

AN ANALYSIS OF DRIVERS AFFECTING THE IMPLEMENTATION OF GREEN SUPPLY CHAIN MANAGEMENT FOR THE INDIAN MANUFACTURING INDUSTRIES

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Abstract

The supply chain consists of those activities associated with manufacturing from raw material acquisition to final product delivery. Because of the recently changed environmental requirements that affect manufacturing operations and transportation systems, growing attention is given to the development of environment management strategies for supply chains. A green supply chain aims at confining the wastes within the industrial system so as to conserve energy and prevent the dissipation of harmful materials into the environment. Frequently researches in study on drivers of Green Supply Chain Management are criticized for its narrow perspectives and lack of industrial relevance. So, it is a real need to find improved processes for adoption and implementation of Green practices Green image in Manufacturing Industries. In the current competitive scenario, the driver of Green Supply Chain Management assumes a significant importance and call for serious research attention. The aim of this paper is to examining the Green practices in the selected Indian Manufacturing Companies. The main objectives of this paper are to gain critical and crucial drivers for implementation of Green Supply Chain Management in Indian Manufacturing Industries in various sectors likewise, two wheeler, four wheeler, and General Manufacturing sector wise companies. This paper has attempted to fill the gaps in the contemporary research in the study on drivers of Green Supply Chain Management in selected Indian corporate sectors. It is observed that Driver, DF10 i.e. 'Employees Motivation, health & Safety' have more important and crucial for adoption of GSCM for 2-wheeler industries. It is also observed that Driver DF1 i.e. 'Government rules & legislation' have more important and crucial for adoption of GSCM for 4-wheeler industries. But it is also observed that Driver DF2 i.e. 'environmental concerns and legislation; DF7 i.e. customer awareness, pressure & support; DF12 i.e. organizational capabilities and awareness; and DF14 i.e. global climate pressure and ecological; respectively have equal importance and crucial for adoption of GSCM for general manufacturing companies.

Keywords: Driving Factors (DF), Green Supply Chain Management (GSCM), Manufacturing Industries.

1. INTRODUCTION

The economic growth increases the level of energy and material consumption, which contribute to the environmental issues and resource depletion problems. It has become increasingly significant for organizations facing competitive, regulatory, and community pressures to balance economic and environmental performance. Nowadays, most organizations are starting to go green in their business as concern to environmental sustainability. They have realized the greater benefit of the green supply technology adoption in business operation, which also affected suppliers and customers. Environmental issues under legislation and directives from customer especially in the US, the European Union (EU), and Japan become an important concern for manufacturers. As a result, Green Supply Chain Management (GSCM) emerges as a new systematic environmental approach in green supply

chain management and has been increasingly accepted and practices by forward-thinking organization.

A GSCM driver is that which adopt and implement the green practices and green image in manufacturing industries for minimizing the pollution which affect the human life. On other way we can say that it is a driver which drives the green supply chain management (GSCM) for adoption of green images and green practices in manufacturing industries. Several studies on GSCM have determined a broad range of factors to develop environmental management initiatives and practices to its supply chain. It can be motivated by firm's stakeholders' requests and persuaded by firm's want to have full compliance with environmental regulations, or even promoted by the firm's internal strategic motivations which are related to the opportunity to gain the competitive advantage in the market.

2. LITERATURE REVIEW

Literature review is that part of this research paper is to find out the research gap. Literature review takes into consideration the broader concept of sustainable development and outlines how and why companies should be concerned with environmental and social issues in Green Supply Chain Management. Common benefits of GSCM in achieving sustainability are enhanced value for cost reduction, customers, and competitive advantage.

2.1 Global Context

Rao [1], in his study on green supply chain management in South East Asian Region (Malaysia, Philippines, Indonesia, Singapore and Thailand,) found that environmental green supply chain management practices had started to take place the implementation of drivers of GSCM and investigated the occurrence of drivers for automobile company and other industries. Results indicated that drivers for automobile industry are the greatest among other companies. Simpson et al. [2], explored the moderating impact of relationship conditions existing between a customer and its suppliers and effectiveness of the customer's environmental performance requirements (otherwise known as "green-supply"). Chen [3], looked into the relationship between green innovation and green image of companies in Taiwan. The study proposed a new concept of green core competence.

Lee [4], has identified the drivers of participation in green supply chain initiatives by considering small and medium-sized suppliers and their most important stakeholders, including buyers and the government. Nawrocka et al. [5], they found that Sweden, has concentrated on the role of ISO 14001 in environmental supply management practices in Swedish companies. They described the existing and potential role of ISO 14001 for three key operational tasks of environmental supply chain management: to communicate the requirements to the supplier, to motivate and enable the supplier, and to verify that the supplier follows the requirement. Shang et al. [6], explored key green supply chain management (GSCM) capability dimensions and firm performance based on electronics related manufacturing firms in Taiwan. On the basis of a factor analysis, six green supply chain management dimensions were identified: green manufacturing and packaging, environmental participation, green marketing, green stock, green suppliers, and green eco-design. Chiou et al. [7], they found that Taiwan has explored the correlation between greening the supplier and green innovation in Taiwan Company by using Structural Equation Modeling. They concluded that greening the supplier through green innovation leads to significant benefits to the environmental performance and competitive advantage of the firm. Liu et al. [8], in China has analyzed the relationship between green supply chain management level (LGSCM) and the classified determinant factors. They confirmed that a company's environmental

management capacities will be strongly enhanced by frequent internal training of employees to increase its involvement in GSCM practices. Ninlawan et al. [9], in Thailand analyzed the recent green activities in computer parts' manufacturers and also measured the level of green supply chain management. The in-depth interview regarding green procurement, green manufacturing, green distribution, and reverse logistic has been conducted. Diabat and Govindan [10], identified the drivers influencing the implementation of GSCM using an Interpretive Structural Modeling (ISM) methodology and extracted 11 drivers collected through past literature: Certification of suppliers' environmental management system; environmental collaboration with suppliers; collaboration between product designers and suppliers to reduce and eliminate product environmental impacts; government regulation and legislation; green design; ISO 14001 certification; integrating quality environmental management into planning and operation process; reducing energy consumption; reusing and recycling materials and packaging, environmental collaboration with customers; and reverse logistics.

Eltayeb and Zailani [11], has identified the four key drivers or motivators to green supply chain initiatives: Regulations, customer requirements, expected business gains, and social responsibility. Eltayeb et al., analyzed the relationship between green supply chain initiatives and performance outcomes and identified the key initiatives (eco-design) that have positive effect on the four types of outcomes (environmental, economic, cost reductions, and intangible outcomes).

2.2 Indian Context

Chopra, S, P. Meindl et.al [12] founded that there are some main drivers behind applying GSCM in Indian manufacturing industry, such as straightforward cost reduction to facilitate the development of co-operative relationships with suppliers and encouraging life-cycle. On the other side, despite that there is an increasing environmental awareness; there is a slow implementation of GSCM across enterprises. Ravi, V., and Shankar R. [13], Interpretive Structural Modeling (ISM) methodology was utilized to understand the mutual influences among the drivers so that those driving factor which can aggravate few more drivers and those independent drivers which are mostly influenced by driving factor were identified. Srivastava and Srivastava [14], suggested a model to manage product returns and utilized average-life cycle of product data, past sales forecast demands to support their analysis. Semi-structured interviews to 84 stakeholders were used to triangulate the findings of the model. The findings shows that reverse logistics can cost-save only if done correctly. Srivastava [15], provided an overview of the academic perspective of the GSCM literature and also provided a brief introduction to traditional supply chain management and the chronology of GSCM. Mudgal et al. [16], they tried to

overcome these limitations and provide a useful framework for GSCM study and activity flow required for successful implementation of drivers of GSCM practices. Luthra, S., Manju, Kumar S., and Haleem A. [17], Importance of GSCM and factors important to implement GSCM in Indian manufacturing industry were identified and described. Various issues related to GSCM were discussed. Models for implementation of GSCM registered in the various approaches of GSCM and three main driving factors affecting GSCM were described. Sarode, and Bhaskarwar [18], they identified the various drivers which help in greening the supply chain of Indian manufacturing sector. They merely focused on top management commitment, societal concern for protection of natural environment, regulations, supplier involvement, customer satisfaction, green product development, green procurement practices, availability of clean technology, green disposal, green transportation, recycle, lean manufacturing practices, economic interests, eco labeling of products, reverse logistics practices, competitiveness and corporate image. Bhateja, et al. [19], identified that the environmental issues are very important for business. The literature about environmentally conscious supply chain is very limited.

Luthra, S. Kumar, V. Kumar, S. & Haleem, A. [20], mentioned that government legislation is one of the major drivers affecting GSCM practices adoption in the country. They have proved that there is a positive relationship between adopting GSCM practices and enhanced reputation and brand image of an organization. Although the results were positive from the perspective of enhancing reputation and brand image of an organization, it didn't imply that seeking for efficiency is the driver for adopting GSCM practices. Chien and Shih, Kumar et al., [21], worked on the implementation of green supply chain management practices in Manufacturing Companies and provided in depth study about procurement, green manufacturing, green distribution, and reverse logistics and investigate green supply chain management practices, measure green supply chain management performance, and explored GSCM pressure, driver. Nimawat Dheeraj and Namdev Vishal [22], they stated that green supply chain management is a very 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. (Pandya Amit R. & Mavani Pratik M. [23], they studied the major external driving factors affecting green supply chain management practices adopted by the Manufacturing companies in Ankleshwar and their objective to recognize and select appropriate strategy for implementing green supply chain management (GSCM) in Indian manufacturing company.

Ajay Verma, Dr. Anshul Gangele [24], they report on results from a cross-sectional survey with manufacturers in Indian companies. Their findings provide insights into the capabilities of Indian organizations on the adoption of green supply chain management (GSCM) practices in industrial contexts and that these practices are not considered equitably across the industries. Sunil Luthra, Dixit Garg, Sanjay Kumar, Abid Haleem [25], Green Supply Chain Management (GSCM) has been identified as an important research area and Green environmental issues have drawn an attention of researchers and Supply Chain practitioners at macro and micro level. Various factors important to implement Green Supply Chain Management relevant to Indian manufacturing company have been identified. Structural model of these factors has been formed using Interpretive Structural Modeling technique. Govindan. K. A, Shankar, M. [26], they found to analyze the drivers of green supply chain management with a fuzzy approach. The common drivers are identified through the existing literature and with the combined assistance of company experts. The Common drivers are provided as competitors, stakeholders, company image, financial benefit, environmental conservation, customers and compliance with regulations. These seven drivers are getting compared over one another based on the data provided by the company which is situated in the southern part of India. They concluded with the priority among common drivers to find out the essential driver of green supply chain management (GSCM) and helps to identify the essential driver of green supply chain management (GSCM) and in the future it also assists to stimulate that essential driver for implementing green supply chain management (GSCM).

3. LISTS OF IMPORTANT DRIVERS

These are various drivers for green supply chain management (GSCM) which are observed from the literature review and also important for Global and Indian manufacturing environment. The list of overall list of drivers are given below

Table 1 Driving factors

Sr.No.	Driving factors
1	Government Rules & legislation
2	Environmental concerns & legislature
3	Social & Environmental responsibility
4	Green image , Global marketing & Competitiveness
5	Society or public Pressure
6	Economic benefits or cost reduction benefits
7	Customers awareness, pressure & support
8	Suppliers Pressure & willingness
9	Investors & shareholder Pressure
10	Employees Motivation , health & Safety
11	Scarcity of Resources, Higher waste generation & Waste disposal problem

12	Organizational capabilities & awareness
13	Demand for environmentally friendly products
14	Global climate pressure & ecological

3.1 Government Rules & Legislation

This driver of Green Supply Chain Management states that the rule of law is a system of government in which a society adopts or maintains a set of good, just, and fair laws by which it and its government will be governed. All government officials and all private citizens must follow the laws of the nation and must the rule of law is the principle that governmental authority is legitimately exercised only in accordance with written, publicly disclosed laws that are adopted and enforced in accordance with established procedure. The government is created by and for the people and is answerable to the people. Government Rules & legislation is a major driver for company's environmental management Regulations increase the threats of penalties and fines for non-compliance among companies. This driver is most helpful for implementing and adoption of Green Supply Chain Management in Manufacturing Industries.

3.2 Environmental Concerns & Legislature

Environmental Concern and Legislation is an important driver or instrument in the control of environmental hazards to health, and has been used from the earliest days of public health, for example in the control of water quality and sanitation in the 19th century, and in various forms of air quality legislation in the 20th century. Legislation may take many forms, including regulation of emissions that may cause environmental pollution, taxation of environment and health damaging activities, and establishing the legal framework for trading schemes (e.g. for carbon emissions). Other Actions may rely on voluntary agreements. Some of the greatest benefits to public health have been achieved as a result of environmental interventions. Legislation has responded to the major environmental and public health concerns of the time and in notable cases has had a crucial influence in improving health. Environmental regulations can be observed as a motivation to innovate and decrease environmental impact.

3.3 Social & Environmental Responsibility

Social & Environmental responsibility is that driver of Green Supply Chain Management which initiative to assess and take responsibility for the company's effects on the environment and impact on social welfare. The term generally applies to company efforts that go beyond what may be required by regulators or environmental protection groups. Corporate social responsibility may also be referred to as "corporate citizenship" and can involve incurring short-term costs that do not provide an immediate financial benefit to the company, but instead promote positive social and environmental change. Some companies may engage in "green

washing", or feigning interest in corporate responsibility, but many large corporations are devoting real time and money to environmental sustainability programs, alternative energy, clean tech, and various social welfare initiatives to benefit employees, customers, and the community at large. Social responsibility becomes an integral part of the wealth creation process - which if managed properly should enhance the competitiveness of business and maximize the value of wealth creation to society.

3.4 Green Image, Global Marketing & Competitiveness

Green image is that driver of Green Supply Chain Management which provides a greening image where a Manufacturing product is to be used. It is most important driver of Green Supply Chain Management to adoption of GSCM in Manufacturing Industries. Global marketing is that driver of GSCM which states that the process of conveying a final product or service, with the hopes of reaching international marketing community. Global marketing has the ability of catapulting a company to the next level by, implementing several marketing strategies based on the region the company is marketing to. Global market is the activity of buying and selling of goods and services in all countries of the world. The idea of a global market has been highly enabled by the improvement of internet connectivity between nations where people are now able to buy and sell products from one nation to another through the internet. Global marketing is marketing on a worldwide scale to merge or take business advantages of the international differences, opportunities and likeness in operation so as to meet the global objectives. This process applies to the various companies that start as domestic companies in the world.

Global competitiveness is that driver of GSCM which states that the existence of competition among diverse organizations that serve global customers. An index of the competitiveness of the countries in the world is compiled every year by the World Economic Forum. Global competition is used to describe the worldwide market, and the struggle of different companies or businesses to prevail over the other. Global competition can help with providing

3.5 Society or Public Pressure

Society or public Pressure is that driver of Green Supply Chain Management which states that in any society, governmental entities enact laws, make policies, and allocate resources. This is true at all levels. Public policy can be generally defined as a system of laws, regulatory measures, courses of action, and funding priorities concerning a given topic promulgated by a governmental entity or its representatives. Individuals and groups often attempt to shape public policy through education, advocacy, or mobilization of interest groups. Shaping public policy is

obviously different in Western-style democracies than in other forms of government. But it is reasonable to assume that the process always involves efforts by competing interest groups to influence policy makers in their favor. In this context, advocacy can be defined as attempting to influence public policy through education, lobbying, or political pressure.

3.6 Economic Benefits or Cost Reduction Benefits

Economic benefits or Cost reduction benefits is that driver of GSCM which may be defined as the achievement of Real and Permanent Reduction in the unit cost of goods manufactured or services rendered without impairing their suitability for the use intended or diminution in the quality of the product. Cost reduction, should therefore, not be confused with cost saving and cost control. Cost saving could be a temporary affair and may be at the cost of quality. Cost reduction implies the retention of essential characteristics and quality of the product and thus it must be confined to permanent and genuine savings in the costs of manufacture, administration, distribution and selling, brought about by elimination of wasteful and inessential elements from the design of the product and from the techniques and practices carried out in connection therewith. In other words, the essential characteristics and techniques and quality of the products are retained through improved methods and techniques used and thereby a permanent reduction in the unit cost is achieved. The definition of cost reduction does not however include reduction in expenditure arising from reduction or similar govt. action or the effect of price agreements. The three fold assumption involved in the definition of cost reduction may be summarized as under.

- There is saving in a cost unit
- Such saving is of a permanent nature
- The utility and quality of goods remain unaffected, if not improved

3.7 Customer's Awareness, Pressure & Support

Customer awareness, pressure & support is that driver of Green Supply Chain Management which states that the understanding and knowledge that a buyer should have of his rights as a customer. The awareness is very important for the buyer since it permits him to get the most from what he buys. Consumer Awareness is making existing and potential customers knowledgeable about product's services, consumer awareness programs create more informed buying decisions. Consumers cannot purchase products and services if they do not know they exist. If specific products and services are better known, those products and services will remain on the front line in sales. Therefore, it is important to implement consumer awareness programs that will introduce and make the target audience aware of the products and services a company offers. Consumer awareness programs can be initiated through the utilization of flyers, brochures, television, radio, guides, fact sheets, information posted to a Web site,

school programs, and other sources depending upon the topic and the message delivered. So Customer awareness, pressure & support are most important for adoption of Green Supply Chain Management for Manufacturing Industries.

3.8 Suppliers Pressure & Willingness

Suppliers Pressure and willingness is that driver of GSCM which states that suppliers can help to provide valuable ideas used in the implementation of environmental projects, but they generally do not act as a direct driving force. However, whilst suppliers may not be the drivers, integration and cooperation in supply chains can support more effective management of environmental issues. A collaborative paradigm has been used to explore green supply chain management practices in manufacturing plants. It was found that greater supply chain integration can benefit environment management in operations. As the supply base was reduced, the extent of environmental collaboration with primary suppliers increased.

3.9 Investors & Shareholder Pressure

Somebody owning stock in corporation a person or organization that owns shares in a limited company or partnership. A shareholder has a stake in the company and becomes a member of it, with rights to attend the annual meeting. Since shareholders have invested money in a company, they have a vested interest in its performance and can be a powerful influence on company policy; they should consequently be considered stakeholders as well as shareholders. Some pressure groups have sought to exploit this by becoming shareholders in order to get a particular viewpoint or message across. At the same time, in order to maintain or increase the company's market value, managers must consider their responsibility to shareholders when formulating strategy. It has been argued that on some occasions the desire to make profits to raise returns for shareholders has damaged companies, because it has limited the amount of money spent in other areas (such as the development of facilities, or health and safety). Shareholders do have rights, which are defined in the corporation's charter and bylaws. They can inspect the company's books and records, sue the corporation for misdeeds of the directors and officers, and if the company liquidates, they have a right to a share of the proceeds. However, creditors, bondholders and preferred stockholders have precedence over common stockholders in liquidation. Shareholders also have a right to receive a portion of any dividends the company declares. Shareholders can attend the corporation's annual meeting to learn about the company's performance, vote on who sits on the board of directors and other matters. They can also listen to the meeting via conference call and vote by proxy through the mail or online. To learn more about a company's policies toward shareholders, consult the company's corporate governance policies.

3.10 Employees Motivation, Health & Safety

Employee motivation, health and safety are that driver of Green Supply Chain Management which is more helpful to implementation and adoption of GSCM in Manufacturing Industries. Employee motivation describes an employee's basic enthusiasm about work and incentives given to accomplish work. Motivating employees about work is the blend of satisfying the employee's requirements and prospect from work and workplace factors that facilitate employee motivation. Employee motivation is the processes that are set up to boost employee's morale by rewarding and acknowledging their work. There are various ways on how employees are motivated they include giving them support, monetary rewards, and good working conditions among others. Organizational health and safety should aim to promotion and maintenance of the highest degree of physical, mental and social well-being of workers; the prevention amongst workers of departures from health caused by their working conditions; the placing and maintenance of the workers in an occupational environment adapted to their capabilities.

3.11 Scarcity of Resources, Higher Waste Generation & Waste Disposal Problem

A resource with an available quantity of products less than its desired use value is known as scarcity of resources. Scarce resources are called factors of production. Scarce goods are also termed as economic goods. Scarce resources are used to produce scarce goods. Like the more general society wide condition of scarcity, a given resource is scarce because it has a limited availability in combination with a greater productive use. It's both of these that make it scarce. In other words even though an item is quite limited it will not be a scarce resource if it has few if any use. Waste Generation defined as 'any substance or object which the holder discards or intends or is required to discard', potentially represents an enormous loss of resources in the form of both materials and energy; in addition, the management and disposal of waste can have serious environmental impacts. For example, take up land space and may cause air, water and soil pollution, while incineration may result in emissions of dangerous air pollutants, unless properly regulated. Waste management policies therefore aim to reduce the environmental and health impacts of waste and improve the environmental resource efficiency. The long-term aim of these policies is to reduce the amount of waste generated and when waste generation is unavoidable to promote it as a resource and achieve higher levels of recycling and the safe disposal of waste.

3.12 Organizational Capabilities, Awareness

Organizational Capability and awareness is that driver of Green Supply Chain Management which is most important to adoption and implementation of GSCM in Manufacturing

Industries. Awareness of each and every employee regarding their work and to adoption of Green Supply Chain Management in Manufacturing Industries is so important. Organizational Awareness is a Social and Emotional Intelligence competency that can also be defined as situational awareness, or even empathy on an organizational scale. It is the ability to read social and political currents in organizations, teams, communities, and situations. When your skills in Organizational Awareness are strong, you are able to detect crucial social networks, power relationships, guiding values, and organizational norms. When these skills are weak, you may find it difficult to get things done in the organization, find yourself surprised by organizational events, make mistakes due to misunderstanding the organizational structure, or act in ways that the organization, team or community find inappropriate. Organizational Capability is the firm's ability to manage people to gain competitive advantage.

3.13 Demand for Environmentally Friendly Products

Demand for Environmentally friendly Products is that driver of Green Supply Chain Management which is most important to adoption of GSCM in Manufacturing Industries. Eco- and environmental friendly are two subjects seemingly without clear definitions. Terms such as green, natural and organic are frequently used. Eco Products as being produced by natural resources. Starting with the fiber, through the complete production chain, everything is controlled from an environmental perspective. Environmental friendly products are addresses recycling, sustainable production and reduction of energy consumption and transport. There is a need to recognize the increased demands regarding environmentally friendly products. There is a need of work constantly to find environmental friendly alternatives which are commercially viable. Environmentally friendly Products are green, purchasing options of eco friendly goods, that are good for people, animals, and the environment, and that will allow you to leave the smallest possible impact on the planet.

3.14 Global Climate Pressure & Ecological

Global climate pressure and ecological is that driver of Green Supply Chain Management which is most important to adoption and implementation of GSCM in Manufacturing Industries. Global climate pressure and ecology is a tremendously complex form of science that requires a broad spectrum of knowledge. If it is accepted that the planet is an interdependent system, every aspect of every local ecosystem must be considered to fully understand a problem. For instance, if a logging or mining project starts at one end of a river, global ecologists might look at not only the localized effects, but how the runoff would affect the whole river, ecosystems far downstream, and even the possible added pollution to the ocean at the end of the river. Keeping tabs on Earth-wide environmental issues, such as the thinning of the ozone layer, require dozens if not hundreds of dedicated field

researchers obtaining information in different areas around the globe. Most research on global ecology suggests that no one part of the world is expendable; that to protect humans, people must protect the Earth.

4. RESEARCH METHODOLOGY

Research methodology is based on empirical data collected through a questionnaire survey. The survey methodology is used for study. The main objective of survey is observing the status of driving factor of green supply chain management of Indian manufacturing companies. The problem was selected on the gap identified in literature. Data is collected through the questionnaire survey. The questionnaire was administered in 80 companies in the northern region of India.

4.1 Industry Database

The database 80 manufacturing companies located in northern part of India have been extracted from industrial directories. This is having name of the company, their location and postal address. The numbers of employee in surveyed industry are more than 100. In Indian scenario, major manufacturing industries are automobile (two wheeler and four wheeler) and general manufacturing industries. These sectors are included in our study. The reasons for selection of these sectors are as under

- These sectors are basically mechanical engineering industry which requires strong R & D activities to become successful in competition.
- These sectors are more involved in economic progress of the country as these sectors form the backbone of the industrial economy of the nation.

4.2 Development of Questionnaire

Based on literature (Diabat, A. & Govindan, K, [10], a questionnaire was designed. The questionnaire has been developed on a five point Likert scale. The various Drivers which are more important for the adoption of GSCM have been incorporated relevant to Indian context and which was not incorporated by the earlier researchers. The earlier studies are not focus on the various drivers particularly for the Automobile Industries, General Manufacturing Industries. This motivates to develop a new questionnaire in Indian context for particular sectors. Questions are related to company profile, number of employee, degree of importance given by company to adoption of GSCM for Indian manufacturing environment. The questionnaire contained two section ‘A’ and ‘B’. Section ‘A’ contain 03 question pertaining to company details and section ‘D’ has 14 question related to Drivers of green supply chain management.

4.3 Questionnaire Administration

Data is collected through a postal survey from northern Indian companies. Total numbers of questions on various Drivers of

GSCM to adaption of green supply chain management are 14 for finding the critical driver to adaption of GSCM in Indian manufacturing companies.

Profile of Respondents

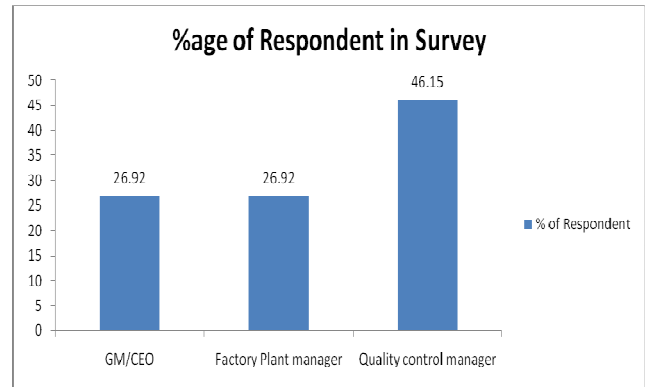


Fig 1 Percentage of various respondents during the survey

After the phone calls, email and remainder, out of 80 sending questionnaire, 26 filled responses have been received from the companies, which gives response rate 32.5%. Out of 26 respondents, 12(46.15%) were from quality control department manager. Seven (26.92%) were factory/plant manager. Seven (26.92%) were general manager.

5. OBSERVATION OF DATA

The data is collected from the executive of various manufacturing organizations on five point likert scale through survey. The SPSS software is used for analysis of collected data.

Table 2 Mean & Standard Deviation of drivers of GSCM for 4-wheeler industries

DRIVERS FOR ADOPTION OF GSCM	MEAN	STD. DEVIATION
Government Rules & legislation (DF1)	4.6154(1)	.5064
Environmental concerns & legislature (DF2)	4.3077(4)	.6304
Social & Environmental responsibility (DF3)	4.2308(6)	.8321
Green image, Global marketing & Competitiveness (DF4)	4.0000(9)	.8165
Society or Public Pressure	3.6923(12)	.6304

(DF5)		
Economic benefits or cost reduction benefits (DF6)	4.3077(5)	.6304
Customers awareness, pressure & support (DF7)	4.5385(2)	.5189
Suppliers Pressure & willingness (DF8)	4.1538(7)	.8006
Investors & shareholder Pressure (DF9)	3.3846(14)	.9608
Employees Motivation , health & Safety (DF10)	4.3846(3)	.5064
Scarcity of Resources, Higher waste generation & Waste Disposal problem (DF11)	3.6154(13)	1.1209
Organizational capabilities & awareness (DF12)	4.0769(8)	.6405
Demand for environmentally friendly products (DF13)	3.7692(11)	.9268
Global climate pressure & ecological (DF14)	3.9231(10)	.7596

(4.3846). This indicate that 4-wheeler automobile companies giving more importance to government rule and legislation (DF1). This driving factor is more helpful for maintaining the green image in companies. 4-wheeler automobile companies are also giving importance to customer awareness, pressure and support (DF7) and employee motivation, health and safety (DF10).4-wheeler automobile companies are giving less importance to investor and shareholder pressure (DF9, having mean score value 3.3846) and scarcity of resources, higher waste generation and waste disposal problem (DF11, having mean score value 3.6154).

Table 3 Mean & standard deviation of drivers of GSCM for 2-wheeler industries

DRIVERS FOR ADOPTION OF GSCM	MEAN	STD. DEVIATION
Government Rules & legislation (DF1)	4.5000(4)	.5477
Environmental concerns & legislature (DF2)	4.3333(6)	.8165
Social & Environmental responsibility (DF3)	4.0000(9)	.8944
Green image, Global marketing & Competitiveness (DF4)	4.5000(5)	.5477
Society or Public Pressure (DF5)	3.6667(13)	.5164
Economic benefits or cost reduction benefits (DF6)	4.1667(7)	.9832
Customers awareness, pressure & support (DF7)	4.6667(2)	.5164
Suppliers Pressure & willingness (DF8)	4.0000(10)	.8944
Investors & shareholder Pressure (DF9)	3.8333(12)	.7528
Employees Motivation , health & Safety (DF10)	4.8333(1)	.4082
Scarcity of Resources, Higher waste generation & Waste Disposal problem (DF11)	2.8333(14)	1.1690
Organizational capabilities & awareness (DF12)	4.0000(11)	.8944
Demand for environmentally friendly products (DF13)	4.6667(3)	.5164

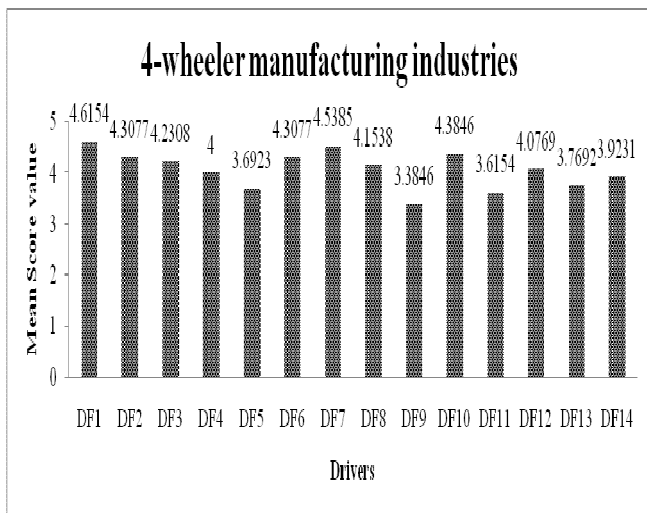


Fig 2 Mean score value of drivers of GSCM for 4- wheeler manufacturing industries.

Table 2 shows that DF1 i.e. ‘Government Rules & legislation’ having the highest mean score value (4.6154), DF7 having mean score value (4.5385) and DF10 having mean score value

Global climate pressure & ecological (DF14)	4.1667(8)	.9832
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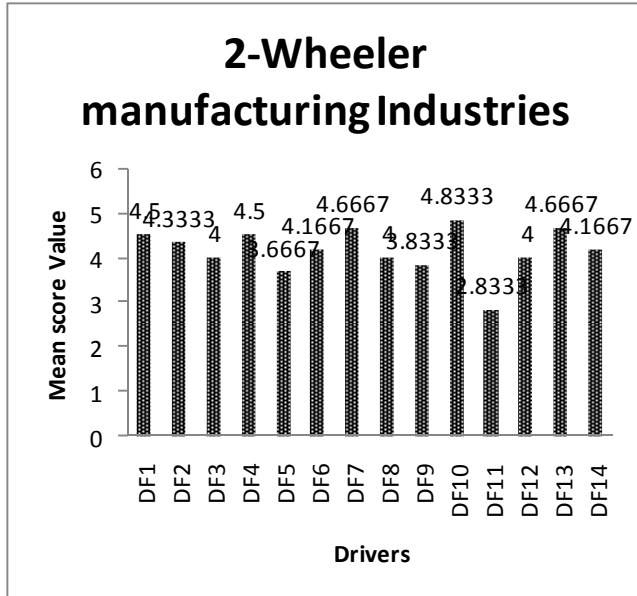


Fig 3 Mean score value of Drivers of GSCM for 2- Wheeler Manufacturing Industries.

Table 3 shows that DF10 having the highest mean score value (4.8333), DF7 having mean score value (4.6667) and DF13 having mean score value (4.6667). This indicate that 2-wheeler automobile companies giving more importance to employee motivation, health and safety (DF10). This driving factor is more helpful for maintaining the employee motivation, health and safety in companies. 2-wheeler automobile companies are also giving importance to customer awareness, pressure and support (DF7) and demand for environmentally friendly products (DF13). 2-wheeler automobile companies are giving less importance to lack of customer and shareholder awareness (DF11, having mean score value 2.8333) and incompatibility with different management and manufacturing system (DF5, having mean score value 3.6667).

Table 4 Mean & standard deviation of Drivers of GSCM for General Manufacturing Industries

DRIVERS FOR ADOPTION OF GSCM	MEAN	SDT. DEVIATION
Government Rules & legislation (DF1)	3.3750(10)	.7440
Environmental concerns & legislature (DF2)	3.8750(1)	.8345

Social & Environmental responsibility (DF3)	3.7500(5)	1.1650
Green image, Global marketing & Competitiveness (DF4)	3.6250(7)	1.3025
Society or Public Pressure (DF5)	2.5000(13)	.7559
Economic benefits or cost reduction benefits (DF6)	3.2500(11)	1.7525
Customers awareness, pressure & support (DF7)	3.8750(2)	.8345
Suppliers Pressure & willingness (DF8)	3.5000(9)	1.3093
Investors & shareholder Pressure (DF9)	2.2500(14)	.8864
Employees Motivation , health & Safety (DF10)	3.7500(6)	.8864
Scarcity of Resources, Higher waste generation & Waste Disposal problem (DF11)	3.6250(8)	1.3025
Organizational capabilities & awareness (DF12)	3.8750(3)	1.1260
Demand for environmentally friendly products (DF13)	2.8750(12)	.6409
Global climate pressure & ecological (DF14)	3.8750(4)	1.3562

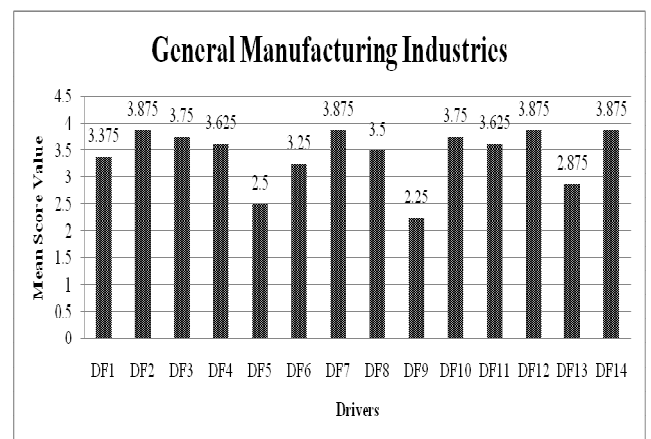


Fig 4 Mean score value of Drivers of GSCM for General Manufacturing Industries.

Table 4 shows that DF2 i.e. ‘environmental concerns and legislature’ having the highest mean score value (3.8750), DF7 having mean score value (3.8750) and DF12 having mean score value (3.8750). and DF14 having mean score value (3.8750) This indicate that general manufacturing companies giving more importance to environmental concerns and legislature (DF2). This driving factor is more helpful for maintaining the environmental concerns and legislature in companies. General manufacturing companies are also giving importance to customer awareness, pressure and support (DF7) and organizational capabilities and awareness (DF12).and global climate pressure and ecological (14). General manufacturing companies are giving less importance to lack of investors and shareholder pressure (DF9, having mean score value 2.2500) and society or public pressure (DF5, having mean score value 2.5000).

Table 5 Mean & standard deviation of drivers of GSCM for Overall Manufacturing Industries

DRIVERS FOR ADOPTION OF GSCM	MEAN	STD. DEVIATION
Government Rules & legislation (DF1)	4.1481(4)	.9074
Environmental concerns & legislature (DF2)	4.2222(3)	.7511
Social & Environmental responsibility (DF3)	4.0741(5)	.9168
Green image, Global marketing & Competitiveness (DF4)	4.0000(6)	.9608
Society or Public Pressure (DF5)	3.3333(13)	.8321
Economic benefits or cost reduction benefits (DF6)	4.0000(7)	1.1767
Customers awareness, pressure & support (DF7)	4.4074(1)	.6939
Suppliers Pressure & willingness (DF8)	3.9259(9)	.9971
Investors & shareholder Pressure (DF9)	3.2222(14)	1.0500
Employees Motivation , health & Safety (DF10)	4.2963(2)	.7240
Scarcity of Resources, Higher waste generation & Waste Disposal problem (DF11)	3.4074(12)	1.2172

Organizational capabilities & awareness (DF12)	4.0000(8)	.8321
Demand for environmentally friendly products (DF13)	3.7037(11)	.9929
Global climate pressure & ecological (DF14)	3.9630(10)	.9799

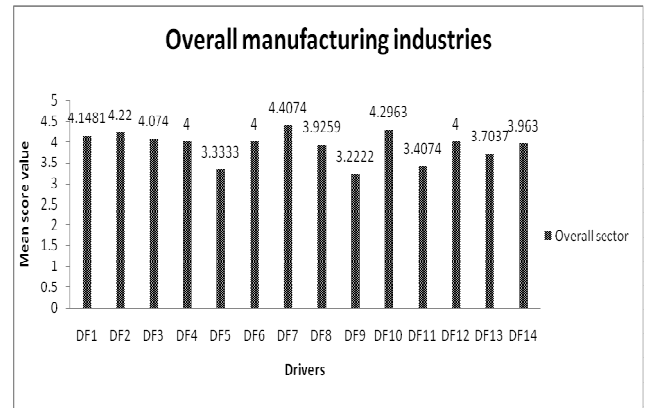


Fig 5 Mean score value of drivers of GSCM for overall manufacturing industries.

Fig 5 shows that DF7 having the highest mean score value (4.4074), DF10 having mean score value (4.2963) and DF2 having mean score value (4.2222). and DF1 having mean score value (4.1481) This indicate that general manufacturing companies giving more importance to customers awareness, pressure and support(DF7). This driving factor is more helpful for maintaining thecustomer’s awareness, pressure and support in companies. General manufacturing companies are also giving importance to employee’s motivation, health and safety (DF10) and environmental concerns and legislature (DF2) and government rules and legislation (1). General manufacturing companies are giving less importance to lack of investors and shareholder pressure (DF9, having mean score value 3.2222) and society or public pressure (DF5, having mean score value (3.3333). It means that theses drivers are notmore crucial for implementation of green supply chain management (GSCM).

Table 6 Overall Comparison of mean statistic of different sector

Sr.No.	Industry	Mean	Standard Deviation
1	2-Wheeler	4.15	0.848
2	Automobile	4.066	0.730
3	4-Wheeler	3.425	0.871
4	Automobile General Manufacturing	3.903	0.926

	Overall Manufacturing		
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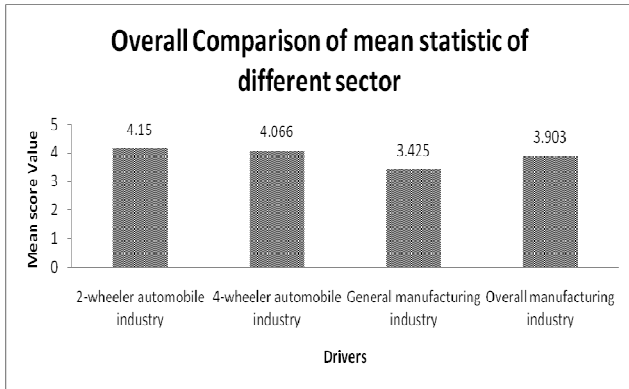


Fig 6 overall comparison of mean statistic of different sector

From the table 5.5 and graph it is observed that 2-wheeler automobile industries are having higher sector statistics value this indicate that 2-wheeler automobile industries are suitable for the adoption of GSCM. General manufacturing companies are having the less sector statistics value, i.e. the General manufacturing companies are not suitable for the adoption of GSCM.

Table 7 Most & Least Preferred Drivers of GSCM

Most Preferred Drivers RANK	2-wheeler	4wheeler Manufacturing Industries	General Manufacturing Industries	Overall Manufacturing Industries
1.	Employees Motivation, health & Safety (DF10)	Government Rules & legislation (DF1)	Environmental concerns & legislature (DF2)	Customers awareness, pressure & support (DF7)
2.	Customers awareness, pressure & support (DF7)	Customers awareness, pressure & support (DF7)	Customers awareness, pressure & support (DF7)	Employees Motivation, health & Safety (DF10)
Least Preferred Drivers	Scarcity of Resources, Higher	Investors & shareholder Pressure	Investors & shareholder Pressure	Investors & shareholder Pressure (DF9)

RANK	waste generation & Waste Disposal problem (DF11)	(DF9)	(DF9)	
1.				
2.	Society or Public Pressure (DF5)	Scarcity of Resources, Higher waste generation & Waste Disposal problem (DF11)	Society or Public Pressure (DF5)	Society or Public Pressure (DF5)

Table 7 shows that most preferred sector wise Drivers of GSCM of Manufacturing Industries. This table shows the top two Drivers of GSCM which are most important to adoption and implementation of Green Supply Chain Management for 2-wheeler Manufacturing Industries, 4-wheeler Manufacturing Industries, and General Manufacturing Industries. It is observed from the table 5.6 these top seven Drivers of Green Supply Chain Management are most helpful for maintaining the green practices and to adoption of GSCM in Manufacturing Industries.

Table 7 also shows that least preferred sector wise Drivers of GSCM of Manufacturing Industries. This table shows the least two Drivers of GSCM which are less important to adoption and implementation of Green Supply Chain Management for 2-wheeler Manufacturing Industries, 4-wheeler Manufacturing Industries, and General Manufacturing Industries. It is observed from the table 5.6 these least two Drivers of Green Supply Chain Management, are less helpful for maintaining the green practices and to adoption of GSCM in Manufacturing Industries.

CONCLUSIONS

With increasing competition in today’s global market, the organizations have to look to the modern strategic manners in order to gain sustainable organization and competitive advantage. Green Supply Chain Management (GSCM) as a new innovative managerial tool that can be used as a strategic weapon to gain competitiveness and to promote the organizations environmental and financial performance simultaneously.

As the result of this paper it is observed that the driver of GSCM, ‘employees motivation, health & safety’ is very important and crucial for adoption of GSCM for 2-wheeler industries. This is because of motivated employees gives their

full partition effectively for the up gradation of industry in regarding the work of green practices in companies. It is also observed that Driving factor 'Government rules & legislation' have high importance and crucial for adoption of GSCM for 4-wheeler industries. The driver 'Government rules & legislation' is important for adoption of GSCM because companies environmental management regulations increase the threats of penalties and fines for non compliance among companies. Manufacturing company follows the rules and regulation of government which helps to improve the green practices and green images in four-wheeler manufacturing industries and company, makes the product with free from pollution and this helps to adopt the GSCM. The drivers of GSCM 'environmental concerns and legislation; customer awareness, pressure & support; organizational capabilities and awareness; global climate pressure and ecological; respectively which have equal importance and crucial for adoption of GSCM for General Manufacturing companies. The driver 'environmental concerns and legislation' is most important to adoption of GSCM because there is a need for air quality and there is need for water quality for drinking which is helpful for implementing the green practices in industries. The driver 'customer awareness, pressure & support' is most important to adoption of GSCM because the awareness is very important for the buyer since it permits him to get the most from he buys. The driver 'organizational capabilities and awareness; is most important to adoption of green practices because it is the firm ability to manage people to gain competitive advantages that helps to implement GSCM in manufacturing industries. The driver global climate pressure and ecological is most important and crucial to adoption of GSCM because the added pollution would affect composition of the air, and any fumes or gases might rise, if harmful vapors might be absorbed into clouds, and where the contaminated rain might then fall, these all aspects create pressure on manufacturer which help to implement the GSCM in Manufacturing Industries.

REFERENCES:

- [1] Rao, P., (2002) "Greening the supply chain: a new initiative in Sout East Asia", *International Journal of Operations and Production Management*, 22,(6), 632-655.
- [2] Simpson, D., Power, D. & Samson, D., (2007) "Greening the automotive supply chain: a relationship perspective", *International Journal of Operations & Production Management*, 27 (1), 28-48.
- [3] Chen, Y., (2008) "The Driver of Green Innovation and Green Image – Green Core Competence", *Journal of Business Ethics*, 81, 531–543.
- [4] Lee, S., (2008) "Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives", *Supply Chain Management: An International Journal*, 13(3), 185–198.
- [5] Nawrocka, D., Brorson, T., & Lindhqvist, T., (2009) "ISO 14001 in environmental supply chain practices", *Journal of Cleaner Production*, 17, 1435–1443.
- [6] Shang, K.C., Lu, C.S., Li, S., (2010) "A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan", *Journal of Environmental Management*, 91, 1218–1226.
- [7] Chiou, T.Y., Chan, H.K., Lettice, F., & Chung, S.H., (2011) "The Influence of Greening the Suppliers and Green Innovation on Environmental Performance and Competitive Advantage in Taiwan", *Transportation Research Part E*, 47, 822-836.
- [8] Liu, X., Yang, J., Qu, S., Wang, L., Shishime, T., & Bao, C., (2011) "Sustainable Production: Practices and Determinant Factors of Green Supply Chain Management of Chinese Companies", *Business Strategy and the Environment*
- [9] Ninlawan, C., Seksan, P., Tossapol, K., & Pilada, W., (2011) "The Implementation of Green Supply Chain Management Practices in Electronics Industry", *Proceedings of the International Multiconference of Engineers and Computer Scientists*, 3.
- [10] Diabat, A. & Govindan, K., (2011) "An Analysis of the Drivers Affecting the Implementation of Green Supply Chain Management", *Resources, Conservation and Recycling*. 55, 659-667.
- [11] Eltayeb, T. K. & Zailani, S.H.M., (2011) "Greening Supply Chain through Supply Chain Initiatives towards Environmental Sustainability". *International Journal Environment Science Technology*, 2, (5) 506-516.
- [12] Chopra, S, P. Meindl. 2004. *Supply Chain Management: Strategy, Planning, and Operation*. Prentice Hall, New Jersey.
- [13] Ravi, V., and Shankar R. (2005), Analysis of interactions among the drivers of green supply chain management. *International Journal of Technological Forecasting and Social change*, 72(8), 1011-1029.
- [14] Srivastava, S. K., & Srivastava, R. K. (2006). Managing product returns for reverse logistics. *International Journal of Distribution and Logistics Management*, 36, 524-546.
- [15] Srivastava, S.K., (2007) "Green supply-chain management: a state-of-the-art literature review", *International Journal of Management Reviews*, 9(1), 53–80.
- [16] Mudgal, R. K., Shankar, R., Talib, P. and Tilak, R., (2009), Greening the supply chain practices: an Indian perspective of enablers relationships, *International Journal of Advanced Operations Management*, 1(2/3), 51-176
- [17] Luthra, S., Manju, Kumar S., and Haleem A. (2010), Suggested implementation of the green supply chain management in automobile industry of India: A Review. *Proceedings of National Conference on 'Advancements and Futuristic Trends of Mechanical*

- and Industrial Engineering, GITM, Bilaspur (INDIA), 12,(13), 114-125.
- [18] Sarode, A. D. and Bhaskarwar, V. S., (2011), Development and evaluation of performance measure for the environmental management in Indian industries, *Industrial Engineering Journal*, ISSN-0970-2555, 2(26), 31-34.
- [19] Bhateja, A. K., Babbar, R., Singh, S., and Sachdeva, A., (2011). Study of green supply chain management in the Indian manufacturing industries: A literature review cum an analytical approach for the measurement of performance, *International Journal of Computational Engineering & Management*, ISSN , Online: 2230-7893, 13, 84-99.
- [20] Luthra, S. Kumar, V. Kumar, S. &Haleem, A. 2011, "Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique-An Indian perspective", *Journal of Industrial Engineering and Management*, 4(2), 231-257,
- [21] Chien, M. K.& Shih, L. H., (2007) "An empirical study of the implementation of green supply chain management practices in the electrical and electronic industry and their relation to organizational performances", *Int. J. Environ. Sci. Tech.*, 4, (3),383-394.
- [22] NimawatDheeraj and Namdev Vishal,(2012),"An Overview of Green Supply Chain Management in India" *Research Journal of Recent Sciences* ,1(6),77-82
- [23] PandyaAmit R, Mavani Pratik M (2012), —An empirical study of green supply chain management drivers, practices and performances: with reference to The pharmaceutical industry of ankleshwar (gujarat), *I.J.E.M.S.*, 3(3),339-355.
- [24] Ajay Verma, Dr.AnshulGangele(2012),Green Supply Chain Management Empirical Study for"Closing The Loop", 78-94
- [25] Sunil Luthra, Dixit Garg, Sanjay Kumar, AbidHaleem (2012), "Implementation of the Green supply chain Management in Manufacturing Industry in India using Interpretive Structural Modeling Technique",1(1),ISSN-2278-8387
- [26] Govindan. K. A, Shankar, M. (2013), "Evaluation of Essential Drivers of Green Manufacturing Using Fuzzy Approach". 6, 52-64

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