Designing the Green Supply Chain Strategy for Indian Manufacturing Firm

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Abstract

Green supply chain management can be a source of competitive advantage for organizations through improvement in their environmental performance, Bacallan (2000). Green supply chain can produce number of benefits to an organization, starting from cost savings, maximized efficiency, improved profitability, Kushwaha et. al.,(2004). There exists a vast scope in developing countries such as in India to adopt GSCM practices and achieve organizational excellence. By examining the Indian small, medium and large organizations, who have already adopted GSCM practices, we can capture some of the best eco friendly practices that can be set as a benchmark for other non-green organizations to start their own evolution towards a cleaner future. This paper aims to develop a green supply chain strategy for sustainability and how to integrate it into the existing supply chain of organization.

Based on a literature review the constructs were identified. A six step approach to developing and implementing a sustainable green supply chain strategy has been described. Practical implications for operations strategists are also discussed.

Keywords: Green Supply Chain Management (GSCM), Competitive Advantage, Sustainability, Organizational Excellence

1. Introduction

Srivastava (2007) defines green Green Supply Chain Management as an integrating environmental thinking into supply chain management including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.

GSCM has its roots both in the supply chain management and environmental management literature. Previous studies show that investments in greening can eliminate wastages, save resources and improve productivity. Three approaches are suggested in GSCM adoption, i.e. reactive, proactive and value seeking (Simpson and Sampson, 2008).

India is a country where the issues related to GSCM has become very critical. The global trend to manufacture and source products in low cost countries is likely to gather strength over the next ten years, particularly in the skill intensive industries where India has a signification competitive advantage (Mc Kinsey Report). As a major manufacturing country, India has many opportunities, but they also face substantial environmental impacts with this opportunity. Total emissions of Indian economy in 2003-04 are estimated to be 217 million tons of carbon dioxide, of which 57% is due to the use of coal and lignite. The per capita emissions turn out to be 1.14 tons. Manufacturing sector is one of highest contributor of this emission. The appropriate development of GSCM concepts and practices may indeed support the nation by reducing the environmental impact of manufacturing and disposal of products and improve economical and social positioning.

Due to this competitive environment faced by Indian industry, this paper describes the strategic implementation of sustainable GSCM in different Indian manufacturing firms.

In the beginning, we state GSCM barriers, drivers, current green practices and performance measurement in general and in Indian manufacturing industries. Thus the literature review sets the base for developing the six step approach for implementing sustainable green supply chain strategy. An outline of our research methodology is then presented. Research findings are then discussed. The paper concludes with certain suggestions that are relevant to managers and policy makers.

Table 1: Research in Green Supply Chain Management

S.NO.	*AUTHOR(s), YEAR*	*OBJECTIVE*	*MAJOR FINDINGS*
1	Seman, N.A.A,. et.al (2012)	To review the recent literatures of GSCM and determine the new research direction of this emerging field.	Authors bring forward a proposed research direction on GSCM adoption and implementation
2	Kumar and Chandrakar (2012)	To study the correlation of two major factors, i.e. organizational learning and management support in GCSM adoption in Indian manufacturing industries	Significant positive relationships exists between organizational learning and management support with respect to GSCM adoption
3	Luthra, S., et.al, (2012)	To identify the important factors to implement GCSM relevant to Indian manufacturing industry	1. Innovative green practices, Awareness level of customers 2. Supplier Motivation 3. Technology advancement and organization adoption, Organization encouragement, Quality of human resources 4. IT enablement 5. Top management commitment 6. Government support policies 7. International Environmental agreements
4	Bhateja, A.K., et.al, (2012)	To identify the critical factors related to evaluation of GSCM performance measurement in Indian manufacturing industry	A. Green Purchasing 1. Substitute for hazardous material 2. Improved quality of raw material 3. Minimal usage of raw material 4. Supplier Development 5. Reduced Resource B. Green Manufacturing 1. Process Design 2. Product Design 3. Higher Efficiency 4. Employee Satisfaction
5	Pandya, A.R., et al., (2012)	To explore external factors affecting GSCM and understand the relationship between the GSCM practices and environmental performance and operational performance as well as financial performance in the context of Indian pharmaceutical industry	Pressures/Drivers: Environmental regulations, suppliers, consumers and community stakeholders GSCM practices can enhance the environmental, operational and financial performance of firms
6	Bhateja, A.K., et.al, (2011)	To study the activities of the supply chain process of various Indian manufacturing industries and evaluate their degree of greenness for the purpose of measuring performance.	51% of manufacturing industries feels that lack of awareness of environmental issues is the biggest issue facing manufacturing sectors. 36% of manufacturing industries have plans to implement GSCM initiatives within 2 years. 40% of companies use electronic processes to create efficiencies in procurement. 32% of companies are having active discussions regarding collaborating to reduce impact on environment. 64% of companies are not using e-tools extensively to support their supply chain operations. The biggest perceived barrier to adopting GSCM is that it is not cost effective.

7	Duarte, S., et al. (2011)	To develop a conceptual model incorporating lean and green supply chain into performance measurement system using BSC approach	Linking performance measurement system to green/lean practices can benefit firms for better positioning to succeed in their supply chain initiatives
8	Dües CM.,et al., (2011)	To explore and evaluate previous work focusing on the relationship and links between Lean and Green supply chain management practices.	Lean is beneficial for Green practices and the implementation of Green practices in turn also has a positive influence on existing Lean business practices
9	Gangele,A., and Verma,A., (2011)	To survey current green practices in Indian pharmaceutical manufacturers and GSCM evaluation.	Environmental management systems are given top attention than Green Purchasing, Customer Cooperation, Investment Recovery and Eco-Design is given low priority. Influence of GSCM on Performance factors such as Environmental and positive economic are relatively significant. Top two GSCM drivers are Pressure from environmental regulations and export pressure.
10	Luthra, S., et.al, (2011)	To develop a structural model using Interpretive Structural Modeling of the barriers to GSCM implementation in Indian automobile industry	Eleven variables were identified from literature review and expert opinions Top Level Barriers: Market competition and uncertainty; Lack of implementing green practices; Cost implications; Unawareness of customers Bottom Level Barriers: Lack of government support systems
11	Singh, L,P., et al., (2011)	To assess the role of logistics & transportation in GSCM in the context of Indian retail industry	Technological integration with primary suppliers and with major customers was positively linked to environmental monitoring and environmental collaboration. However logistical integration only has an impact on GSCM with primary suppliers but not with the major customers.
12	Yung, et al., (2011)	To examine the impact of environmental regulations on green supply chain management	1. EU directives foster green partnerships among manufacturing firms of all sizes located at different positions in international supply chains 2. Firms environmental management strategy affects its regulation compliance practices
13	Soler et al., (2010)	To describe the use of environmental information at different stages of the Swedish food supply chain	Consumer must be perceived as close to supply chain actors, enabling a correct transaction of consumer preferences into relevant green supply chain practice to avoid distortion of information.
14	Shukla, A.C, et al., (2009)	To identify implementation level, major drivers, various practices and performance of environmentally and socially conscious SCM in the context of Indian automobile industry	Environmentally and socially responsive supply chains are in the early adoption stages in India. Actual implementation lacks a holistic approach
15	Darnall et al., (2008)	To empirically evaluate the relationship between EMS and GSCM practices	Environmental management systems are more likely to adopt GSCM practices.

16	Simpson and Samson (2008)	To develop strategies for GSCM	Described four GSCM strategies: A. Risk -based Strategies B. Efficiency-based Strategies C. Innovation-based Strategies D. Closed-loop Strategies
17	Seuring,S. and Muller, M., (2008)	To develop a conceptual framework for sustainable SCM	Identified dimensions are 1. Suppliers management for risks and performance 2. SCM for sustainable products
18	Zhu,Q., e.al, (2008)	To evaluate perceived GSCM practices in four different Chinese manufacturing firms and relate them to closing the supply chain loop	Adoption of GSCM varies in different industry context. GSCM can be used as an environmental tool to improve the environmental image and gain competitiveness within the international business arena.
19	Zhu,Q., et al, (2008)	To investigate whether organization size plays a role in GSCM adoption	Large and medium sized organizations are more advanced than their small sized counterparts on most aspects, but not necessary all of these GSCM practices
20	Field and Sroufe (2007)	To examine the implications of using recycled materials on operations strategy with a focus on the corrugated cardboard industry	The benefits of the changes in the supply chain and supplier relationships accrue primarily to non integrated firms and managers should expect the use of recycled material inputs to be dominated by non integrated firms with decreasing capital costs over time.
21	Vachon, S., (2007)	To determine if there is a link between green supply chain practices (environmental collaboration and environmental monitoring) and environmental technologies selection	The results suggest that environmental collaboration with suppliers is positively associated with greater investment in pollution prevention technologies while such collaborations with customers has no impact on the adoption and the implementation of pollution prevention technologies
22	Zhu,Q., et al, (2007)	To examine the relationships between GSCM practices, environmental and economic performance in Chinese manufacturing firms, incorporating three moderating factors i.e. market, regulatory and competitive institutional pressures	1. Chinese firms have experienced increasing environmental pressure to implement GSCM practices. 2. The existence of market and regulatory pressures influences organizations to have improved environmental pressures especially in case of eco design and green purchasing 3. Manufacturers facing higher regulatory pressure tend to implement green purchasing and investment recovery 4. Competitive pressure significantly improves the economic benefits from adoption of different GSCM practices 5. None of the institutional pressures contribute to or lessen possible "win-win" situations for organizations.
23	Srivastava, S.K., (2007)	To present a comprehensive integrated view of the published literature on all dimensions of GSCM, primarily taking a reverse logistics angle for facilitating future research directions	GSCM can reduce the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization efficiency.

24	Rao, P., and Holt, D., (2005)	To identify potential linkages between GSCM and environmental performance, economic performance and competitiveness	Greening the different phases leads to an integrated supply chain which ultimately leads to competitiveness and economic performance
25	Zhu,Q., e.al, (2005)	To evaluate and describe GSCM drivers, practices and performance among various Chinese manufacturing firms	Chinese firms have increased their environmental awareness due to regulatory, competitive, and marketing pressures and drivers. Chinese firms have implemented a variety of GSCM practices to improve their environmental performance and directly helped in enhancing export sales. Commitment from top level managers and support from mid level managers is necessary for any GSCM program development.
26	Sarkis, J., (2003)	To present a strategic decision framework that will aid managerial decision making	Strategic & Operational elements were structured for evaluating green supply chain alternatives

2. Literature Review

The importance of GCSM for organization success has received a great deal of attention in recent years. The main purpose of the literature review is to understand the pressures prevalent in Indian system, the roadblocks to GCSM and ultimately how green supply chain practices within an organization can be the source of competitive advantage in general and particularly in Indian manufacturing sector and how in the past various researcher(s) have carried out study to understand the secret behind GCSM practices by which organizations has been benefited and what are the studies carried out in this direction so far. Thus, the author brings forward a proposed research direction on GCSM adoption and implementation in Indian firms.

2.1. Summary of Table 1 is as Follows

Green supply chain management has its roots both in environmental management and supply chain management literature.

Developed countries are those countries where we find high level development based on certain characteristics-consisting of economic, industrialization and human development index. Countries such as Japan, South Korea, Australia , Germany, Portugal, Italy, Sweden and Canada fall in this category and GSCM has been so far practiced majorly in these countries.

In developing countries especially in Asian region (India, China, Philippines, Indonesia, Malaysia, Thailand, and Singapore) GSCM practices are in a very nascent stage. Most firms in developing countries adopt GSCM to reduce the environmental impact of various business activities rather than a proactive attitude to reduce the source of wastage or pollution.

Rapid industrialization in Malaysia has degraded the environment due to heavy pollution from the manufacturing industries and therefore researcher(s) has directed future research direction which will focus on ISO 14001 certified manufacturing firms in Malaysia to study GSCM more deeply. Drivers of GSCM identified in Malaysian context are Regulations, Customer requirements, expected business gains and social responsibility, (Seman, et. al. 2012).

GSCM awareness is high and is perceived as a competitive advantage for companies in India. Adoption of GSCM practices is highest in areas where there is a correlation to efficiency and cost savings and vice versa (Bhateja, A.K., et.al, 2012).

GSCM is an approach for improving firm process and product performance. Eleven variables are as follows:-

A. Dependent Variables: Unawareness of Customers; Supplier Reluctance to change towards GSCM
B. Driver Variables: Lack of government support systems; Lack of top management commitment; Lack of IT implementation
C. Linkage Variables: Resistance to technology advancement adoption; Lack of organizational encouragement; Poor quality of human resources.
D. Autonomous Variables: Nil

Removal of these barriers will lead to successful implementation of GSCM in Indian automobile industry (Luthra,et.al, 2011)

Srivastava (2011) did an extensive literature review to present a comprehensive integrated view of the published literature on all dimensions of GSCM, primarily taking a reverse logistics angle for facilitating future research. In the study focus was more on reverse logistics as the establishment of efficient reverse logistics networks is a prerequisite for efficient and profitable recycling and remanufacturing. Also more focus was given on mathematical modeling aspects.

Main contributing factors of GSCM pressures are supply chain pressure, cost related pressure, marketing and regulations, (Zhu, et al. 2005)

GSCM practice has improved Chinese firm performance mainly the environmental and operational performance, (Zhu, et al. 2005).

Zhu, et al. (2007) conducted a study in Chinese manufacturing firms to examine the relationships between GSCM practices, environmental and economic performance by incorporating three moderating factors i.e. market, regulatory and competitive institutional pressures.

1. Increased environmental pressure has pushed firms to adopt GSCM practices.
2. The existence of market and regulatory pressures influences organizations to have improved environmental pressures especially in case of eco design and green purchasing.
3. Manufacturers facing higher regulatory pressure tend to implement green purchasing and investment recovery
4. Competitive pressure significantly improves the economic benefits from adoption of different GCSM practices
5. None of the institutional pressures provided a "win-win" situation for improving both environmental and economic performance of organizations.

GCSM can be used as an environmental tool to improve the environmental image and gain competitiveness within the international business arena, (Zhu,Q., e.al, 2008)

Organization size plays a major role in GCSM adoption. Medium and large sized organizations are more advanced than their smaller size counterparts on most aspects, but not necessarily all of these GSCM practices. ISO 14001 certification and environmental management systems have significant implementation differences among large, medium and small sized organizations. Generally larger sized organizations have more resources and high level of awareness for implementation of EMS. Even medium and large sized organizations have higher implementation levels on all Investment Recovery practices (Zhu, et. al., 2008).

With increased scarcity of resources, materials and energy tend to be more expensive, therefore products consuming less raw materials/energy would be more profitable. Large and Medium sized organizations initiate eco design for reuse, recycle and recovery of materials than small sized organizations (Zhu, et. al., 2008).

Organizations that involve suppliers and third parties in the greening process early and well in advance of competitors start a development path that may provide a sustained competitive advantage that lasts well into the future (Simpson and Samson, 2008)

Lean environment serves as a catalyst to facilitate Green implementation. The integration of lean and green practices will bring benefits to companies and introducing green as the new lean is no longer a strong and unsupported statement. It is rather undeniable that the ultimate lean will be green (Dües CM, Tan KH, Lim M, 2011)

There is a link between environmental management system and green supply chain management, (Darnall et al., 2008).

2.2. Previous Literature has Talked About the Following Green Practices

Green Design, Repairable inventory, Production planning and control for remanufacturing, Green manufacturing and Product recovery, Logistics network design, Green Procurement, Operational research and Environment Management, Recycling through value collaboration, Lean practices, Green warehousing, Green Distribution, Green Transportation, reverse logistics and waste management (Bhateja,et al., 2012, Seman et al., 2012, Gangele et al., 2012, Dube et al., 2012, Dues et al., 2011, Zhu., 2007).

GSCM Pressures/Drivers: Environmental regulations, market, competition, suppliers, consumers, and community stakeholders, (Pandya, A.R., et al., 2012, Zhu,Q., et al, 2007).

Linkage Variables: Technology advancement adoption; Organizational encouragement; Quality of human resources, (Luthra, et al., 2011)

Tools used: Linear Programming, Network Equilibrium model, Markov Chains, Game theory, Fuzzy and Neuro Fuzzy, Data envelopment analysis, Artificial Intelligence, Knowledge based system, Neural networks, AHP, ISM, SEM.

2.3. Potential GSCM Benefits

A. Reduced product life cycle costs and increased profitability i.e. the following costs savings can be achieved, (Singh, et al. 2011).

Cost avoidance of procurement of hazardous raw materials.

Cost avoidance of storing, managing and disposing process waste, particularly as waste disposal has become quite expensive these days.

Cost avoidance of stigmatization

Cost avoidance of public and regulatory hostility towards harmful organizations

B. Reduced environmental and health risks

C. Safer and cleaner factories

GSCM and Organization Performance: variables: green supply, cooperation with customers, investment recovery and eco design of products

B. Operational performance variables: On time delivery, backorder/stock out, customer response time, manufacturing lead time, shipping error, customer complaints

C. Environmental performance variables: Air emission, waste water generation, fuel & energy consumption and solidw aste,(Pandya , A.R .,e t a l.)

GSCM Strategies: Risk -based Strategies, Efficiency-based Strategies, Innovation-based Strategies and Closed-loop Strategies, (Simpson and Samson, 2008).

3. Problem Statement

Green Supply Chain Management is a new paradigm that integrates the strategies of productivity improvement and environmental protection to produce environmentally compatible goods and services. Environmental friendliness combined with SCM creates the win-win situation for organizations and helps create a strong advantage in both local &global market through cost reductions and enhanced competitiveness. Previous researches conducted in this direction have a limited focus and narrow perspective. They do not cover adequately all the aspects and facets of GSCM. For example in Indian automobile sector actual GSCM implementation lacks a holistic approach, (Shukla, A.C, et al., 2009). GSCM adoption and degree of greenness varies from organization to organization and in most of the organizations GSCM strategy implementation has not become successful instead of high level of awareness.

3.1. Research Objective

The aims of the present research is to discuss the issues that can be summarized as follows:

- To explore the present green practices being adopted by manufacturing firms
- To identify major barriers and drivers of GSCM
- To develop a strategic GSCM roadmap for sustainable GSCM implementation

3.2. Research Methodology

Through a thorough and detailed analysis of literature review, the major section that impacts GSCM strategic implementation in manufacturing firms has been identified.

3.3. Research Framework

The various tasks in green supply chain strategy implementation are not standalone activities. They are interrelated and therefore, have to act in a holistic manner. Each task or activity is related to one another, creating an interconnected network and the hub of which has to be the strategic plan.

It is indeed true that doing is more difficult than thinking about doing. Strategies often fail not because they were not formulated well, but for the reason they were not implemented effectively.

Following are the major obstacles to GSCM strategy implementation:-

1. Specific sustainability goals in the corporate vision and strategy
2. Specific environmental related sustainability goals in the supply chain strategy

3. An inability to manage change.
4. Poor or vague strategy.
5. Not having guidelines or model to guide implementation effects.
6. Poor or inadequate information sharing.
7. Unclear responsibility or accountability.
8. Working against the organization power structure.

In general the model of strategy implementation depicts three major themes, (Kazmi, A, 3rd edition).

A. **Activating strategies**: First of all GSCM strategies should lead to plans and these plans will result in different kind of eco friendly programmes.

A green programme is a broad term which includes goals, policies, procedures, rules& regulations and other steps that must be taken care for putting a plan into action. Green programmes lead to formulation of an environmental project. A project is a highly specific programme for which the time schedule and costs are predetermined.

Policies are guidelines to actions. Since GSCM implementation is all about action, policies are of utmost importance to an effective implementation of strategies. Policy can be for eg., including environmental purchasing clauses in contracts, running machines with alternative power, in house treatment of solid waste and converting into compost, setting up an advanced effluent treatment plant and meeting regulatory requirements before disposing the water in sewerage.

Procedures are the sequential steps described in sufficient detail, required to implement the green policy.

Rules& Regulations are the prescribed mode of conduct in a given situation and all levels must be committed to the green rules & regulations within a firm.

B. **Managing change**: Green supply chain strategy implementation almost always necessitates change. Managing change therefore is an essential requirement for success of green supply chain strategic implementation. Management of change requires an understanding of the process of change. The process usually starts with the triggers of change that set off within or outside an organization. Mangers identify the need for change and prepare the organization for implementing the change, take steps to manage resistance to change and then start the actual change process. Having completed the change process, the managers then set a monitoring system to check whether the planned changes are indeed taking place. They may take corrective actions if the change process is deviating from the set course. For the purpose of green supply chain strategy implementation, we will be focusing on the three main activity areas of structure, leadership and behavior.

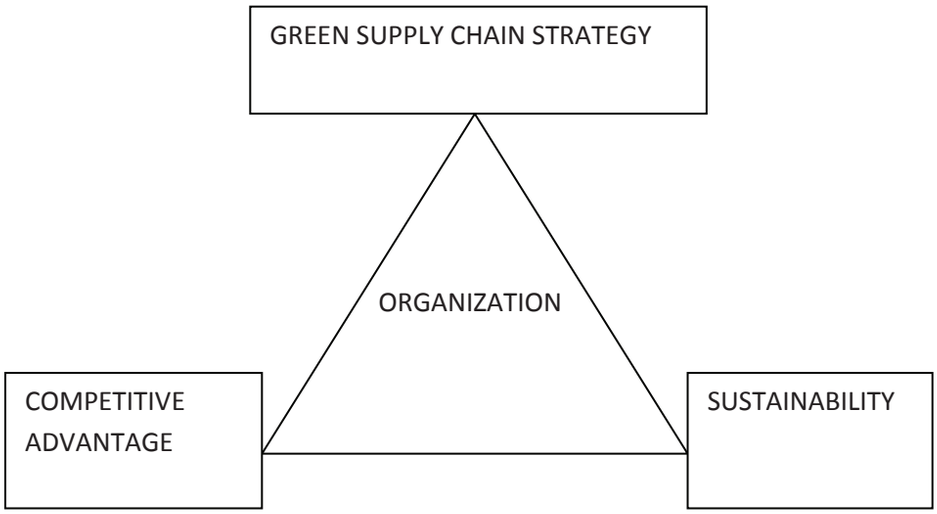

Figure 1: Research Framework

C. **Achieve effectiveness:** The measures of organizational effectiveness depend on which model is used.

In our research framework we shall define the following:-

1.What is a green supply chain strategy?

2.What does a competitive corporate strategy involve?

3.Sustainability and its link with above?

The word "strategy" derives from the ancient Greek "strategos" which is further derived from the two words- "stratus (army) and "ago" (leading).

Green supply chain strategy determines the goals and configuration of the supply chain with regard to supply chain partners, structures, process and systems.

In detail these are:- Supply chain partners such as Environmental collaboration with suppliers, supplier training and associated cost sharing models

Supply chain structures can be configuration of distribution structures

Supply chain process are related to configuration of green procurement, green manufacturing, and green distribution process with respect to costs, reliability, speed and flexibility.

Sustainability is a strategic issue and is given top management commitment; organizational sustainability is often misunderstood to mean primarily financial sustainability. That misconception occurs because, when an organization becomes unsustainable, the symptoms of that problem show up in the finances. However, organizational sustainability -- or the surviving or even thriving of an organization -- depends on much more than effectively managing the organization's finances. However, in an organization, there are some primary dimensions that, if they are managed well, will ensure the sustainability of the organization.

A green supply chain strategy is not a strategy for sustainability unless the organization gives equal weight to the economic dimension. Sustainable green supply chain practices must be financed and provide payback within a minimum time duration. Organizations adopting best practices generally extend their supply chain KPI system to include environmental measures and can further link their entire operational KPI system with their financial measurement systems.

Competitive strategy is a holistic approach aimed to find a differentiated way of competing in order to achieve profitability over a limited time span. It allows the organization to outperform others in the market.

An organization's supply chain plays an important role and represents a vital resource in the achievement of the strategic goals. In today's dynamic environment customers are less likely to purchase products based on price. Organizations like Toyota, Apple and Dell are outperforming others in supply chain excellence. The strategic challenge for a manager is to develop holistically all the aspects of a supply chain targeting as a whole a strong alignment with the competitive and corporate strategy. Environmental management gives a competitive advantage and develops new links between operations strategy and the corporate strategy (eg. Cost leadership and differentiation), (Gupta, 1995). Organizations practicing environmental management systems are more likely to adopt GSCM practices, (Darnall, et al, 2008).

A systematic approach to strategy development and integration assists organizations to develop a sustainable green supply chain and create a value proposition, (C. Tyssen et al., 2011).

Six step approach to strategic GSCM implementation:

Step 1 aims to assess the green supply chain characteristics regarding strategy, resources, and current and planned practices. It is mainly related to internal factors and considers factors which are usually within the control of the company.

Step 2 aims to explore current and forecast potential future developments and trends. It is mainly related to external factors influencing the chain.

Step 3 aims to evaluate the risks and opportunities

Step 4 considers the analysis in the current green supply chain strategy and institutes a strategy change or redesign process with regard to the sensitivity identified.

Step 5 focuses on implementation related aspects to balance the objectives

Step 6 focuses on key factors for successful implementation of sustainable green strategy.

4. Research Direction

Green supply chain management is a mega trend having a more global and extended impact on the economic and

business environment and therefore continues to be an important research agenda among researchers. However there are still limited studies available on GSCM adoption and implementation in Indian context. Therefore, our research direction will focus on manufacturing firms in Indian context in order to extend the study in more depth.

5. Conclusion

Organizations must follow a holistic approach for successful GSCM implementation. Organization structure, organization culture, Leadership and Employee behavior impacts the strategic implementation of green supply chain management.

Organizations that involve suppliers and third parties in the greening in advance of their competitors- start a development path that provides a sustained competitive advantage and lasts well into the future.

6. Managerial Implications

This paper provides an opportunity to Indian managers to appreciate the green dimension of supply chain which ultimately enhances the employee morale, customer satisfaction and market share of the company. Based on our recommendations managers can implement GSCM strategy to realize superior benefits.

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