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A REVIEW OF GREEN SUPPLY CHAIN MANAGEMENT ISSUES IN INDIAN BOTTLEDWATER INDUSTRY

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ABSTRACT

Green supply chain management (GSCM) has emerged as a vigorous managerial philosophy to attain co-operate profit and market share objectives by diminishing environmental threats and impacts while improving ecological efficiency of organizations. Green supply chain can be effectively applied to moderate the environmental damages caused by end of life products by considering the interplay of social, economic and environmental aspects with integrated and long-term perspectives. This paper reviews the factors affecting the implementation of green supply chain management for the Indian bottled water industry using Interpretive Structural Modelling (ISM), a multiple criteria decision making method used for structuring complex decision making problems. An important step for using ISM is to identify the prominent drivers that can affect the implementation of green supply chain and their interrelations between each other. The various drivers of green supply chain management are identified based on the literature and an overall examination of the industry taken under study.

Keywords: Green supply chain management, Interpretive structural modelling.

1. INTRODUCTION

Global consumption of polyethylene terephthalate (PET) packaging is forecasted to reach 19.1 million tonnes by 2017, with a 5.2% increase per annum between 2012 and 2017 [1]. This rapid increase in PET bottle consumption has also led to the emergence of various issues. These include environmental pollution, health concerns for scavengers, and low utilization efficiency for reclaimed PET bottles [2]. Even though PET bottles are graded in number one category of recyclable products but are not risk free. Long periods of use or exposure to sunlight can cause PET bottles to leach toxic carcinogens. In light of growing concerns over environmental protection, resource conservation, and the development of recovery technology, recycling has become a key factor in the supply chain of PET bottles [1] Julia 'Butterfly' Hill once quoted "It pollutes several times more water to make the plastic bottle than it actually holds".

Studies have found that for every pound of reclaimed PET flake used, energy use is reduced by 84%, while greenhouse gas emissions are reduced by 71% [3]. Will companies retain ownership of products they sell to Harvest and re-use the materials they contain? Many business enterprises in the 21st century are searching for a preferred policy approach to promote cost effective diversion and recovery of post-consumer solid waste.

Supply Chain management and logistics are not new ideas. From the building of the pyramids to the relief of hunger in Africa, the principles underpinning the effective flow of materials and information to meet the requirements of customers have altered little [4]. Recently, customers' attention to environmental issues, business' adaptation to the competitive market, and an increasingly controlled legislation all play a central role in the way businesses are created and managed in the global market. To meet these requirements, companies increasingly focus on developing sustainability practices and on creating reverse supply chains in order to recapture value and to provide methods of proper disposal [5]. With the increasing social demand of environmental sustainability, companies are recognizing that environmental concerns are the key strategic issue with the potential for a lasting impact on organizational performance. GSCM integrates environmental thinking into supply chain management.

Green supply chain management (GSCM) has emerged as an important organizational philosophy to achieve corporate profit and market share objectives by reducing environmental risks and impacts while improving ecological efficiency of these organizations and their partners [6]. The scope of GSCM practices implementation ranges from green purchasing (GP) to integrated life-cycle management, supply chains flowing from supplier, through to manufacturer, customer, and closing the loop with reverse logistics. [7] Many manufacturers have adjusted their manufacturing philosophies and introduced environmental program into their organizations. Through social and environmental responsibility some firms proactively recognize the urgency of environmental protection and have integrated goals into their co-operate strategies. This paper investigates the issues in implantation of GSCM in Indian bottled water Industry via interpretive structural modelling (ISM), a multiple criteria decision making method used for structuring complex decision making problems.

2. GREEN SUPPLY CHAIN MANAGEMENT

With a growing social demand of environmental sustainability firms embrace the strategic importance of sustainable (green) management practices for competitive advantage. There is an ambiguity of the relationship between pollution reduction and profitability. [23] The compatibility of environmental objectives with economic viability is an on-going debate among the practitioners. In light of these divergent views, while organizations recognize that environmental sustainability has implications for their competitive advantage.

Faced with many challenges, some initiatives have decided to assess the 'greenness' of a company based on the qualitative criteria, which influences resource accumulation and varied outcomes. Various companies looked forward for finding the management practices that are synergic in terms of their focus on reducing waste and inefficiency.[24] It is considered to be important for manufacturing firms to implement both management practices and environmental practices together to enjoy eco-advantage through improvements in environmental performance. This will also enable firms to meet their business performance objective better.

Many manufactures have attuned their manufacturing philosophies and blended environmental programs into their organizations through social and environmental responsibility. Some firms proactively recognize the urgency of environmental protection and have integrated goals into their co-operate strategy. GSCM is an effective management tool and philosophy for proactive and leading manufacturing

organizations which incorporates environmental criteria or concerns into organization purchasing decisions and long- term relationships with suppliers. It covers all phases of product life cycle from the extraction of new materials through the design, production, and distribution phases to the use of the product by consumers and its disposal at the end of products life cycle. GSCM practices implementation, which is materials acquisition, pre-production, production, use, distribution, and disposal of the product

GSCM covers activities such as 'green design', 'green sourcing/procurement', 'green operations' or 'green manufacturing', 'green distribution or green marketing' and 'reverse logistics' [8]. The U.S Environmental Protection Agency (2000) provided four basic steps to implementing a green supply chain. They are

- Identifying costs
- Determine opportunities
- Calculate benefits, and
- Decide, implement and monitor.

According to Dayna Simpson and Danny Samson (2008), the explosion of GSCM activity in the practical realm has led to an increasing body of empirical work regarding both external influences leading to the uptake of green supply chain management practices, and their impact on firm performance. Investigation in this area has generally fallen into four main categories:

Figure 1 Green supply chain decision making framework Source- EPA- 742-R-00-001 (January 2000)

- Use of compliance-based strategies that support the cascading of basic environmental requirements generically across all suppliers.
- Aligning supply chain goals for both efficiency and pollution-reduction.
- Transfer of environmentally specific innovations or technologies from customers to suppliers.
- Collaboration or competition between firms to develop re-manufacturing or closed-loop recycling systems.

GSCM encompasses a set of environmental management practices which are also useful for logistics management and are designed to incorporate environmental consideration into forward and reverse logistics. Examples of green supply chain management practices include

- Reducing package and waste

- Assessing suppliers based on environmental performance
- Developing more ecofriendly products
- Reducing carbon emissions associated with the transport of good.

GSCM yields studies linking green, environment or sustainable concepts to traditional supply chain management. Integrating environmental concepts into traditional business functions ameliorates environmental pollution. A more elaborate and organized study allows efficient implementation of various green strategies.

2.1 Green Supply Chain Management Strategy

GSCM strategies explains the attitudes that companies hold towards green management. Depending on degree of resource commitment and complexity in implementation, Simpson et al. [25] proposed various GSCM strategies. The strategies considered in this study are,

2.1.1 **Risk Based strategy**

This strategy is based on the minimal inter-organizational engagement. [25] The goal of this strategy is to minimize the risk by passively accomplishing environmental programs. Organizations choosing this strategy invest minimal organizational resource for green management and ask their suppliers to comply with environmental requirement. Vendor management inventory (VMI) is an example of effective co-operation and partnering practices between up end and downstream stages in supply chain. [26] If there is an increasing interest in measuring the relative environmental performance of the firm and production sites, systems based on risk minimization only and managed in a climate of low relational investment only guarantee supply chain compliance with local or national regulations. The end result being that risk can be minimized and green status enhancement is possible, but no additional innovation or balancing economic benefits are likely.

2.1.2 **Efficiency based strategy**

This type of strategy develops environmental performance benefits for the supply chain beyond simple regulatory compliance through the requirement for suppliers to meet operations-based efficiency targets. [25] Most of the environmental performance benefit ascends from specific manufacturing practices that have been found to provide secondary environmental performance benefits. This strategy aims at reducing the cost by operational optimization and decrease environmental degradation through specific approaches. It allows increased economic benefits and efficient resource use with increased waste reduction. According to Rondinelli and Vastag (1996), firms may be reacting to an increasing difficult regulatory environment or responding to market pressure in adopting environmental management practices the responses of firms to exogenous pressures have led to green practices that impact profitability [27]

2.1.3 **Innovation based strategy**

Keeping up-to-date with environmental legislation changes and training suppliers in environmentally relevant process changes requires more dedicated environmental resources, specialized personnel, and design. [25] The amplification of such resources offers the conditions for an organization to shift from an efficiency-based to an innovation- based GSCM strategy. For products, the resources developed could be used to incorporate innovative environmental planning into explicit product designs characteristics, functionality, or life-cycle related activities. This strategy forces the companies to invest more resources and cultivate innovative capabilities for green management. It helps the companies to develop products from product life cycles, endorse stricter environmental requirement upon their suppliers and even trains them to adjust operational process to follow the newest environmental regulations.

Porters (1991) “win-win” argument was among the first in the literature to challenge the conventional wisdom that government environmental standards are harmful to competitiveness of the firms. The

benefits of environmental management are larger than the costs and tighter regulating standards will in fact lead to Innovation. [27] Porters 'Innovation offsets' is a type of technological change that will 'partially or more than fully offset the costs of complying with environmental regulation' 2.1.4 **Closed loop strategy**

Closed-loop strategies are a more recent type of GSCM strategy and represent the most complex and collaborative form of this type of activity. Often referred to in its simplest form as 'reverse logistics,' closing the loop involves the capture and recovery of materials for either re-manufacture (high-value) or recycling. [25] It links the environmental performance to the entire supply chain. It includes taking back materials produced from any production process and end of life products and disposing them. This strategy requires much effort to be highly integrated, co-operate with many parties and develop specialized knowledge and technology. It is the final goal of organizations executing Green management practices completely.

According to Berry and Rondinelli (1998) proactive environmental strategies are required to promote improved performance. They identified multiple links of mechanism between environmental performance and firm performance. Studies suggest that environmentally proactive companies have lower regulatory related expenses and being environmentally proactive leads them to new opportunities created by 'clean products and processes' and can participate in voluntary international standards.[27]

The main objectives of this study include

1. Identifying the various drivers affecting the Implementation of the green supply chain.
2. Understand and cross examine the limiting factors of green supply chain.
3. To measure the interactions among the various drivers.

3. LITERATURE REVIEW

To establish an adequate structural model, this paper reviews various green supply chain management practices in the literature over the past decade to clarify the definitions of the various measures considered for the study. In recent years the literature on supply chains has growing and new ways of looking into the supply chains structures have been emerging. In particular, the society increased concerns towards environmental preservation has led to the need of incorporating, into the traditional supply chain networks, reverses logistics activities where product recovery is accounted dealing with producer responsibility. [29] Reinhardt [28] observed that the need for green practices is often not just a matter of choice but is required by law. He argues that ultimately environmental quality can only be ensured through government regulation, as the environment is a public good.

Ali Diabat et al. [7] identified eleven crucial drivers affecting GSCM implementation in aluminium products manufacturing industry. Due to the complexity of GSCM practices, customer and cost pressures and regulation uncertainty, they considered implementing GSCM as a thankless task that increases overall cost. Green design, integrating quality environmental management into the planning and operation process, reducing energy consumption and reusing and recycling materials and packaging etc. are some of the top drivers considered in their study

Chiau-Ching Chen et al. [16] conducted a study to identify the successful GSCM strategy through the thorough understanding of the competitive environments during dynamic and unstable times. This study suggests top management to choose an appropriate GSCM strategy from the results of several comprehensive analysis with a balance between short term and long term profits in business operations. It also point out that green management thinking is pro-active and the appropriate GSCM strategy presented in the final result is 'innovation-based strategy'.

They modelled the different functions and activities as network clusters and elements in an Analytical network process (ANP). ANP is an appropriate technique to process an unstructured problem by considering mutually influential factors. It deals with tangible and intangible factors and represents the relations of dependence and feedback. The result from ANP is stable and convergence of the limiting super matrix provides an advantage over other tools. But this study focuses on selection of strategy from the internal environment point of view. It is difficult to solve the problem using ANP if more clusters are added to the network. Precise formulations of a real world problem and well established networks are difficult work. [16] Quantitative methods like ISM can simplify the dependence relations among the clusters and their elements more precisely.

Barriers, which hinder organizations to implement GSCM, have been identified from various literature and the overall examination of the Industry taken under study. Any energy saving measure can be a green measure. Some measures considered for this study are described below.

3.1 Green Consumers

Green consumers are part of ethical consumerism practices through positive buying by favoring ethical products, be they fair trade, cruelty free, organic, recycled, reused or produced locally. Green consumers respond to global warming and climate change by re-evaluating what they buy and adjust their living habits and assess the green attributes of a product or service through their purchases. Green consumers saves electric energy, recycle paper, returns bottles or cans and buy more environmental friendly products. They experience the effect of global warming, climate change and pollution. They do not expect companies to be perfect in order to be considered 'green'. Rather, they look for companies that are taking substantive steps and have made a commitment to improve.

An axiom that has shaped policy approaches to sustainable consumption has been that if more consumers understand the environmental consequences of their consumption patterns, through their market choices they would inevitably put pressure on retailers and manufacturers to move towards sustainable production. The result is the proliferation of consumption of “green” products, eco-labels, consumer awareness campaigns, etc [22].

It is also considered that promoting green consumerism at once lays responsibility on consumers to undertake the function of maintaining economic growth while simultaneously, even if contradictorily, bearing the burden to drive the system towards sustainability

3.2 Extended producer responsibility

EPR is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact of a product by making the manufacturer of the product responsible for the entire life cycle of the product and especially for the take back, recycling and final disposal. EPR is a regulatory approach designed to promote the integration of environmental costs associated with goods throughout their life cycles into the market price of the products

Physical environmental variable considered in EPR are

- Firms innovation strategies
- Consumer choices
- Development of Recycling activities

3.2 Product Stewardship

In the context of broad-based concerns about the need to move towards a more sustainable materials economy, particularly as they are expressed in debates around Ecological Modernization (EM) product

stewardship has radical potential as a means to promote significant change in the relationship between society and the material world.[30] Product stewardship is where environmental, health, and safety protection centers around the product itself, and everyone involved in the lifespan of the product is called upon to take up responsibility to reduce its environmental, health, and safety impacts. For manufacturers, this includes planning for, and if necessary, paying for the recycling or disposal of the product at the end of its useful life. This may be achieved, in part, by redesigning products to use fewer harmful substances, to be more durable, reusable and recyclable, and to make products from recycled materials. For retailers and consumers, this means taking an active role in ensuring the proper disposal or recycling of an end-of-life product.

Increasingly, Extended Producer Responsibility (EPR) and Product Stewardship (PS) frameworks are being adopted as a preferred policy approach to promote cost-effective diversion and recovery of post-consumer solid waste. Because the application of EPR/PS generally requires the creation of a separate and often parallel collection and/or management system, key to increasing the amount of waste recovered is to maximize the convenience of the collection system to maximize consumer participation. [31]

3.4 Green marketing and services

Green marketing is the marketing of products that are presumed to be environmentally safe. Thus green marketing incorporates a broad range of activities, including product modification, changes to the production process, packaging changes, as well as modifying advertising. Green manufacturing requires good use of information and communication technology tools and needs extended producers responsibility to keep the information of products and services. GM emphasizes green characteristics during sale and promotion of products and services and highlight reduced environmental destruction.

Eunju Ko et al [32]. confirms that corporate images consist of three factors: social responsibility, product image, and corporate reputation. In an estimated model, the green marketing has a direct effect on the social responsibility and product image. In particular, the factor of social responsibility plays an important role as mediator in the effect of green marketing on product or corporate reputation. Of the three factors of corporate image, product image and corporate reputation have a direct effect on purchase intentions, whereas social responsibility has an indirect effect on purchase intentions in the retail setting.

Green Marketing used in

- Strategic activities
- Manipulating and 4P activities
- Segmenting targeting and positioning
- Greening logistics
- Green alliances

3.5 Green manufacturing

Manufacturing process consumes a lot of energy acquired from burning various natural resources such as coal, coke and natural gas and combustion causes air pollution. Manufacturing systems evolution is a function in multiple external and internal factors. With todays' global awareness of environmental risks as well as the pressing needs to compete through efficiency, manufacturing systems are evolving into a new paradigm. The main goal of green manufacturing is to save energy via new technologies or by supplying greener source of Energy by extending the life cycle of pollutants and wastes and increase the production efficiency via new processes.

A successful green manufacturing technology master the following key factors

- The amount of energy and resource utilization
- Green degree of energy
- Amount of hazardous waste
- Number of reuses of Hazardous waste.

3.6 Green Purchasing

Green purchasing focuses on environmentally conscious practices such as reducing resource utilization, eliminating waste, recycling and reuse, purification and substituting materials without affecting material property. A firm implementing green purchasing can establish environmental standards in its purchasing policies for supplier that involve supplier selection, evaluation and relation development. Green purchasing suggests three crucial factors for rating alternative supplier which are Green competencies, Green Image and green management.

Environmental collaboration with suppliers, top-management commitment, and customer pressure influence firms' green purchasing positively and significantly. [33] Besides directly affecting green purchasing, top-management commitment also indirectly affects green purchasing via environmental collaboration with suppliers. Overall, internal motives of top-management commitment and environmental collaboration with suppliers exceed the external motives of regulatory pressure and customer pressure with regard to green purchasing adoption.

3.7 Green Design

The intention of sustainable design is to "eliminate negative environmental impact completely through skillful, sensitive design". Manifestations of sustainable design require no non-renewable resources, impact the environment minimally, and connect people with the natural environment. Green design includes essential material selection, production procurement, package design, and energy use. Green design consider four crucial factors

- Design for environment
- Eco design
- Life cycle design

Other factors considered for the study includes

- Top management commitment
- Organizational culture
- Reverse logistics function
- Reclaim and reuse
- Recycle, remanufacture and Disposal
- Impact of use of 3PL
- Environmental Management System
- Government regulations and legislation
- Reducing energy consumption…etc.

3. INTERPRETIVE STRUCTURAL MODELLING

Multiple criteria decision making (MCDM) approaches are major parts of decision theory and analysis. They seek to take explicit account of more than one criterion in supporting the decision process. The aim of MCDM methods is to help decision makers learn about the problems they face, to learn about organizational values and objectives, and through exploring these in the context of the problem to guide them in identifying a preferred course of action. [34]

Interpretive Structural Modelling (ISM) is defined as a process aimed at assisting the human being to better understand what he/she believes and to distinguish clearly what he/she does not know. Its most essential function is organizational. The ISM process transforms unclear, poorly articulated mental models of systems into visible and well-defined models [9]. ISM is a proven methodology for identifying relationships surrounded by specific items, which outline a problem or an issue. For any multifaceted problem under consideration, a number of factors may be related to the particular problem. However, the direct and indirect relationships between the factors describe the situation far more accurately than the individual factor taken into isolation. Therefore, ISM develops insights into collective understandings of these relationships.

ISM is a computer-aided method for developing graphical representations of system configuration and structure. ISM had its inception in Warfield's perception of the need, when attempting to couple science to policy, for "a set of communication tools which have both a scientific and lay character serving as a linkage mechanism between science and the public, and having meaning for all who are involved" and which, in particular, are capable of communicating a collective sense of the elements and their relations which define system structure.

4.1 ISM Methodology

ISM is primarily proposed as a group learning process, but can also be used individually. The ISM process transforms unclear, poorly articulated mental models of system into visible, well defined models useful for many purposes. [10] Various steps involved in the ISM methodology are given below [11].

1. Step 1: The drivers affecting the implementation of green supply chain management for the firm under study are listed.

2. Step 2: For each pair of drivers identified in Step 1, a contextual relationship is established.

3. Step 3: A Structural Self-Interaction Matrix (SSIM) is developed, which indicates pairwise relationships among drivers of the system under consideration.

4. Step 4: A reachability matrix is developed from the SSIM and the matrix is checked for transitivity. The transitivity rule states that if a variable 'A' is related to 'B' and 'B' is related to 'C', then 'A' is necessarily related to 'C'.

5. Step 5: The reachability matrix obtained in Step 4 is partitioned into different levels.

6. Step 6: Based on the relationships given above in the reachability matrix, a directed graph is drawn and the transitive links are removed.

7. Step 7: The resulting digraph is converted into an ISM by replacing the variable nodes with statements.

8. Step 8: The ISM model developed in Step 7 is reviewed to check for conceptual inconsistencies, and necessary modifications are made.

The various step by step procedures for ISM are show in Fig. 1

Rajesh Attri et al [9] explains various steps involved in the development of an ISM model that are illustrated below. The procedure followed is based on this literature.

Step 1: **Structural self- Interaction Matrix** (SSIM): ISM methodology advocates the use of experts opinions based on various management techniques such as brainstorming, nominal technique, etc. in developing the contextual relationship among the variables [12].
The appropriate relationship for each factor and the existence of a relationship between any two factors (i and j), the associated direction of the relationship is questioned. [9] The following four symbols are used to denote the direction of relationship between two factors (i and j): (a) V for the relation from factor i to factor j (i.e., factor i will influence factor j) (b) A for the relation from factor j to factor i (i.e., factor i will be influenced by factor j) (c) X for both direction relations (i.e., factors i and j will influence each other) (d) O for no relation between the factors (i.e., barriers i and j are unrelated). Based on the contextual relationships, the SSIM is developed. To obtain consensus, the SSIM should be further discussed by a group of experts. On the basis of their responses, SSIM must be finalized.

Step 2: **Reachability matrix:** The next step in ISM approach is to develop an initial reachability matrix from SSIM. For this, SSIM is converted into the initial reachability matrix by substituting the four symbols (i.e., V, A, X or O) of SSIM by 1s or 0s in the initial reachability matrix.

The rules for this substitution are as follows: (a) If the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0. (b) If the (i, j) entry in the SSIM is A, then the (i, j) entry in the matrix becomes 0 and the (j, i) entry becomes 1. (c) If the (i, j) entry in the SSIM is X, then the (i, j) entry in the matrix becomes 1 and the (j, i) entry also becomes 1. (d) If the (i, j) entry in the SSIM is O, then the (i, j) entry in the matrix becomes 0 and the (j, i) entry also becomes 0. Following these rules the reachability matrix is formed. [9]

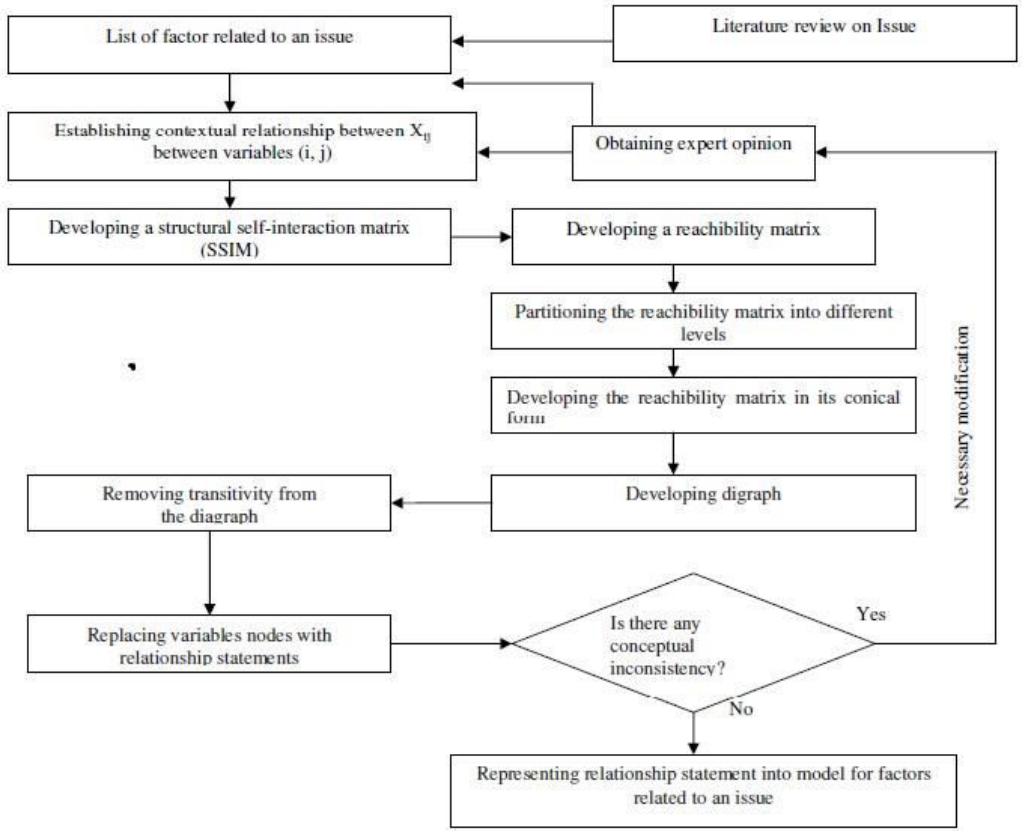

Figure 2 . Flow diagram for preparing ISM Source: Rajesh Attri et al., 2013

Step 3: **Level partitions**: From the reachability matrix, for each factor, reachability set and antecedent sets are derived. The reachability set consists of the factor itself and the other factor that it may influence, whereas the antecedent set comprise of the factor itself and the other factor that may influence it. Afterwards, the intersection of these sets is derived for all the factors and levels of different factor are determined. The factors for which the reachability and the intersection sets are the same occupy the top level in the ISM hierarchy. The top-level factors are those factors that will not lead the other factors above their own level in the hierarchy. Once the top-level factor is identified, it is removed from consideration. Then, the same process is repeated to find out the factors in the next level. This process is continued until the level of each factor is found. These levels help in building the diagraph and the ISM model.

Step 4: **Conical matrix**: Conical matrix is established by grouping factors in the same level across the rows and columns of the final reachability matrix. The drive power of a factor is derived by summing up the number of ones in the rows and its dependence power by summing up the number of ones in the columns. Next, drive power and dependence power ranks are calculated by giving highest ranks to the factors that have the maximum number of ones in the rows and columns, respectively.

Step 5: **Digraph**: From the conical form of reachability matrix, the preliminary digraph including transitive links is obtained. It is generated by nodes and lines of edges. After removing the indirect links, a final digraph is developed. A digraph is used to represent the elements and their interdependencies in terms of nodes and edges or in other words digraph is the visual representation of the elements and their interdependence. In this development, the top level factor is positioned at the top of the digraph and second level factor is placed at second position and so on, until the bottom level is placed at the lowest position in the digraph.

Step 6: **MICMAC analysis**: The purpose of MICMAC analysis is to analyse the drive power and dependence power of factors. MICMAC principle is based on multiplication properties of matrices. It is done to identify the key factors that drive the system in various categories. Based on their drive power and dependence power, the factors, have been classified into four categories i.e. autonomous factors, linkage Factors, dependent and independent factors.

5. CONCLUSION

One of the key components of a successful implementation of GSCM is the profound understanding of the environmental impacts caused by the end of life products. The factors hindering the selection of GSCM considerably challenges both the managers and policy makers in industries. After identification of key factors or elements, strategy is developed for dealing the issue. In this work, a model to analyse the relationship among the enablers of GSCM in the Indian bottled water Industry is developed based on the identified drivers. Some of the major factors identified in this study are put into an ISM model to analyse the interaction between various levels in the supply chain. ISM delivers a methodical, guiding framework for complex problems and gives decision makers a credible picture of their situation and the variables involved.

To benefit from productive GSCM practices, individual businesses should develop their own business cases in fulfilling the sustainable needs of the society. The major contribution of this work lies in the development of linkages among various attributes in GSCM. The utility of proposed ISM methodology in imposing order and direction on the complexity of relationships among elements of system assumes tremendous value to the decision makers. ISM has the capability to develop an initial model through managerial technique such as brainstorming, nominal group techniques etc. In this sense, ISM is a supportive analytic tool for the situation discussed.

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