

Green management indicators & environmental sustainability: An ISM based approach

Saad Bin Azhar and Parvaiz Talib
Department of Business Administration,
Aligarh Muslim University

Keywords

Green Management; Environmental Indicators; Environmental Sustainability; Interpretive Structural Modeling

Abstract

The purpose of this paper is to identify indicators (Barriers and Enablers) for green management practices in manufacturing organizations and to understand their relationship with environmental sustainability. By using Interpretive Structural Modeling (ISM) approach, the paper presents a hierarchy based model and the contextual relationships among these indicators. The research shows that there exists a group of indicators having low dependence and high driving power and are of strategic importance for the companies.

The proposed model provides a useful tool for companies. By focusing on specific green indicators, environmental performance can be significantly improved leading to environmental sustainability. This study further augments the academic literature on green management.

Introduction

In today's quickly developing range of manufacturing areas managers are just worried about the growth and profit of the firm, whether these things are coming at any cost of impacting the environment in a hazardous way. Only a very few public sector units are concerned about the hazardous impact of the waste products on environment. Various industrial units are considered to be the eminent source of most of these environmental problems. To avoid these problems Green management practices (GMP) comes out as a tool that need to be adopted at various processing levels in various manufacturing firms. GMP is a consolidated arrangement of innocuous manufacturing procedures that aggregately help to minimize waste and contamination, to give contamination free environment to buyers, workers and partners. In GMP, environmental effect of industrial procedures is considered at all phases of production. The manufacturers avoid the use of all materials & manufacturing processes which are harmful to the ecosystem, at the various stages of production system. Various stages may include design, surface finishing, storage, disposal of wastes etc. GMP addresses a number of practices including recycling, waste management, green purchasing & green design, using a cleaner & renewable sources of energy, end-of-life management of products, green logistics & GSCM etc. Adopting these green practices for the production of various goods is very beneficial in solving the problem of environmental pollution.

"Greening has emerged as strategic weapon and in addition as social responsibility tool."

GMP Strategies

The major strategies for GMP are to create and actualize answers for open, enterprises, nonprofit organizations and so on that accomplish positive results for environment and the general public in which they live.

Some of them are talked about beneath:-

- Make products and frameworks that utilize fewer amounts of material and energy.
- Use input materials that are non-dangerous & renewable.
- Reduce undesirable outputs.
- Convert outputs to inputs with recycling system.
- Improve structure of production procedure.
- Green Transportation and logistics.
- Green purchasing.

In this paper, an effort is made to understand the levels of the barriers and enablers to GMP in supply chains and the relationship between such indicators using ISM methodology to Environmental Sustainability. These indicators are also categorised depending on their driving power and dependence. After a review of literature on GMP and the opinion of experts, both from the Indian manufacturing segment and the academia, Different important indicators of GMP in supply chains have been identified.

The main objectives of this paper are as per the following:

- (1) To identify the indicators for Green management practices in supply chains of manufacturing sector.
- (2) To determine the interaction among recognized indicators utilizing ISM, and
- (3) To examine how this model can help managers to build environmental sustainable supply chains.

Literature Review

Factors that act as “Drivers” and “Barriers” of green Management practices are identified from the extant Literature review, which are generally faced during implementation of green practices in Indian manufacturing industries.

Historical Background

The role of "Green Practices" in reducing and eliminating waste was discussed by H. Min and W. Galle. Additionally impacts of "green" purchasing on packaging choices are investigated. Discussion is made on different barriers in execution of green practices. Murray embraced the exploration technique which was the contextual investigation sort in which the creator examined green purchasing procedure, asset sparing method, waste evacuation and its management by taking the instance of paper usage in office work. Pun et al. educated the appropriation & execution with respect to Environmental Management System (EMS) and the different impacts and components that may influence EMS planning. Environmentally Responsible Manufacturing (ERM) is additionally a propelled system for controlling the industrial contamination. M. Baxter firstly clarified the boundaries and after that the fruitful approaches to go through these obstacles have been proposed, to effectively execute EMS. The revamped idea which demonstrated as a most existing driver of GM practices is Environmental, Health and Safety (EHS) of the working representatives in a specific firm. One more vital idea of SCM was introduced by Paquette. In the same sense the idea of "GREEN" in the previous field of production network management is assessed and portrayed by Zhu et al, which came about later on into GSCM that incorporates different Drivers, Green practices and Performance parameters among different manufacturing associations. Further work in this field of greening the manufacturing practices improved its development into chemicals, mining and resources, oil, gas and petroleum, transport and tourism, development, sustenance and family unit segments for their discussion to discover environmental sustainability. Simpson et al. had presented effectively green management rehearses on economical environmental improvement. The advantages of reverse logistics were highlighted by Chunguang et al. The creator underlined on the ISO 14001 confirmations and these are considered as systemic prerequisites arranged toward changing business procedures and techniques.

Literature review and discussion with experts make it clear that there exist a few empowering agents and boundaries that could go about as indicators for socially responsible green production network.

Different High Driving Power Indicators which are distinguished by surviving literature review procedure are:

- Employee's Motivation, wellbeing & Safety
- Global climatic pressure & Environmental advantages
- Environmental concerns & lawmaking body
- Green image, Global marketing & Competitiveness
- Social & Environmental responsibility
- Organizational capabilities & awareness
- Government rules & regulations
- Client's awareness, pressure & support
- Demand for environmentally friendly products

Economic benefits
 Society or public pressure
 Supplier's Pressure & willingness
 Investors & Shareholder Pressure
 Different Low reliance indicators to GMP which are distinguished by surviving literature review procedure are:
 Lack of exploration & exact studies
 Lack of customer's, supplier's & shareholder's awareness
 Financial pressure
 Lack of awareness in Companies for environmental sustainability
 Lacking coordination between distinctive departments
 Need of advancement of new investigative tools & models
 Incompatibility with different management & manufacturing systems
 Lack of management commitment
 Lack of essential devices, management aptitudes and learning
 Loose Government Legislation
 Failure to receive satisfactory environmental treatment measures

Methodology

Interpretive Structural Modelling (ISM) can be utilized to recognize and condense connections among particular variables which define a problem or an issue (Warfield 1974, Sage 1977). ISM is an interactive planning methodology that permits a gathering of individuals, filling in as a group, to add to a structure that forces request and course on the mind boggling connections among components in a set (Sage 1977). The components to be organized, (for example, targets, boundaries, empowering influences, etc.) are characterized by the gathering toward the ISM's start arranging session. The gathering likewise determines a social articulation that characterizes the sort of relationship wanted, for example, 'irritates', 'upgrades', 'adds to', 'goes before', et cetera (Bolaños et al. 2005). The ISM philosophy is interpretive in light of the fact that it is the bunch's judgment that chooses whether and how the variables are connected. It is auxiliary as well, as on the premise of relationship a general structure is separated from the mind boggling arrangement of variables. It is a demonstrating method in which the particular connections of the variables and the general structure of the framework under thought are depicted in a digraph model. ISM has been connected by various scientists in different fields to add to a superior comprehension of the frameworks under thought.

ISM is basically proposed as a gathering learning procedure, yet it can likewise be utilized exclusively. The different steps included in the ISM philosophy are as per the following:

Step 1: Variables influencing the framework under thought are recorded, which can be destinations, activities, people, and so on.

Step 2: From the variables distinguished in Step 1, a logical relationship is built up among indicators as for which matches of variables will be inspected.

Step 3: A basic self-association framework (SSIM) is created for variables, demonstrating pair-wise connections among variables of the framework under thought.

Step 4: A reachability grid is produced from the SSIM and this framework is checked for transitivity. The transitivity of the logical connection is an essential supposition made in ISM. It expresses that if a variable An is identified with B and B is identified with C, then An is fundamentally identified with C.

Step 5: The reachability grid acquired in Step 4 is parceled into distinctive levels.

Step 6: Based on the connections given above in the reachability grid, a coordinated diagram is drawn and the transitive connections are evacuated.

Step 7: The resultant digraph is changed over into an ISM, by supplanting variable hubs with explanations.

Step 8: The ISM model created in Step 7 is reviewed to check for any applied irregularity and fundamental changes are made.

Green Management Indicators	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1. Green purchasing practices	V	V	O	O	O	O	A	V	O	V	O	V	A	A
2. Government policies & rules	V	V	O	O	V	O	V	O	O	V	V	V	A	
3. Social Responsibility for protection of environment	O	V	V	V	V	V	X	V	V	V	V	V		
4. Use of clean technology	V	V	A	V	O	O	A	O	O	X	A			
5. Top management support	V	V	V	V	V	V	O	V	V	V				
6. Green logistics practices	O	A	V	V	A	O	A	V	O					
7. Client satisfaction	A	A	O	A	A	O	O	O						
8. ISO:14001 EMS Certification	V	O	O	O	A	A	V							
9. Eco-literacy of stakeholders	V	V	O	O	V	V								
10. Proper workplace management:	O	O	V	V	V									
11. Green manufacturing	V	V	V	V										
12. Competitiveness	O	A	A											
13. Economic benefits	O	V												
14. Green product development	V													
15. Eco-labeling of products														

Table I: Structural Self Interaction Matrix (SSIM)

Green Management Indicators	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Green purchasing practices	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1
2. Government policies & rules	1	1	0	1	1	1	0	0	1	0	1	0	0	1	1
3. Social Responsibility for protection of environment	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
4. Use of clean technology	0	0	0	1	0	1	0	0	0	0	0	1	0	1	1
5. Top management support	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1
6. Green logistics practices	0	0	0	1	0	1	0	1	0	0	0	1	1	0	0
7. Client satisfaction	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
8. ISO:14001 EMS certification	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
9. Eco-literacy for stakeholders	1	0	1	1	0	1	0	0	1	1	1	0	0	1	1
10. Proper workplace management	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0
11. Green manufacturing	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1
12. Competitiveness	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
13. Economic benefits	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0
14. Green product development	0	0	0	0	0	1	1	0	0	0	0	1	0	1	1
15. Eco-labeling of products	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1

Table II: Initial Reachability Matrix

Green Management Indicators S. No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Driving Power
1	1	0	0	1	0	1	1*	1	1*	0	0	1*	1*	1	1	10
2	1	1	1*	1	1	1	1*	1*	1	1*	1	1*	1*	1	1	15

3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1*	15
4	0	0	0	1	0	1	1*	1*	0	0	0	1	1*	1	1	08
5	0	0	0	1	1	1	1	1	1*	1	1	1	1	1	1	12
6	0	0	0	1	0	1	1*	1	1*	0	0	1	1	1*	1*	09
7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	01
8	1*	0	1*	1*	0	1*	1*	1	1	1*	1*	0	0	1*	1	11
9	1	1*	1	1	1*	1	1*	1*	1	1	1	1*	1*	1	1	15
10	0	0	0	1*	0	1*	1*	1	1*	1	1	1	1	1*	1*	11
11	0	0	0	1*	0	1	1	1	1*	1*	1	1	1	1	1	11
12	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	02
13	0	0	0	1	0	1*	1*	0	0	0	0	1	1	1	1*	07
14	0	0	0	0	0	1	1	1*	0	0	0	1	1*	1	1	07
15	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	02
Dependence	5	3	4	11	4	12	15	11	9	8	7	12	11	12	13	

Table III: Final reachability matrix

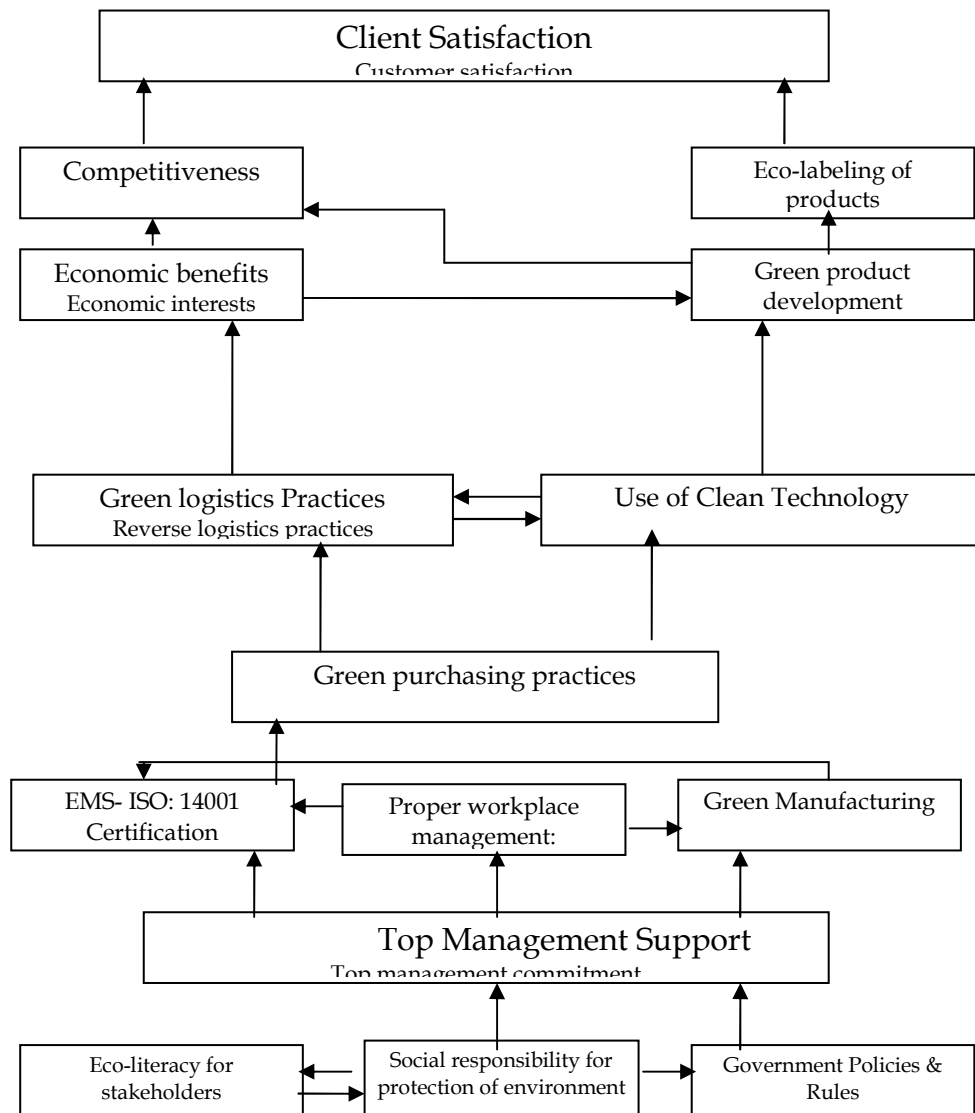


Figure 1: ISM Based Model for Green Management Indicators

Conclusion

Today's associations are confronted with inquiries in the matter of how they can distinguish, oversee, and measure the indicators for improved environmental sustainability performance and the frameworks and structures to enhance their social execution (James 2000, Epstein and Roy 2001). The ISM model developed in this paper helps to answer these questions and provides an understanding of mutual relationships among the variables. It provides an opportunity to achieve environmental sustainability in a wider context of the supply chain.

The main contributions of this research include the following:

- In this paper, an endeavor has been made to distinguish the imperative obstructions and empowering influences for accomplishing environmental sustainability through green management practices.
- The variables with higher driving forces have even more a vital introduction and there are other dependent variables being influenced by them. In this way, management ought to accord prime significance to these variables.
- Though the context of ISM model in this paper is manufacturing sector, the variables recognized are very non specific and with peripheral modification can be utilized for alternate areas too.

Supply chains that not only identify and communicate key issues and value drivers but also clearly prioritize social responsibility issues can gain a competitive edge. The objective must be to achieve environmental sustainability through the overall business strategy and policy of the company.

Limitations and Scope for Future Work

In this paper, different variables are distinguished for demonstrating the indicators to GMP in supply chains. Further, the model was developed from the perspective of manufacturing sector. In future exploration, more broad studies are expected to investigate the variables influencing GMP in other sectors also.

The help of experts has been sought to analyze the driving power and dependence of the variables, but the framework developed depends upon the opinion of relatively few stakeholders and may have some element of bias.

Through ISM, a relationship model of the variables of GMP in supply chains has been developed but this model has not been statistically validated. Path analysis or structural equation modelling approaches have the capability of testing the validity of such a hypothetical model. AMOS or LISREL software could be used to further examine the relationships derived from this model.

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