A CRITICAL STUDY ON THE SOCIO-TECHNOLOGICAL FACTORS INFLUENCING GREEN SUPPLY CHAIN MANAGEMENT IN THE HEALTHCARE INDUSTRY; MUMBAI REGION

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Abstract-

In this ever evolving world of automation, industrial marvels and increasing ease of usage, it is extremely important to give due diligence to environment and eradicate or optimize processes that degrade sustainability at any cost. We have taken Healthcare sector into consideration because this is the only sector where products are used to deliver service which forms the basis of supply chain system. The study projected here consists of effect of contemporary independent variables on GSCM. To further carry forward our analysis, we created a theoretical framework consisting of all the factors depicting relationship between them. In order to gather data, we prepared a questionnaire to know the responses of how GSCM is currently been practiced in healthcare sector and after a successful survey we got certain datasets for analysis. Finally, a series of correlation analysis between different parameters was performed and the results were cross referenced with the objectives carving a direction for future research and deducing that this research was successful in order to plot impactful factors to implement GSCM.

Keywords: *Green Supply Chain Management (GSCM), innovation, healthcare, social & technological sustainability, innovation, leadership, green marketing.*

1. Introduction

The study focuses on the impact of factors such as Innovation, Continuous Improvement and Social & Technological Sustainability on Green Supply Chain Management. These factors have evolved due to increasing trends of creativity deployment in industries, or innovation, while blending the concept of Quality culture through continuous improvement into the processes so as to ensure social sustainability along with technological prudence over other players in the industry. The research was primarily intended towards healthcare sector, because it is the only field which serves the best-in-class supply chain culture towards the society and uses the disruptive technologies to create solutions against diseases and drug controls. So it is very necessary for the healthcare industry to focus on GSCM, because by using this approach in the care provider environment, an organization will tend to become more integrated. According to GSCM, the integration bet ween supply chain strategies combined with green technology becomes much easier especially in improving supply chain performance. Manufacturing information among supply chain influence the behavior and performance and make decisions in a better direction for the healthcare industry environment.

2. Literature review

Green Supply Chain Management: It was identified that there are three types of industrial manufacturers, namely early adopters, followers, and laggards, based on the adoption of green supply chain management , Test results indicate that differences exist between them in terms of environmental, operational, and economic performance and

Practically GSCM results in provide managerial insights for manufacturers to benchmark for environmental management practices and performance improvement (Zhu, Sarkis & Lai, 2012). [18]

Green Supply Chain Management (GSCM) has received more attention in the last few years in academia and industries. As customers are becoming more environmental conscious and governments are making stricter environmental regulations, the industries need to reduce the environmental impact of their supply chain and the requirement of GSC increased (Jayant & Azhar, 2014). [6]

Leadership: In this Study Supply chain professionals are tested and results indicates that environmental pressure from rivals and stakeholders influences green supply management implementation through the mediating role of top management support for environmental initiatives (Dai, Montabon & Cantor, 2014). [3]

Innovation: Green supply chain decision makers should be able to identify the most appropriate green solution to meet various needs of different product-market characteristics. Moreover, the green supply chain managers should find ways to evaluate the impact of potential supply chain strategies for the natural environment and the environmental performance change, apart from the economic advantages expected from the strategy (Karimi & Rahim, 2015). [7]

It was determined that Increasing environmental concern from customers, buyers, communities, and government regulations have forced companies to implement Green Supply Chain Management and green innovation. GSCM and green innovation have strategic interconnection in developing new green product and findings shows

that GSCM leads to green innovation (Aslinda, Zakuan, Jusoh, Arif & Saman, 2012). [1]

This paper focuses on upstream supply chain management activities, which are usually responsible for diffusing environmental sustainability practices across the supply base. Therefore, peer-reviewed papers focused on the diffusion of environmental sustainability practices across manufacturing supply chain base are examined. It is found that this diffusion is sharply related to the purchasing, performance assessment and collaboration (Pimenta & Ball, 2015). [14]

Social Sustainability: The environmental image and environment consciousness of customers are increasing in the market day by day. It has pushed SMEs to think about clean and green production by implementing of GSCM. Auto component manufacturing industries play vital role in a country's economy and should begin adopting GSCM as their strategy (Jayant & Azhar, 2014). [6]

Green supply chain management (GSCM) integrates ecological concepts with those of supply chain management in order to minimize energy and material usage and to reduce adverse impacts of supply chain activities on the environment (Muduli & Govindari, 2013). [12]

GSCM is important in influencing the total environment impact of any organizations involved in supply chain activities. More importantly, GSCM can contribute to sustainability performance enhancement (Chin & Hon tat, 2015). [2]

Technological Sustainability: Developing frameworks for comparing alternative manufacturing technologies with environmental concerns

is an important area for future research (Kumar, Agrahari & Roy, 2015). [8]

There was a significant relationship between green supply chain management (GSCM) practices and technological innovation (TI) in manufacturing firms from the perspective of a developing nation. The importance of GSCM practices has been proven to enhance firms' TI, in addition to improving the environment, bringing about a positive impact on the manufacturing establishment (Lee, Ooi, Chong & Seow, 2014). [9]

SCM can contribute to sustainability performance enhancement. In this paper, we focus on the environmental collaboration, which has been seen as a key relational capability to facilitate the GSCM strategic formulation and execution. The purpose of this paper is two-fold: (i) review the extant literature on the relationship between GSCM, environmental collaboration and sustainability performance and (ii) propose a plausible conceptual model to elucidate the relationship between these three variables (Sulaimana, 2015). [2]

The growing importance of GSCM is driven mainly by the escalating deterioration of environment, e.g. diminishing raw material resources, overflowing waste sites and increasing level of pollution. However, it is not just about being environment friendly; it is about good business sense and higher profit (Toke and Dandekar, 2010). [15]

Waste Management: Assembler dominated manufacturing supply chains have different within-chain waste generation patterns than manufacturing supply chains, also assemblers with suppliers that produce less waste tend also to have better economic performance. All

Sectors policies aimed at reducing manufacturing waste should take account of incentives for achieving waste reduction all along a supply chain (Hayami, Nakamura & Nakamura, 2015). [5]

Drivers of Green Supply Chain are purchasing and in-bound logistics, production, distribution and out-bound logistics, and reverse logistics (Toke and Dandekar, 2010). [15]

Quality improvement: Different green supply chain (GSC) operational activities may involve different risks and risk factors and or drivers. Its effect could be delay in order, quality damage or may even loss in business, if managers do not account them on timely (Mangla, Kumar & Barua, 2014). [10]

Research in supply chain area, regarding lean and green tool has been found to complement each other. Similarly, correlation between green objectives and lean tools such 5S and KAIZEN can be studied (Kumar et al., 2015). [8]

Paper confirms that internal green practices and external green collaboration have positive impacts on green performance, which in turn helps to enhance firm competitiveness. The findings show that a firm's green performance and external green collaboration act as mediator variables between internal green practices and firm competitiveness, and they influence firm competitiveness positively (Yang, 2013). [17]

Green purchasing is process of selection and acquisition of product and services which minimise negative impact over the life cycle of manufacturing, transportation, use and recycling, Green Purchasing Network India (GPNI) is an evolving network of professionals

interested and active in the general area of sustainable consumption and production- more specifically: green purchasing and public procurement (Nimawat and Namdev, 2012). [13]

Six sigma projects have quantifiable financial targets to make more money and, at the same time, satisfy customers and improve efficiency. They focus on customer requirements, cycle time reductions, error elimination and cost reductions. Elimination of defects from products or services being delivered, therefore, it has a direct impact on the bottom line of the business (Nimawat and Namdev, 2012). [13]

Continuous improvement: The manufacturing companies that adopt GSCM, believe in collaborative practices, and involve their suppliers in their strategy enjoy superior advantage in terms of positive business performance and environmental performance (Dubey, Gunasekaran, Papadopoulos & Childe, 2015). [4]

In the last few decades, environmental concerns of manufacturing operations have motivated the organizations to implement green principles in different processes of the supply chain (Kumar et al., 2015). [8]

The goal of GSCM is to reduce a firm's pollution and other environmental impacts. In the proposed method, the weights of GSCM criteria and alternatives are described using linguistic preferences that can be resolved with fuzzy set theory. Subsequently, the rank of each alternative was calculated from incomplete information by applying a grey degree (Tseng, 2011). [16]

Green Supply Chain Management (GSCM) Attributes: Green Policy, Green Operations, Green Marketing, Green Collaboration with Supplier, Green Collaboration with Partner and Green Collaboration with Customer were found to influence Supply Chain Performance (Manohar and Kumar, 2015). [11]

Brand building is one of the top incentives for green SCM, highlighting the importance of public perception of how companies operate (Nimawat and Namdev, 2012). [13]

3. Methodology

3.1. Research design

The research framework is being prepared so as to derive correlation between different actions which a company would undertake so as to implement GSCM, and its social and technological sustainability w.r.t financial viability.

Research Variables:

Dependent Variable or DV: Green Supply chain management

Moderating Variable or MV: Leadership

Independent Variables or IV(s): Social and Technological Sustainability, Innovation, Continuous improvement

3.1.1. Proposed Model

Green supply chain management can be implemented only through the combined efforts of innovation (IV), thinking out of the box and using creative ideas to solve problems, continuous improvement (IV), i.e., establishing quality awareness and a sig sigma approach towards production, keeping in mind the social and technological sustainability (IV), because no matter how innovative an idea may be, if it is not

sustainable over a long period of time, it's not worth investing into. Nevertheless, leadership (MV) will moderate these efforts because it is a leadership promoting organization which could incorporate risk taking ability and implement the GSCM by leading its way to excellence. (Refer Fig. 1)

3.1.2. Research Hypothesis

According to the framework prepared, three hypothesis were derived, as seen in Table-1.

3.2. Sources of data

The research will be taken forward from here, first, by conducting a survey (quantitative analysis) based on questionnaire designed as per the research framework.

The data would be collected on the basis of the Google form designed to record observations of the questions asked. The use of Google form is very appropriate here because the data could be easily gathered, stored and analyzed which would help us to interpret it later on.

3.3. Sampling procedures

The sampling mechanism used for our analysis is probabilistic clustering (i.e. random sampling). The sample population would be the top management of different hospitals, medical and pharmaceutical institutions, medical representatives, and intermediate suppliers in Mumbai region, thus generalizing the study to whole demographic of India.

3.4. Methods and Instruments of data gathering

The instrument used here is a questionnaire which would be distributed via e-mails and web-links to the desired sample population. The method would be purely quantitative in nature.

The questions are designed as per the framework, which could help us in further analysis process. The survey would start off with general information about the organization, followed by classifying it under leadership, further taking it towards the effect of various independent variables, and finally asking the financial viability of implementation. During this process, we would be using basic scales such as ordinal & nominal, including, likert, category & dichotomous rating scales.

3.5. Methods of data analysis

The questions will lead to a quantitative analysis, i.e., correlation analysis, where the relation between the three specified IVs, one MV, and DV will be established, thus leading us to the conclusion of our research.

4. Results

4.1 Preliminary Analysis

The preliminary analysis, primarily, was done as a firsthand review on the responses received using Google analysis which basically gave us the descriptive analysis of our data collected.

First of all, the sample population used for the survey has a mix of all the types of people which we wanted to target, thus giving us an appropriate estimate of Mumbai Area.

Next, we see that almost 50% of the sample don't implement GSCM in the present time frame, but since 50% of them are using GSCM, we can say that it is a key feature in Healthcare sector. Also among the

50% who are using it, almost 75% of them are satisfied with their implementations.

Almost 90% promote leadership in their organizations, thus giving us a positive effect, since it is a moderating variable. We can see that 40% follow GSCM as a lean & compliance based practice, but above 55% are in the favor of Innovation centered GSCM practice.

The main aim is social sustainability with best cost usage, which we can see clearly as almost 50% of the responses are in favor of the same, while people (60%) prefer implementing GSCM using an incremental technology that ensures sustainability.

With the changing market scenario, it's essential to adapt and go with the flow. The people are willing (40%) to change their GSCM framework as per technology changes, leaving the rest sample population to carry on with the restricted practice.

For the healthcare industry, Cradle-to-grave is most suitable because equipment and waste can't be treated as they are done in manufacturing industries, since they are hazardous. We can see this clearly from the responses as more than 50% support Cradle-to-grave over the latter.

Over all of this, managing and keeping a watch on Quality is very essential. So a team functioning as a QM team is necessary for any industry to build and foster. Thus more than 90% agree that this must be a necessary feature.

Last but not the least, financial viability is of utmost importance to every organization, as wealth maximization is a primary objective. We can see that more than 85% think it's a financially viable option to implement GSCM, making it a success.

4.2 Secondary Analysis Procedure

The analysis of the data that has been collected will be done using descriptive analysis and correlation analysis in IBM's SPSS software.

For analysis, the data has been divided on the basis of moderating variable i.e. Leadership (Q3 of Form). The responses indicating a "Yes" will be analyzed further because we have to check the impact of Leadership on GSCM in our problem statement.

The selected data will then be further categorized into two parts on the basis of whether the sample is using GSCM currently or not (Q1 of Form). So we have two datasets for analysis, **D1**: GSCM (Yes) & Leadership (Yes) and **D2**: GSCM (No) & Leadership (Yes).

The correlation analysis will be done w.r.t Green Supply Chain Management Satisfaction index (Q2 of Form), i.e. the dependent variable will be tested for correlation with each of the independent variables chosen for the research. (Refer Table-2)

Finally, according to the concept, correlations were performed and observations were recorded as C1 to C14 in Table-3.

5. Discussion

5.1. Summary & Conclusions

5.1.1. Restatement of Problem and Modified Hypothesis

According to the observations, certain inferences were derived (refer Table-4) and correspondingly hypothesis and problem statement were redefined.

Modified Hypothesis (after analysis): *Refer Table-5*

Modified Problem Statement (after analysis): To study the impact of Social Sustainability, Innovation and Continuous Improvement on Green Supply Chain Management considering the moderating effect of Leadership in the Healthcare Industry with respect to the Indian scenario.

5.1.2. Major Findings & its relevance

As our research project objective is to study the impact of Social and Technological Sustainability, Innovation and Continuous Improvement on Green Supply Chain Management considering the moderating effect of Leadership in the Healthcare Industry with respect to the Indian scenario, therefore after all the analysis, the three hypothesis are accepted with some modification in hypothesis related to innovation and social & technological sustainability. The findings relate to the very fact that the direction of study was not flawed and the results cohere with it. Thus, the analysis finally fulfils the objective of the study & after seeing it, we can say that research is not deviated from its original research objective because it proves that the proposed conceptual framework was correct by showing positive analysis results.

5.2. Implications & Recommendations

After the study we can imply the following:

- Innovation & Green Supply Chain Management are weakly correlated

  The literature proved that innovation comes with great leadership and employee empowerment, and we were successful in

portraying it in our study to some extent. GSCM and innovation have strategic interconnection in developing new green product.

The increasing importance of green innovation is becoming promising area in the green supply chain management, with which companies can eliminate direct and indirect environmental impact of an organization's final product and also the Green innovation concept can support the implementation of GSCM by providing a new idea, approach or technology to manufacturers in developing new products. Green innovation is believed to provide continuous seeking ways to innovate each stage of supply chain in order to gain competitive advantage and decrease the environmental problems in healthcare. Hence, it is considered that green innovation concept is underlying GSCM practices.

Pertaining to the weak correlation, it can also be stated as many organizations are keen in using six-sigma processes, because it not only optimizes process but also reduces cost.

- Social and Technological Sustainability & Green Supply Chain Management are weakly correlated to each other

GSCM is to integrate environmental thinking into supply chain management & also GSCM is important in influencing the total environment impact of any organizations involved in supply chain activities. GSCM also contribute in sustainability performance enhancement. In order to achieve a long-lasting competitive advantage, organizational sustainability requires the intersection of economic, environmental and society superiority which means businesses should focus on long-term profitability that could simultaneously reduce the Environmental and societal risks. Therefore, GSCM practice is in a prime position to leverage

sustainability performance in terms technological and social factors. The research also implied that financial viability is a problem while any organization considers to implement GSCM, as most of today's industries focus on cost cutting, as cited in the literature.

- Continuous Improvement & Green Supply Chain Management are positively correlated to each other

  This has been proved absolutely right that continuous improvement including waste management and change management have drastically transformed the shape of economy and GSCM implementation, as cited in the literature also. Green supply chain management aims to focus on continuous improvements of healthcare sector to reduce the higher prices of drug manufacturing and to reduce the waste, it is also suggested that by these improvements, this also focuses on lean manufacturing. Kaizen is a Japanese word which means continuous improvement for perfection. In a healthcare firm it is used for optimizing the inventory and reduction of wastage due to drug production.

  The resultant effective tool of continuous improvement is 5s, which aims for effective and maximum efficiency in the working area.

5.3. Limitations of the study

The limitations of this research can be considered as since most organizations implement Green supply chain management only if it is forced by the top management or to abide by government laws, so there is a possibility that the survey forms were inaccurately filled due to

corporate pressures resulting into the fact that the relationship between technological impact and GSCM was not so properly established due to improper results obtained through primary research. During analysis of final results it came out that some organization were not ready to share their sensitive information with us, due to which overall accuracy of the results decreased.

5.4. Scope for future research

We can stretch our research to different metro cities like Kolkata, Chennai, Delhi, etc. in order to focus the GSCM practices of big institutions like AIIMS, Apollo and Fortis. Further, this research could be generalized to other sectors of operations like manufacturing, agriculture, architecture, etc.

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Appendix-A

Figures, Tables and Illustrations

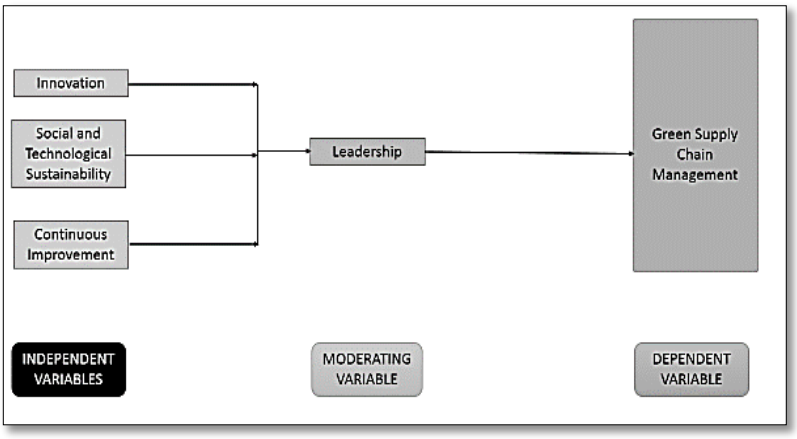

Fig. 1: Research Framework

Table-1: Research Hypothesis

H0:	**NULL**
H1:	There is a significant impact of Innovation on Green Supply Chain Management considering the mediating effect of Leadership.
H2:	There is a significant impact of Social and Technological Sustainability on Green Supply Chain Management considering the mediating effect of Leadership.
H3:	There is a significant impact of Continuous Improvement on Green Supply Chain Management considering the mediating effect of Leadership.

Table-2: Correlation Analysis Schedule

Leadership (Q3) : YES			Correlation Label
GSCM (Q1) : YES	**GSCM Satisfaction Index (Q2) : 0-5**	Innovation (Q4)	**C1**
		Social Sustainability (Q5)	**C2**
		Technological Sustainability (Q6)	**C3**
		Change Management (Q7)	**C4**
		Waste Management (Q8)	**C5**
		Quality Improvement Process (Q9)	**C6**
		Financial viability (Q10)	**C7**
GSCM (Q1) : NO	**GSCM Satisfaction Index (Q2) : 0-5**	Innovation (Q4)	**C8**
		Social Sustainability (Q5)	**C9**
		Technological Sustainability (Q6)	**C10**
		Change Management (Q7)	**C11**
		Waste Management (Q8)	**C12**
		Quality Improvement Process (Q9)	**C13**
		Financial viability (Q10)	**C14**

Table-3: Different correlations with their observations

Corr. Label	Pearson Correlation	Sig. (2-tailed) (N=19)	Between Questions	Observation
C1	.036	.891	Q2,Q4	There is a weak positive correlation between GSCM and Innovation, and p=.891>0.05 i.e. there is an insignificant correlation.
C2	.107	.682	Q2,Q5	There is a weak positive correlation between GSCM and Social Sustainability, and p=.682>0.05 i.e. insignificant correlation.
C3	-.019	.941	Q2,Q6	There is a weak negative correlation between GSCM and Technological Sustainability, & since p=.941>0.05 so it's an insignificant correlation
C4	.243	.348	Q2,Q7	There is a weak positive correlation between GSCM and Change Management, and as p=.348>0.05 i.e. insignificant correlation exists
C5	.536	.027	Q2,Q8	There is a positive correlation between GSCM and Waste Management, and since p=.027<0.05 i.e. a significant correlation exists
C6	.397	.115	Q2,Q9	There is a positive correlation between GSCM and Quality Improvement Process, since p=.115>0.05, there is an insignificant correlation.
C7	-.118	.653	Q2,Q10	There is a weak negative correlation between GSCM and financial viability, and since

				p=.653>0.05 so it's an insignificant correlation.
C8	-.412	.079	Q2,Q4	There is a negative correlation between GSCM and Innovation and p=.079>0.05 which represents insignificant correlation.
C9	-.056	.819	Q2,Q5	There is a weak negative correlation between GSCM and Social Sustainability, also p=.819>0.05 which represents insignificant correlation.
C10	-.190	.436	Q2,Q6	There is a weak negative correlation between GSCM and Technological Sustainability, also p=.436>0.05 which represents insignificant correlation.
C11	-.190	.435	Q2,Q7	There is a weak negative correlation between GSCM and Change Management, also p=.435>0.05 which represents insignificant correlation.
C12	.344	.149	Q2,Q8	There is a positive correlation between GSCM and Waste Management, also p=.149>0.05 which represents insignificant correlation.
C13	-.480*	.038	Q2,Q9	There is a negative correlation between GSCM and Quality Improvement Process and p=.038<0.05 which represents significant correlation.
C14	-.244	.315	Q2,Q10	There is a weak negative correlation between GSCM and financially viability and p=.315>0.05 which represents insignificant correlation.

Table-4: Inferences

H0:	**NULL**
H1:	**Stated Hypothesis:** There is a significant impact of Innovation on Green Supply Chain Management considering the mediating effect of Leadership. **Correlations under consideration:** C1 & C8 **Inference:** The correlation between Innovation and GSCM is **NOT significant**, and they are **weakly correlated** considering the mediating effect of Leadership. **Thus, the above hypothesis is accepted with modification in significance level.**
H2:	**Stated Hypothesis:** There is a significant impact of Social and Technological Sustainability on Green Supply Chain Management considering the mediating effect of Leadership. **Correlations under consideration:** C2, C3, C7, C9, C10 & C14 **Inference:** The correlation between Social Sustainability and GSCM is weak positive, while that between Technological Sustainability, Financial Viability and GSCM is weak negative. Overall all the correlations are **NOT significant** but **weakly correlated** to each other. **Thus, the above hypothesis is accepted with modification in factors and significance level.**
H3:	**Stated Hypothesis:** There is a significant impact of Continuous Improvement on Green Supply Chain Management considering the mediating effect of Leadership.

	Correlations under consideration: C4, C5, C6, C11, C12 & C13 **Inference:** The correlation between Change Management and GSCM is **weak positive** and **NOT significant**, while that between Waste Management and GSCM is **positive** and **SIGNIFICANT**, whereas that between Quality Improvement Process and GSCM is **positive** and **SIGNIFICANT**. **Thus, the above hypothesis is accepted with NO modification.**

Table-5: Modified Hypothesis

H0:	**NULL**
H1:	There is an **impact** of Innovation on Green Supply Chain Management considering the mediating effect of Leadership.
H2:	There is an **impact** of *Social Sustainability* on Green Supply Chain Management considering the mediating effect of Leadership.
H3:	**There is a significant impact of Continuous Improvement on Green Supply Chain Management considering the mediating effect of Leadership.**