

Green Supply Chain Management: A Study Based on SMEs in India

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ABSTRACT

This empirical study explores the extent of implementation of green supply chain initiatives for small and medium enterprises (SMEs) in Chennai area, in the southern part of India. The green supply chain management (GSCM) framework, which has been adopted in the research, comprises three phases of the green supply chain. These phases are:

- greening the inbound logistics of the supply chain, categorized into green sourcing and green process.
- greening production or internal supply chain
- greening the outbound logistics of the supply chain

SMEs have always been the backbone of industrial activity in manufacturing, as well as service sector. Thus, if greening of industry is to be achieved it is very important for SMEs to be green.

Using a questionnaire as research instrument, survey was conducted amongst the environmental management representatives (EMR) or the chief executive of SMEs in Chennai area. The database generated thereby was analyzed using significance testing followed by structural equation modeling. From the results obtained one observes that greening of Inbound Logistics on sourcing aspect is significantly being achieved but greening of Inbound Logistics on process is not significantly being achieved yet. Greening of production is being achieved but not outbound logistics. Economic performance is achieved significantly but environmental performance is not significantly achieved, as in the current state. All the same, to achieve environmental performance the outbound logistics adopted by SMEs must be significantly enhanced.

Keywords: Small and Medium Enterprises, Green Supply Chain Management, Environmental Performance

INTRODUCTION

Over the last two decades business organizations across the world woke up to the increasing relevance of sustainable development. Many business enterprises adopted environmental initiatives as an integral part of their business, integrating various innovative concepts such as environmental sustainability, responsible manufacturing, triple bottom line, better compliance to environmental standards, environment friendly waste management, etc. into their overall company strategy (Bacallan, 2000; Rao & Kondo, 2010). These organizations in their effort to turn green have also realized that if sustainability has to be achieved, the greening initiative has to encompass the entire stretch of the operations of a company and include suppliers, customers, waste handlers and other business partners in the greening process (Cervera & Flores, 2012; Sharma, Rajan, Jose, & Rao, 2015). Thus, an integrated green supply chain approach would have to be incorporated where companies would need to identify environmental aspects at every stage, assess the environmental impacts associated with the aspects and design action plans to mitigate the adverse effects

on the environment if any. This initiative would need to consider the inbound logistics phase of the supply chain, production or internal supply chain, outbound logistics phase and reverse logistics phase (Rao, 2002; Rao & Holt, 2005; Rao, 2007; Sarkis, 1999; Seuring & Muller, 2007).

Ever since 1992, when the sustainability word was first coined in the Earth Summit at Rio, the environment management in the context of business became a topic on the international policy arena, as the United Nations Environmental Programme (UNEP) was established. Since then, several initiatives have been taken, like EMS, Environmental Management System, Cleaner Production, Responsible Manufacturing and GSCM, green supply chain management. The latter approach seems to be the most comprehensive of such initiatives as it encompasses the entire operations of a company and involves all stakeholders. It even looks beyond “The walls of the Factory” to extend the sustainability benefits to communities surrounding them (Rao, 2000).

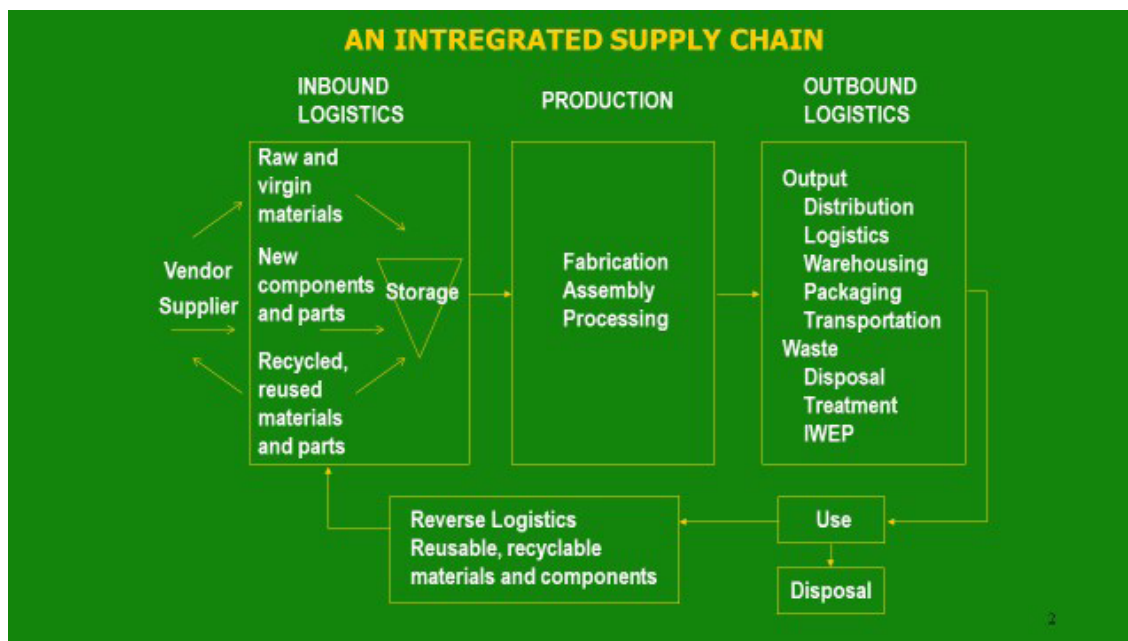
The green supply chain on one side would help companies to contribute towards sustainability for their own operation. On the other side this initiative would directly

lead to greening of industry which is so desperately needed in today's world.

In India like most of Asia, for many organizations, green supply chain approach has been a popular way to demonstrate their commitment to sustainability (Bacallan, 2000). Also, given that company and its business partners

are always considered as one single system to deliver the product or the service, any shortfall on the part of sustainability initiative from business partners is taken as the company's failure to ensure sustainability. This is why the state of the art companies have tried to integrate the sustainability initiative in a complete manner along the entire supply chain.

TRADITIONAL GREEN SUPPLY CHAIN



Source: Sarkis (1999), Rao (2014)

Fig. 1

Green supply chain management practices in India have generally been more popular with large and state of the art companies. However, for SMEs, who form the backbone of manufacturing sector in most countries in Asia, these endeavors have not been much in priority primarily because of lack of awareness and the perception that environmental initiatives are costly. However, for greening of industry it is crucial that the SME sector is environmentally sustainable.

This is all the more so because SMEs often carry on manufacturing without adhering to cleaner production approaches. This results in production of effluent solid and liquid waste and hazardous emissions which pollute the air. Also they take short cuts in waste management so the effluent waste is not recycled and disposed of in an environment friendly manner. All these produce severe water and air pollution and impact the health of communities all around. The greenhouse gases emitted produce global warming and climate change too.

All the same, in the recent years, some groups of SMEs in India have been trying to incorporate green supply chain management in their operations. They have been taking interest in this approach because their customers, most of whom are large global and multinational companies, insist on their supplier companies to have sustainable practices. They insist that they would only do business with suppliers, who are the SMEs in India, have taken measures to green their supply chain. Thus SME suppliers, in order to be in business and remain competitive have been taking care to green the Inbound logistics which include green sourcing and green inbound process, green production as well as green outbound logistics. While this initiative certainly ensures SMEs to remain competitive and achieve economic performance, it needs to be assessed whether the environmental performance is also achieved.

The current paper explores the extent of implementation of green supply chain initiative for a group of SMEs in the Chennai area of India and tries to determine if economic

performance as well as environmental performance are getting achieved. This exploration is carried out with the help of an empirical survey conducted in this area where many SMEs exist supplying auto parts to global multinational companies.

SMEs IN INDIA

In every country SMEs, both in manufacturing and service sector, carry a major portion of the operations. In India over 50% to 66% of all businesses constitute small and medium enterprises, SMEs. In many regions, this proportion is even greater. SMEs are capable of creating jobs and wealth with the least amount of capital. They are also adaptable and help in development in dispersed locations. These enterprises are often the sole job-provider and form the backbone of industrial activity in not so developed regions. This makes SMEs attractive to policy makers

However, they remain a heterogeneous group with different organizational forms, ranging from proprietorship to corporate (Venkatesh & Muthiah, 2012).

All the same these enterprises are typically low in capital and thereby lack money and technological expertise to address environmental pollution.

SMEs play a vital role in the growth of the Indian economy by contributing 45% of industrial output and 40% of exports, employing 60 million people, creating 1.3 million jobs every year, and producing over 8000 quality products for the Indian and international markets. The contribution of SMEs towards GDP in 2016 was about 20 %; this is expected to increase much higher in next few years. There are approximately 30 million micro, small, and medium enterprises (MSME) units in India, and 12 million people are expected to join the workforce in the next few years (Rawat et al., 2014).

SMEs are the fountainhead of several innovations in manufacturing and service sectors; they serve as the major link in the supply chain with corporates and public sector undertakings (PSUs).

By promoting SMEs, the rural areas of India will be developed.

Thus, it has been recognized that SMEs play very important role in the economies of developing countries and developed countries by generating employment, revenues and regional development. The definition of SME differs from country to country. In India, the small enterprises are defined as the firms with the total

investment in between Rs. 25 lakh to Rs. 5 crore; and the medium enterprises are the firms where total investment is in between Rs. 5 crore to Rs. 10 crore (Inayatullah & Singh, 2015).

SMEs are now exposed to greater opportunities than ever for expansion and diversification across sectors. The Indian market is growing rapidly, and Indian entrepreneurs are making remarkable progress in various industries like manufacturing, precision engineering design, food processing, pharmaceutical, textile & garments, retail, IT and ITES, agro, and services (Barton & Thomas, 2009).

In India, SMEs are commonly categorized in terms of the size of the investment in assets (Rai, 2009).

Table 1

Manufacturing Enterprises – Investment in Plant & Machinery			
Description		INR	USD(\$)
Micro	Enter-prises	Up to Rs. 25 lakh	Up to \$62,500
Small	Enter-prises	Above Rs. 25 lakh & up to Rs. 5 crores	Above \$62,500 & up to \$1.25 million
Medium	Enter-prises	Above Rs. 5 crore & up to Rs. 10 crore	Above \$1.25 million & up to \$2.5 million

Source: Rai (2009)

SMEs IN CHENNAI

Chennai, in southern part of India, is an emerging leader in the Indian manufacturing industry, with a special focus on automotive industry, with a large number of thriving SMEs driving the growth. Unless, this sector is environmentally sustainable, the overall greening of industry will suffer.

This study aims to explore whether GSCM awareness and initiatives exist in this sector in Chennai, and whether GSCM improves the economic and financial performance of SMEs in the Chennai region.

Since their contributions to the industry are huge, and also their contribution to pollution is huge, it is really important that the operations of SMEs are made environment-friendly. SMEs should be motivated to focus on proper waste disposal practices, to reduce waste at the source (both hazardous and non-hazardous), to use environment-friendly materials and more reusable and recyclable materials, to optimize their processes to cut down air emissions, water contamination, and effluent production, and to ensure environment-friendly disposal of solid and liquid wastes.

The objective of this research is to investigate to what extent GSCM has been established and implemented for SMEs in Chennai and to determine the degree of correlation of the GSCM initiatives with the environmental performance and economic performance of the SMEs.

GSCM Implementation for SMEs...A Brief Literature Review

The theoretical literature which is available on SMEs adopting sustainability issues, is currently encompassing integrative approaches encompassing products, process and the systems which bind them, rather than considering generic issues of environmental management. The integrative approaches are considered to be more efficient and add value to economic and business sustainability (Esty & Winston, 2006).

For SMEs in UK, Cassells and Lewis (2011) found that waste and transport are the main areas where SMEs impact upon the environment, and their initiative focused on activities to neutralize hazardous waste before discharging into the environment, reduce waste and packaging and increase recycling. Also they aim to reduce fuel and energy use, adopt environment friendly distribution system and minimize generation of pollution.

Dangelico and Pujari (2010) find that SMEs are likely to adopt green product/process innovation primarily for strategic opportunity, while there is an urgent need to meet customer expectations and legal compliance (Esty & Winston, 2006), (van Hemel & Cramer, 2002).

Also SMEs consider commercial benefits, customer and competition and also inter-organizational cooperation as supply chain priorities (Seuring & Muller, 2007). These issues impact upon material sourcing, distribution and integration into the entire supply chain, but there is a lack of empirical research into the challenges of developing and marketing green products (Dangelico & Pujari, 2010).

It is well known that proactive businesses, especially large business houses can achieve first mover benefits by adopting more sustainable practices, which in turn create competitive advantage that is hard for competitors to copy (Rao, 2005; Markley, 2007). According to Lynne (2008) there have been leading companies who met both customer and environmental needs. They designed and manufactured green products and developed the reputation of a trusted eco-brand.

Jain and Gupta (2016) have explored the status of GSCM Implementation in SMEs in different countries such as China and Japan and found that the mode of

implementation has been different in different countries. (Rao, 2002; Zhu et al., 2005). Their review also suggests that manufacturing industry in one country becomes different from other countries due to their differences in background and culture because different industry sectors face different pressures.

Esty and Winston (2006) explore the SMEs considering to achieve 'eco-advantage' by considering how to integrate sustainability issues into their operations and achieve competitive advantage...how they adopt and innovate in terms of sustainability, the benefits which accrue and the obstacles they face. Their work build on 15 SMEs in UK revealing the scope and challenges for SMEs to adopt more sustainable practices, encompassing innovations and a broad set of capabilities.

According to them Small and medium enterprises (SMEs) have generally been thought of as experts in innovations and creativity. (DTI, 1994). This initiative can now be transformed into green innovation and SMEs could be seen to encourage the development of new, more sustainable products, changing processes to reduce hazardous and non-hazardous waste, reduce particulates and emissions, come up with more energy efficient warehousing and a host of other sustainability initiatives.

Kot (2018) conducted a detailed analysis of sustainable development in the supply chain of SME sector and came out with a finding that the interest and implementation of sustainability in this sector is currently underdeveloped. A limited number of studies in this specific field have been conducted at present in the existing literature. However, the examination shows that small and medium enterprises are involved more in environmental and social practices of the supply chain, which are strongly connected with the customers and managers' priorities.

In the Indian context Inayatullah and Singh (2015) explored the similarities and dissimilarities of green supply chain management practices between large enterprises (LE) and small and-medium enterprises (SME) of India. Using a Survey method to gather the responses from Indian organizations they come out with the finding that both large enterprises and SMEs have similar business objectives and to achieve these objectives they employ strategies which are similar. However, SMEs lack in strengthening the relationship with suppliers and supplier's skill development as well. In other words they are not able to green the Inbound logistics of the supply chain with respect to suppliers. Also there are differences in the way SMEs and large organizations look at barriers to implementation of SCM practices, the culture prevalent

in the organization, and benchmarking practices. Their finding revealed that the major barriers to implement SCM practices in the context of SMEs are found to be high costs, human resource resistant to new techniques, lack of clear understanding of SCM, non-availability of training for new technologies, and improper communication systems.

With literature examining implementation of Green supply chain amongst SMEs in different parts of the world and coming up with the result that the driving forces, obstacles and barriers faced are not the same everywhere, one observes that the extent of implementation would also be specific to the region and indeed to the industry sector the SMEs are operating in. Thus the GSCM implementation and their motivations would also be different leading to different strategic approaches which would lead to greening industry.

In the current research the empirical approach would assess the extent of implementation of GSCM for the SME sector and endeavor to see if these results would indeed lead to not only economic performance, which is of primary interest to the SMEs, but also to environmental performance which would benefit the environment and communities they serve.

The GSCM framework which has been adopted in the research comprises different phases of the green supply chain which have been formulated as constructs in the analytical modeling.

The constructs depicting the phases of the green supply chain are as follows:

- greening the inbound function of the supply chain, categorized into green sourcing and green process.
- greening production or internal supply chain.
- greening the outbound function of the supply chain.

Inbound Logistics: Green Sourcing

This construct considers Green purchasing / green sourcing related to products.

The individual variables making up the construct are:

- sourcing environment friendly materials.
- substitution of environmentally questionable materials.
- reducing the purchase volume of items that are difficult to dispose of.
- reducing the use of virgin materials by using more recycled, reused and recyclable Materials (Rao & Kondo, 2010)

Inbound Logistics: Green Process

This construct considers the process component under green Inbound Logistics.

The individual variables constituting this construct are:

- Selection of suppliers by environmental criteria.
- Requiring suppliers to provide environmental impacts of the product content.
- Specifying that the products that are supplied must have green attributes.
- Specifying that the products must not contain environmentally hazardous attributes.
- Requiring suppliers to provide information (MSDS) about their environmental aspects. (Rao & Kondo, 2010)

Internal Logistics: Greening the Production Phase

This construct encompasses the following items which make up the green production phase.

1. Use of environmentally friendly raw materials in production.
2. Substitution of environmentally questionable materials.
3. Taking environmental criteria into consideration in production.
4. Accounting for environmental design considerations.
5. Optimization of process to reduce solid & liquid waste and emissions.
6. Use of cleaner technology processes to save energy, water, and waste.
7. Internal recycling of materials within the production phase.
8. Incorporating environmental total quality management principles such as worker empowerment.

Outbound Logistics: Greening the Outbound Function

1. Environmentally friendly waste management.
2. Environmental improvement of packaging.
3. Taking back packaging.
4. Eco-labelling and communicating to customer.
5. Recovery of company's end-of-life products.

6. Providing customer with information on environmental friendly products and/or production methods.
7. Use of environmentally friendly transportation.

The current research endeavors to explore if these phases of green supply chain would indeed lead to environmental performance and economic performance. So the framework considers constructs for achieving environmental performance and economic performance too.

Achieving Environmental Performance

This construct is perhaps the most critical of all other variables which are of relevance in the context of green supply chain as they are implemented in today's world.

Because of business being globalized in today's world without borders, India is fast becoming an important provider of products and services for markets in different countries. Several players in our country deal with global companies in these markets in the form of suppliers of products and services and in the form of business partners in the organization. This is especially true in Chennai where SMEs are mostly suppliers to such global companies. However, in order to be acceptable to and welcome in these markets and to be competitive simultaneously, these companies/providers need to have an image of environmentally sustainable performance in all the company's initiatives. Thus they need to demonstrate that they are putting in significant efforts to achieve the following:

- Reduction of solid/liquid waste.

- Reduction of emissions, particulate and CO2.
- Improvement of compliance.
- Preserve environmental performance in general.
- Achieve social commitment.
- Reduction of material use, water use and energy use.

All the same whether these measures of environmental performance are actually been achieved would need to emerge with the examination of data. In other words, they must achieve reduction in emissions, reduction of toxic waste, improve compliance with standards at every point, ensure conservation of resources, and reduce greenhouse gases to address climate change concerns.

Achieving Economic Performance

Economic performance, especially for SMEs forms the leading driving force towards adopting green initiatives (Sharma et al., 2015; Rao, 2002; Klassen & McLaughlin, 1996).

In this research economic performance encompasses the following items.

- New market opportunities
- Product price increase
- Profit margin
- Sales enhancement
- Improvement in market share

CONCEPTUAL FRAMEWORK

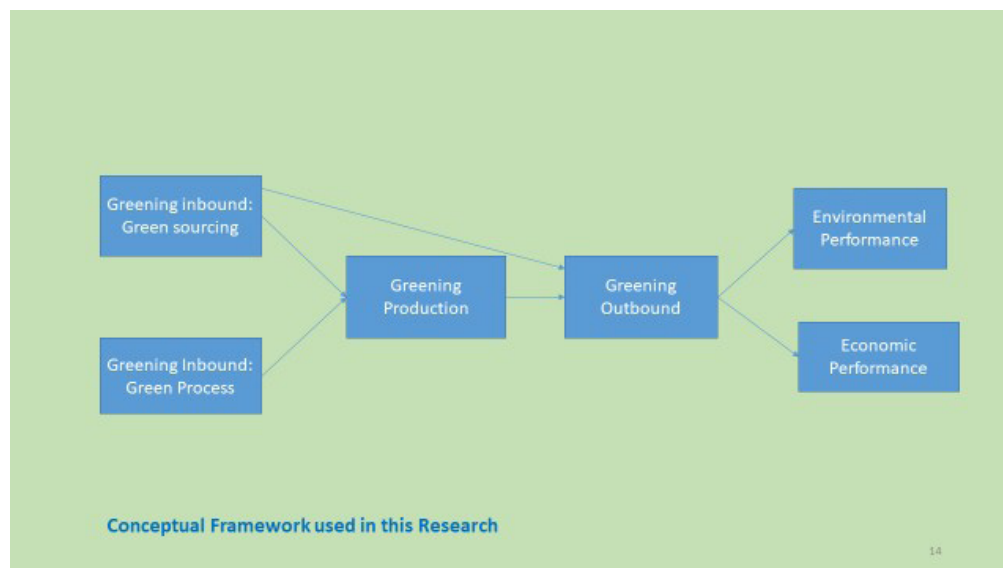


Fig. 2

RESEARCH METHODOLOGY

In the empirical research, a questionnaire was used as research instrument and a survey was conducted amongst the environmental management representatives (EMR) or the chief executive of SMEs in Chennai.

The responses for each item in the questionnaire were rated on a 4-point Likert scale (ranging from 1 = “strongly disagree” to 4 = “strongly agree”). The data collection method comprised a non probability approach because a proper sampling frame was not available.

The final sample size was 99.

DATA ANALYSIS

Extent of Implementation of Green Supply Chain Initiatives for SMEs in Chennai

Significance Testing

Results pertaining to effects of implementation of green supply chain initiatives on operations of

99 SMEs in the Chennai area. (Margin of error in sampling = 10 %, level of significance = 5 %)

For the six constructs Greening of Inbound Logistics on Sourcing, Greening Inbound on Process, Greening Production, and Greening of Outbound Logistics, achieving environmental performance and economic performance, a one-sample *t*-test was conducted with the following values (one-tail significance test with cut-off point = 2.5, the median of the 4-point scale).

H0: Mean \leq 2.5

H1: Mean $>$ 2.5.

t-critical = 1.645.

Table 2

Construct	t-value	significance
Greening Inbound: sourcing	1.959	significant at 5% level of significance
Greening Inbound : Process:	0.985	not significant
Greening Production	1.861	significant
Greening Outbound	-3.845	not significant
Economic performance	2.856	significant at 5% level of significance
Environmental performance	0.742	not significant

The results from data analysis above concludes that Greening of Inbound Logistics phase on sourcing is being

achieved by SMEs concerned at 5 % level of significance, but Greening of Inbound logistics with reference to Process is not achieved significantly.

Greening of Production is achieve significantly.

Greening of Outbound Logistics is not achieved.

Economic Performance achieved.

Environmental Performance is not achieved.

Data Analysis to Explore Linkages Between Green Supply Chain Management and Environmental and Economic Performance... by Confirmatory Factor Analysis Structural Equation Modeling.

For structural equation modeling, SEM (Jöreskog & Sörbom, 1993) the data analysis tried to determine the causal relationships between the different latent constructs: greening the inbound function for sourcing; greening of inbound logistics with reference to process, greening production; greening the outbound function; environmental performance; and economic performance. The goodness of fit or probabilistic significance of the overall model was determined by the chi-square value, the corresponding degrees of freedom, and the *p*-value associated with level of significance related to chi square value and degrees of freedom. For the model to be significant the overall *p*-value should have a level of significance greater than 0.05.

The individual linkages between any two variables were tested using the critical ratio, which is a statistic that has an approximate standard normal distribution. Thus, using a significance level of 0.05, any critical ratio that exceeds 1.96 in magnitude would be significant, in a two tail scenario. The critical ratio is interpreted as: if there were a significant link between greening the inbound function for sourcing and environmental performance, it would imply that the former latent construct directly influences the latter.

For the confirmatory analysis, under SEM, the conceptual model involving the six constructs was run using AMOS Graphics for Windows, estimating the regression weight of each link (arrow) and the associated significance, using maximum likelihood estimation (MLE) procedure, which is known to provide valid results with sample sizes as small as 50. In addition to *p*-value, the analysis used a further index of goodness of fit which is chi-square/degrees of freedom. In addition, Goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and root mean square residual (RMSR) indicators were used to evaluate

the validity of the model. Several sets of analyses were conducted with the input being the descriptive statistics of the indicator variables and their correlation matrix.

The SEM estimates a series of separate but interdependent multiple regression equations simultaneously. In the research the theory and the research objectives were considered to determine which independent variable would predict which dependent variable. The proposed relationships were then translated into a series of structural equations for each dependent variable. The structural model expresses these relationships among the independent and dependent variables.

The model was designed using IBM-SPSS-AMOS Version 20.0.0(Build 788).

RESULTS PERTAINING TO CONFIRMATORY ANALYSIS

Using the structural equation modelling approach under confirmatory factor analysis, the overall measures of goodness of fit were observed.

Table 3: Measures of Goodness of Fit Indicators

Chi-square/ degrees of Freedom	= 1.087	very acceptable
Overall model p-value	=0.249	very acceptable
GFI	=0.946	acceptable
CFI	=0.997	very acceptable
AGFI	= 0.909	very acceptable
NFI	=0.963	very acceptable

Next, we looked at the regression estimates, critical ratios, and the individual *p*-values of the different links.

Table 4

Links	estimate	critical ratio	p-value
GreeningInbound (sourcing) → Greeningprod	.369	2.224	0.026 (significant)
Greening Inbound (sourcing) → greening outbound	.125	.853	.195 (not significant)
Greeningprod → greening outbound	.177	1.732	.046 (significant)
Greening outbound → envperformance	.428	3.245	0.031 (significant)
GreeningInbound (process) → Greeningprod	.234	1.389	.147 (not significant)
Greeningprod → economic performance	.343	1.514	.062 (not significant)
Greening outbound → economic performance	.625	2.735	.025 (significant)

Covariance link between environmental performance and economic performance is not significant.

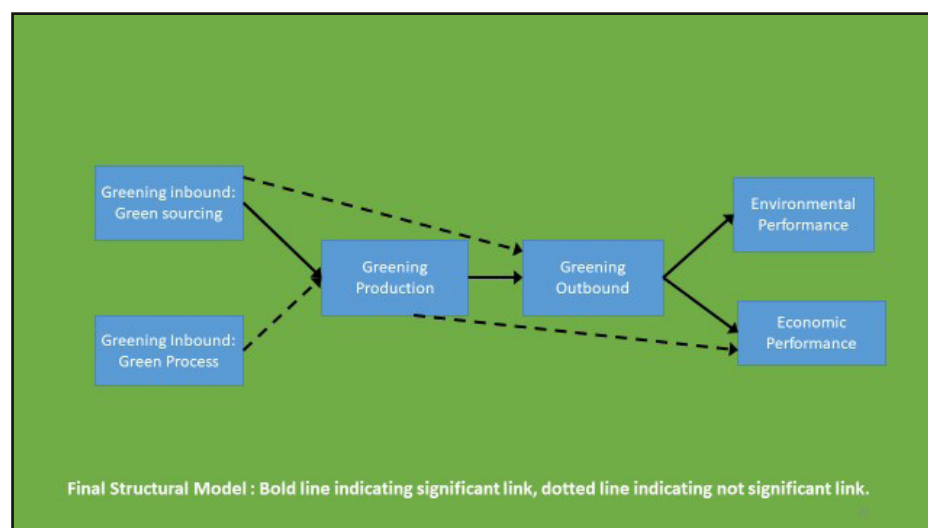


Fig. 3

DISCUSSION OF RESULTS

From the results obtained upon running the structural equation model, one infers that as SMEs increase their greening the inbound logistics initiative on sourcing, it is leading to increase of greening production initiative, which is leading to increase in greening of outbound logistics. The outbound logistic in turn is significantly leading to achievement of both environmental performance as well as economic performance. Greening the inbound on process does not have significant link to production yet. This clearly brings out the if SMEs are able to implement green sourcing; it would immediately enhance their economic as well as environmental performance.

From Table 2, as given on page 21, one observes here that Greening of Inbound on sourcing is significantly being implemented but greening of inbound on process is not significant yet. Greening of production is implemented but not outbound logistics. Economic performance is achieved significantly but environmental performance is not significantly achieved, as in the current state.

Thus the research concludes that currently green sourcing and green production are able to result in economic performance, as the customers are fine with greening initiatives of SMEs. The SMEs often have customers who are world class companies who need their suppliers to be green. So as long as SMEs are able to convince these customers that they are putting in effort to green their supply chain, the customers are fine, leading to economic performance of the SMEs. However, failure to achieve green outbound perhaps is resulting in not achieving the environmental performance, leading to failure to achieve greening of industry. In fact the Environmental Performance not being significantly achieved is indeed a concern because without environmental performance the pollution levels, toxic emissions, hazardous solid and liquid waste being generated, would seriously burden the health and well-being of communities surrounding the SMEs.

These results bring out the fact that greening of inbound as well as greening of production have to be achieved at a much higher level so that greening of outbound would be significant leading to significant environmental performance.

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