anu Solar Power
	4. Omega Industries
	5. Airvent Private Limited
	6. Micromatic Machine Tools Private Limited
	7. Alpha Industries
	8. Emmvee Solar
	9. Maini Precision Products Private Limited
	10. TDS Power Systems
	11. San Engineering
Food & Beverages	1. J. S. Masala Co
	2. Swastik Masalas & Food Products Private Limited
	3. Sri Venkateshwara Minerals
	4. Neo Foods
	5. DropKaffe Food & Beverages Pvt. Ltd.
	6. Kanti Sweets
	7. Jumbotail
	8. Sun valley foods & beverages private limited
	9. Modern Food Ltd
Textile	1. Mittal Clothing Pvt Ltd
	2. Indian Textile Auxiliary Co.
	3. Eka
Pharma	1. Vesper Pharmaceuticals
	2. Sami Labs
	3. Bal Pharma Ltd
Consumer Durables	1. Embedtronics Ltd
	2. Unitronics
	3. Flexitron
	4. Dip TEchcorp

Factor Analysis for Environmental Performance

The following are the factors defined:

Factor 1 – With GSCM, the firm can manage resources and suppliers optimally thereby reducing production costs.

Factor 2 - With GSCM-driven superior exploitation of resources, the firm can reduce operational costs.

Factor 3 - Given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand.

Factor 4 - With GSCM, firms' production of hazardous substances can be reduced, thereby reducing the likelihood of the firm violating environmental regulations.

Factor 5 - With GSCM, Bind the suppliers to minimise waste and emissions from the supply chain.

Factor 6 - GSCM achieves waste reduction through improved efficiency, minimizing damage to environment.

Factor 7 - With GSCM, the firm can promote recycling and reuse raw materials thereby reducing production costs.

Factor 8 - GSCM promotes recycling, reducing the outflow of effluents from factories and minimizing the damage to environment.

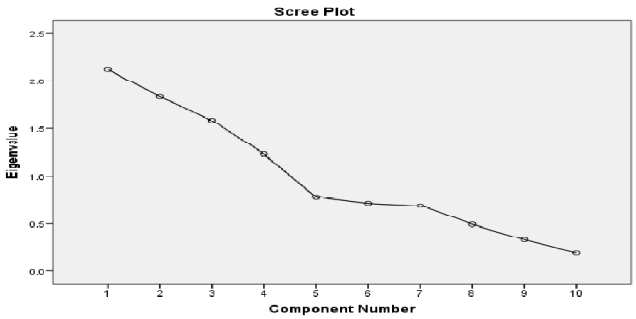
Factor 9 - GSCM facilitates reuse of raw materials which minimizes air pollution.

Factor 10 - GSCM set targets for supply chain carbon reductions.

KMO and Bartlett's Test for Environmental performance

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.544
Bartlett's Test of Sphericity	Approx. Chi-Square	56.861
	df	45
	Sig.	.002

It may be noted that the value of KMO is greater than .5, indicating that the factor analysis can be used for the given set of data. Bartlett's Test of Sphericity indicates that the correlation coefficient matrix has a significant P value which is less than .05. It indicates rejection of the null hypothesis.



The result of the total variance and eigen values of seven factors is shown in the above graph. The table presents the total variance explained by the factor analysis solution and gives an indication about the number of useful factors (Hair, 2008). The first column under "initial eigenvalues" gives the eigenvalues for all the possible factors in a decreasing order. The second column titled "extraction sums of squared loadings" gives information on factors with eigenvalues greater than 1 after factor extraction. The last part of the table, titled "rotated sums of squared loadings" gives the information on the extracted factors after rotation. The value under the column "Cumulative %" indicates that the seven extracted factors explain 67.610. % of the variance.

The extraction method followed is principal component analysis. The first four components are dominating with Eigen values 2.117 with 21.165% of variance, 1.830 with 18.303% of variance, 1.587 with 15.873% of variance and 1.227 with 12.268% of variance. The newly formed four components explain the 67.610% of variance.

Total Variance Explained

Component	*Initial Eigenvalues*			*Extraction Sums of Squared Loadings*			*Rotation Sums of Squared Loadings*		
	Total	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*	*Total*	*% of Variance*	*Cumulative %*
1	2.117	21.165	21.165	2.117	21.165	21.165	2.036	20.356	20.356
2	1.830	18.303	39.469	1.830	18.303	39.469	1.629	16.293	36.649
3	1.587	15.873	55.342	1.587	15.873	55.342	1.619	16.194	52.843
4	1.227	12.268	67.610	1.227	12.268	67.610	1.477	14.767	67.610
5	.785	7.852	75.462						
6	.721	7.215	82.677						
7	.694	6.939	89.616						
8	.495	4.948	94.564						
9	.341	3.414	97.978						
10	.202	2.022	100.000						

Component Matrix[a] for Environmental Performances

Component	*1*	*2*	*3*	*4*
With GSCM, the firm can manage resources and suppliers optimally thereby reducing production costs (factor 1)	.347	.405	.567	-.352
With GSCM-driven superior exploitation of resources, the firm can reduce operational costs. (factor 2)	-.142	.367	.452	.327
Given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand. (factor 3)	.229	.134	.688	.040
With GSCM, firms' production of hazardous substances can be reduced, thereby reducing the likelihood of the firm violating environmental regulations. (factor 4)	.741	-.207	-.282	.384
With GSCM, Bind the suppliers to minimise waste and emissions from the supply chain (factor 5)	-.073	.568	.061	.446
GSCM achieves waste reduction through improved efficiency, minimising damage to environment. (factor 6)	-.012	-.754	.193	.515
With GSCM, the firm can promote recycling and reuse raw materials thereby reducing production costs (factor 7)	-.857	-.027	.029	.216
GSCM promotes recycling, reducing the outflow of effluents from factories and minimising the damage to environment (factor 8)	.584	-.477	.340	-.116
GSCM facilitates reuse of raw materials which minimises air pollution (factor 9)	-.388	-.424	.065	-.553
GSCM set targets for supply chain carbon reductions. (factor 10)	.378	.416	-.589	-.126

(Extraction Method: Principal Component Analysis. ***a. 4 components extracted)***

The extraction method followed is principal component analysis. Component 1 is explained by factor 7 which is negatively correlated; factor 4 and factor 8 are positively correlated to component1. Component 2 is explained by factor 6 and factor 8 which are negatively correlated and factor 5 which is positively correlated to component 2. Component 3 is explained by factor 3, factor 1 and factor 10 which is negatively correlated to the component 3.Component 4 is explained factor 6, factor 5and factor 9 which is negatively correlated to component 4.

Association between the view that given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand and the sectors the firms belong to.

H_0: *The view that given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand is independent of the sectors the firms belong to.*

Association test for environmental friendly products

Given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand	*Sectors the firms belong to*					
	Engineering	*Pharma*	*Consumer durables*	*Textiles*	*Food and beverages*	*Total*
Strongly Agree	1	0	1	0	2	4
Agree	4	1	1	2	1	9
Neutral	1	0	0	1	1	3
Disagree	3	1	2	0	3	9
Strongly Disagree	2	1	0	0	2	5
Total	11	3	4	3	9	30

Chi-Square Tests

	Value	*df*	*Asymp. Sig. (2-sided)*
Pearson Chi-Square	10.205[a]	16	.856
Likelihood Ratio	12.755	16	.691
Linear-by-Linear Association	.019	1	.891
No. of Valid Cases	30		

a. 25 cells (100.0%) have expected count less than 5. The minimum expected count is .30.

The chi square value is 10.205 with a degree of freedom 16. Here the Asymp Sig is 0.85 (> 0.05, the critical value). Hence the null hypothesis is accepted that *'The view that given its environment-friendly products, the firm can attract more customers, gain competitive edge and enhance its brand is independent of the sectors the firms belong to'.*

Association between the view that GSCM achieves waste reduction through improved efficiency, minimising damage to environment and the sectors the firms belong to

H_0: *Association between the view that GSCM achieves waste reduction through improved efficiency, minimising damage to environment is independent of the sectors the firms belong to.*

GSCM achieves waste reduction through improved efficiency, minimising damage to environment	*Sectors the firms belong to*					
	Engineering	*Pharma*	*Consumer durables*	*Textiles*	*Food and beverages*	*Total*
Strongly Agree	0	1	1	0	1	3
Agree	5	0	0	2	1	8
Neutral	2	0	1	0	0	3
Disagree	3	1	2	0	5	11
Strongly Disagree	1	1	0	1	2	5
Total	11	3	4	3	9	30

Chi-Square Tests

	Value	*df*	*Asymp. Sig. (2-sided)*
Pearson Chi-Square	17.676[a]	16	.343
Likelihood Ratio	22.063	16	.141
Linear-by-Linear Association	.979	1	.322
No. of Valid Cases	30		

a. 25 cells (100.0%) have expected count less than 5. The minimum expected count is .30.

The chi square value is 17.676 with a degree of freedom 16. Here the Asymp Sig is 0.34 (> 0.05, the critical value). Hence we reject the alternate hypothesis and accept the null hypothesis: *Association between the view that GSCM achieves waste reduction through improved efficiency, minimising damage to environment is independent of the sectors the firms belong to.*

DISCUSSION AND CONCLUSIONS

In Factor Analysis for environmental performance, the dominant factors in accordance to GSCM practices are waste reduction, recycling of raw materials, production of hazardous substances and optimally utilizing supplier affecting environmental performance. (Kumar, 2012)

Environment friendly products, the firm can attract more customers, gain competitive edge and enhance its brand. However the responses show a negative skewness which indicates most respondents have disagreed with the above statement. The kurtosis for the Table,-1.35 (< 3) is a platykurt which means that the data is widely spread across the normal distribution. (Vachon, 2007)

Green practices also help the firms achieve waste reduction. This represents savings not only at the level of the firms but also at the national and international levels. Waste reduction raises productivity more cost-effectively compared to other dedicated productivity-enhancing measures.

GSCM reduces production costs for the firms since it helps the firms to manage resources and suppliers optimally. Being a measure that enhances ROI without much investment upfront, firms should necessarily be into GSCM. This not only translates into improved benefits for stakeholders like shareholders but also for other stakeholder categories, the government included. The energy conserved owing to adherence to GSCM, the pollution curtailed, again thanks to GSCM, etc will benefit the local community and the village / town the firm operates from, apart from benefiting the government. The latter can reduce energy imports and reduce its investment in pollution control measures. Production of hazardous substances can also be

minimised, courtesy GSCM. Hazardous substances released as by-products during manufacturing operations in particular can be greatly minimised if GSCM is adhered to. Presently the release of such by-products during the manufacture of relatively non-polluting or harmless products poses a great threat to the environment. Even the regulator is finding it difficult to track all the offending manufacturers since they come in all shapes and all sizes in every nook and cranny of the country. Given that India is a huge geography, resource constraints render it impossible for the regulator to identify and act upon all the manufacturing units that spew hazardous substances into the atmosphere. Hence the government should mandate green practices in all the sectors.

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