Research Journal of Management Sciences ISSN 2319–1171
Vol. **3(7),** 7-13, July **(2014)** *Res. J. Management Sci.*

Analysis of Barriers for Environmental Education in India through Interpretive Structural Modeling (ISM) Technique

Tauseef Zia Siddiqui[1] Pramod Pathak[1]and Asif Akhtar[2]
[1]Indian School of Mines, Dhanbad, Jharkhand, INDIA
[2]Aligarh Muslim University, Aligarh, UP, INDIA

Available online at: www.isca.in, www.isca.me
Received 12th June 2014, revised 29th June 2014, accepted 4th July 2014

Abstract

Environmental education has been well – thought – out as one of the most significant long – term solution to the crisis of the environment pollution. Alternative or informal approaches in the environmental education have become more significant in encouraging the attitudinal change. The perception of environmental education is not a new concept and this is a major section of the knowledge of human which is derived from the nature. The effective implementation of environmental education and conservation agendas depend on the stages of expertise of the teachers in training.The paper focuses in developing working model of Environmental Education (EE). In this paper, Interpretive Structural Modeling (ISM) technique has been used for analyzing the various barriers in promoting Environmental Education. In this paper, through ISM methodology, we attempted to: i. Prepare the ISM-based models of important barriers impacting integration of environmental education in Indian schools for establishing the relationship among these elements. ii. Ascertain the driving power and dependence of different barriers for their respective categorization and implications in real-life management of environmental education practices. iii. Gain an insight from these models to help smoothen adoption and implementation of environmental education in pragmatic manner

Keywords: Environmental education (EE), Interpretive structural modeling (ISM), Ministry of Environment and Forest (MoEF).

Introduction

Environmental education takes a holistic approach and as such it is inherently interdisciplinary in nature. EE has been a failure to prepare citizens who are more responsive to environmental problems. The paper focuses in developing working model of Environmental Education (EE) in the field of environmental education and to evaluate and analyze the EE knowledge perception of the different sectors of the society. In this paper, Interpretive Structural Modeling (ISM) technique has been involved for analyzing the various barriers in promoting EE[1]. Interpretive Structural Modeling is a methodology for identifying and summarizing relationships among specific elements, which define a problem or an issue[2,3]. It provides some means by which order can be imposed on the complexity of such elements[4].

Identification of Main Barriers in Environmental Education

After review of literature and the opinions of experts, a number of barriers thatimpact integration of environmental education were listed in the survey and respondents were asked to indicate their opinions on them. Through the results of the survey, all the barriers were ranked in descending order of their mean score. Based on survey rankings and opinions of experts, top 8 barriers were selected for further analysis. In this paper, they are analyzed by Interpretive Structural Modeling (ISM) technique[5,6].

List of Key Barriers in Environmental Education: These top 8 barriers identified through survey research are reproduced below. A brief discussion on the same has also been carried out to reiterate some of the key points regarding each of them.

No Pricing of Natural Capital: In simple terms Natural Capital is basically pricing of natural resources in their present form. In our dysfunctional model of growth we never put economic value generated from the usage of fresh air, water and other natural resources. It puts a serious problem and therefore it leads to degradation of natural resources. The day we start putting value on the natural resource the entire context will change.

Lack of Environmental Awareness and Lack of Organizational Support: There is also need of better communication and collaboration with developed countries. There is need of extensive teachers training and their participation in workshops and conferences to expose them with new environmental education materials, techniques and information.

Role of Media in Promoting Environmental Education: No one can deny the proactive role of Media in promoting and acting as a catalyst in initiating change in the society. However,

with reference to Environmental Education, whether Print media, electronic media or social media has not done justice and we rarely see any structured approach when dealing with environmental issues.

Lack of Attitude towards Environmental Management and Resistance to Change: Lack of Environmental Education is a major factor that has an important bearing on environmental attitude/behavior.

Lack of Environmental Training Modules: The status of Environmental Training programs and its contents is not satisfactory.

Lack of Preparedness of teachers: Another barrier to environmental education activities is the reluctance of support and lack of preparedness on part of the teachers.

Inadequate School Curriculum: No one can deny that the current curriculum is focused on age old teaching practices prevailing over decades, and is responsible for development of stress among students and thereby affecting their normal developments[7,8]. We need to develop curriculum which will develop skills and attitudes in the students.

Ineffective Environmental Educational Programs and Policies: Without a doubt the present EE Programs and policies are not sufficient to drive students for opting Environment as a career option. Few steps are taken by Ministry of Environment and Forest (MoEF), India. However, the implementation of these steps and policies is a major challenge.

ISM approach for Modeling of Barriers

In this section, the relationship among various barriers is analyzed.Further, the barriers are categorized as driving and dependent barriers through ISM technique.

Establishing the Contextual Relationships between Barriers and Development of Structural Self-interaction Matrix: After identifying and enlisting 8 barriers through literature review and expert opinion, the next step was to analyze these barriers[9]. Four symbols (V, A, X, O) are used to denote the direction of relationship between the barriers (p and q): Symbol V is assigned to cell (1, 8) because barrier 1 influences the barrier 8. Symbol A is assigned to cell (2, 6) because barrier 2 is influenced by the barrier 6. Symbol X is assigned to cell (6, 7) because barrier 6 and 7 influence each other. Symbol O is assigned to cell (3, 5) because barriers 3 and 5 are unrelated. Based on the contextual relationship between barriers, the SSIM has been developed. To obtain consensus, the SSIM was further discussed in a group of experts. Based on their responses, SSIM has been finalized and it is presented in table 1.

Development of the Initial and Final Reach ability Matrix: The next step is to develop the initial and final reachability matrix from the SSIM. This is obtained in two sub-steps. The first sub-step is to obtain the initial reachability matrix from the SSIM format by transforming the information of each cell of SSIM into binary digits (i.e. ones or zeros).

Following these rules, initial reachability matrix is prepared as table 2. In the second sub-step, final reachability matrix is obtained. The concept of transitivity is introduced for this purpose, and some of the cells of the initial reachability matrix are filled by inference. After incorporating the transitivity concept in the table 2, the final reachability matrix is developed and is presented in table 3 wherein entries marked 1* show the incorporated transitivity.

Table-1
Structural Self-Interactive Matrix (SSIM)

Barriers	8	7	6	5	4	3	2
1. No Pricing of Natural Capital	V	O	O	O	V	O	V
2. Lack of Environmental Awareness	X	X	A	X	V	A	
3. Role of Media in Promoting Environmental Education	O	V	V	O	V		
4. Lack ofAttitude towards Environmental Management	A	A	O	V			
5. Lack of Environmental Training Modules	X	O	A				
6. Lack of Preparedness of teachers	X	X					
7. Inadequate School Curriculum	X						
8. Ineffective Environmental Education Programs and Policies							

Table-2
Initial Reachability Matrix

Barriers S. No.	1	2	3	4	5	6	7	8
1	1	1	0	1	0	0	0	1
2	0	1	0	1	1	0	1	1
3	0	1	1	1	0	1	1	0
4	0	0	0	1	0	0	0	0
5	0	1	0	1	1	0	0	1
6	0	1	0	0	1	1	1	1
7	0	1	0	1	0	1	1	1
8	0	1	1	1	1	1	0	1

Table-3
Final Reachability Matrix

Barriers S. No.	1	2	3	4	5	6	7	8
1	1	1	0	1	1*	0	0	1
2	0	1	0	1	1	0	1	1
3	1*	1	1	1	1*	1	1	1*
4	0	0	0	1	0	0	0	0
5	1*	1	0	1	1	0	1*	1
6	0	1	0	0	1	1	1	1
7	0	1	0	1	1*	1	1	1
8	1*	1	1	1	1	1	0	1

Table-4
Iteration i

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,2,4,5,8	1,3,5,8	1,5,8	
2	2,4,5,7,8	1,2,3,5,6,7,8	2,5,7,8	
3	1,2,3,4,5,6,7,8	3,	3	
4	4,	1,2,3,4,5,7,8	4	**I**
5	1,2,4,5,7,8	1,2,3,5,6,7,8	1,2,5,7,8	
6	2,5,6,7,8	3,6,7,8	6,7,8	
7	2,4,5,6,7,8	2,3,5,6,7,8	2,5,6,7,8	
8	1,2,4,5,6,7,8	1,2,3,5,6,7,8	1,2,5,6,7,8	

Level Partitioning the Final Reachability Matrix: After creating the final reachability matrix, it is processed to obtain the structural model (digraph). Warfield (1974) has presented a series of partitions which are induced by the reachability matrix on the set and subset of different variables. From these partitions, one can identify many properties of the structural model[5,9,10]. Level identification process of these barriers is completed in four iterations as shown in tables 4 -7.

Development of Conical Matrix: Development of conical matrix is carried out by clubbing together barriers in the same level, across rows and columns of the final reachability matrix, as shown in table 8. The driving power of a barrier is calculated by summing up the number of ones in the rows and its dependence power by summing up the number of ones in the columns. Subsequently, ranks are calculated by giving highest ranks to the barriers that have the maximum number of ones in the rows and columns indicating driving power and dependence power respectively.

Table-5
Iteration ii

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,2,5,8	1,3,5,8	1,5,8	
2	2,5,7,8	1,2,3,5,6,7,8	2,5,7,8	**II**
3	1,2,3,5,6,7,8	3,	3	
5	1,2,5,7,8	1,2,3,5,6,7,8	1,2,5,7,8	**II**
6	2,5,6,7,8	3,6,7,8	6,7,8	
7	2,5,6,7,8	2,3,5,6,7,8	2,5,6,7,8	**II**
8	1,2,5,6,7,8	1,2,3,5,6,7,8	1,2,5,6,7,8	**II**

Table-6
Iteration

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1	1	1,3,	1	**III**
3	1,3,6	3	3	
6	6	3,6,	6	**III**

Table-7
Iteration iv

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
3	**3**	**3**	**3**	**IV**

Table-8
Conical Matrix

Barriers S. No.	1	2	3	4	5	6	7	8	Driving Power
1	1	1	0	1	1*	0	0	1	5
2	0	1	0	1	1	0	1	1	5
3	1*	1	1	1	1*	1	1	1*	8
4	0	0	0	1	0	0	0	0	1
5	1*	1	0	1	1	0	1*	1	6
6	0	1	0	0	1	1	1	1	5
7	0	1	0	1	1*	1	1	1	6
8	1*	1	0	1	1	1	1	1	7
Dependence	4	7	1	7	7	4	6	7	

Development of Digraph

Based on the conical matrix, an initial digraph including transitivity links is obtained. This is generated by nodes and lines of edges[10]. If there is a relationship between the barriers *p* and *q* this is shown by an arrow which points from *p* to *q*. After removing the indirect links, a final digraph is developed (figure 1). In this development, the top level barrier is positioned at the top of the digraph and second level barrier is placed at second position and so on, until the bottom level is placed at the lowest position in the digraph.

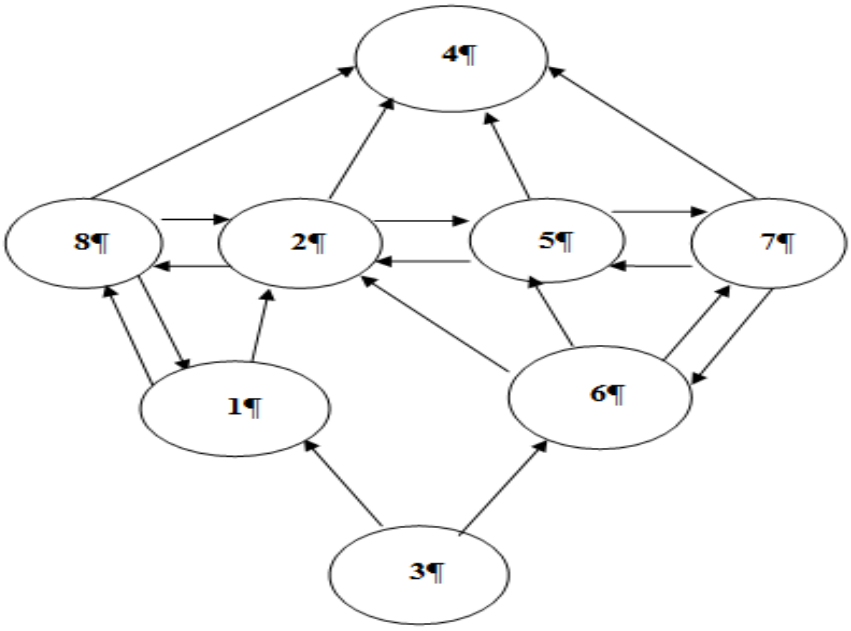

Figure-1
Digraph Depicting Levels of Barriers

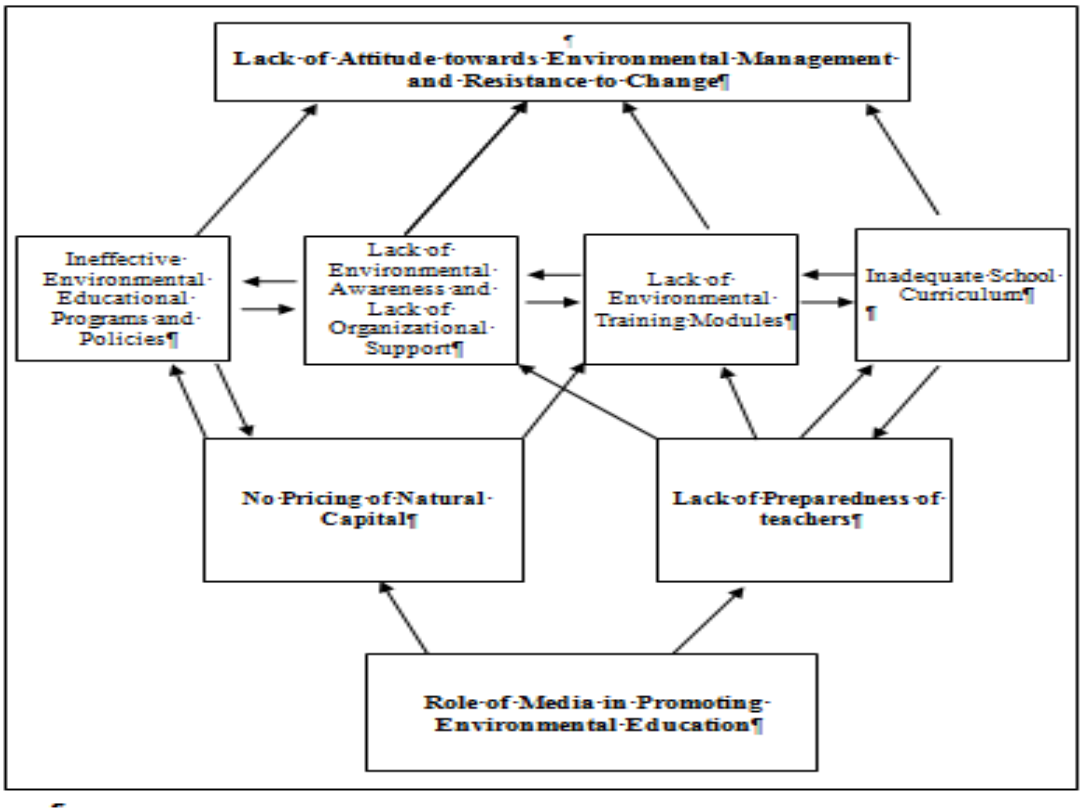

Figure-2
ISM Based Model for Barriers

Building the ISM- based Model

In the next step the digraph is converted into an ISM model by replacing nodes of the barriers with statements as shown in figure 2. From the model developed with the identified barriers in this research, it is clear that the most important barrier that hamper the promotion of environmental education in Indian system is the Role of Media in Promoting Environmental Education (barrier 3), which forms the base of ISM hierarchy. Lack of Attitude towards Environmental Management and Resistance to Change (barrier 4) on which the effectiveness of environmental education activities depends, has appeared on top of the hierarchy.

Role of Media in Promoting Environmental Education (barrier 3) leads toNo Pricing of Natural Capital (barrier 1), which results in Lack of Preparedness of teachers (barrier 6). Also, Lack of Preparedness of teachers (barrier 6) hampers Lack of quality environmental training modules (barrier 5). Lack of No Pricing of Natural Capital (barrier 1)and Ineffective Environmental Educational Programs and Policies (barrier 8) are interrelated.

MICMAC Analysis for Barriers

The objective of the MICMAC analysis is to analyze the driving power and the dependence of the variables. In the present case, based on their driving power and dependence, the previously identified variables are classified into four clusters (figure 3). The first cluster comprises of the "autonomous barriers", second consists of the "dependent barriers", third has "linkage barriers" and the fourth cluster consists of the "independent barriers"

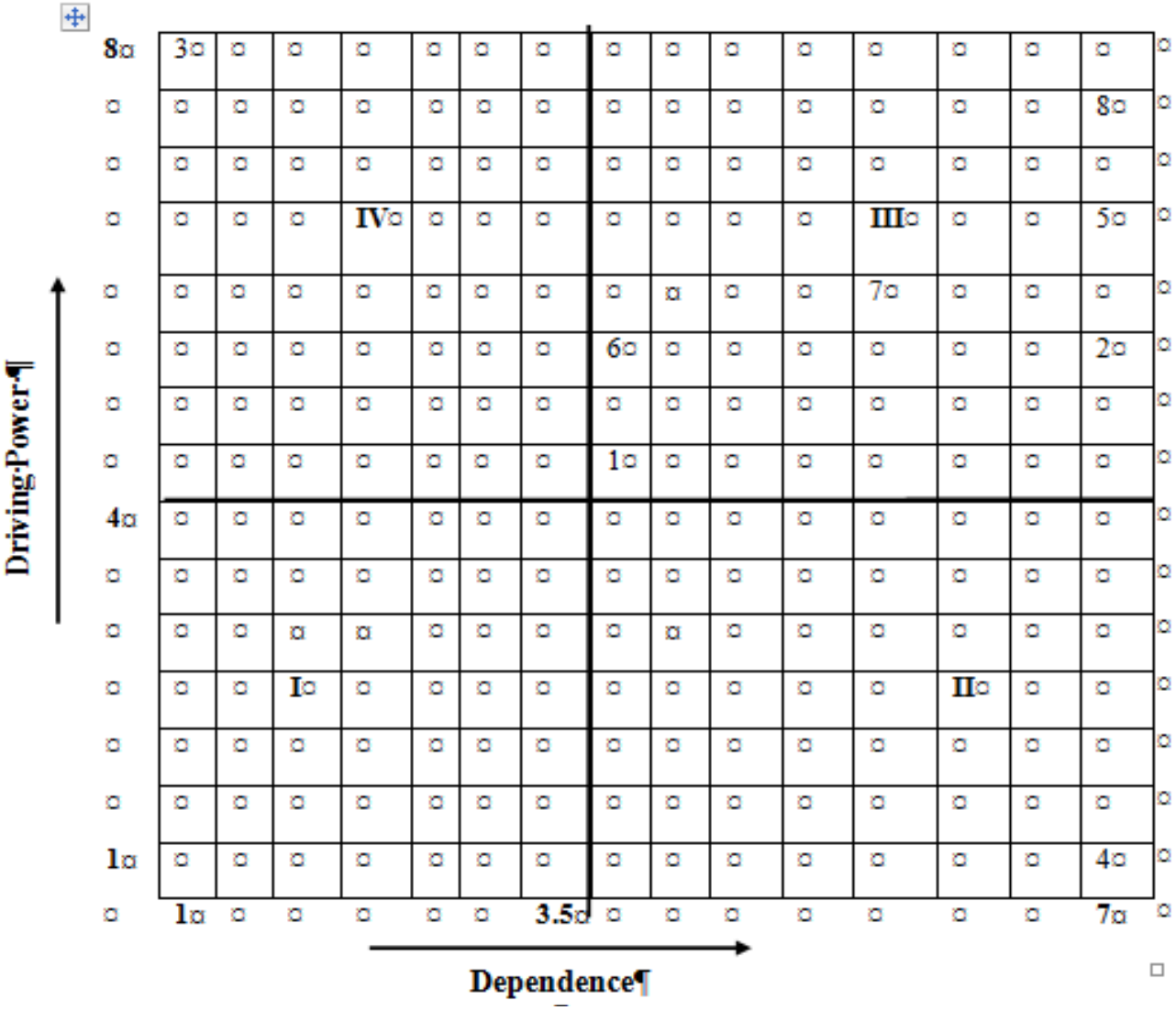

Figure-3
Driving Power-Dependence Diagram (Barriers)

Conclusion

The barriers hindering the Environmental Education (EE) practices pose considerable challenges both for society as well as policy makers in education. In this paper, an ISM-based model has been developed to analyze the interactions among different EE barriers. These barriers need to be overcome for success in EE programs. It also identifies the hierarchy of actions to be taken for handling different barriers. The driver-dependence diagram gives some valuable insights about the relative importance and the interdependencies among the barriers. The policy makers can get better insights of these barriers, so that they can proactively deal with these barriers.

References

1. Agarwal A., Shankar R. and Tiwari, M.K., Modeling agility of supply chain, *Industrial Marketing Management,* **3(6),** 443-457 **(2006)**

2. Jharkharia S. and Shankar R., IT- Enablement of supply chains: Understanding the barriers, *Journal of Enterprise Information Management,* **18(1),** 11-27 **(2005)**

3. Raj T. and Attri R., Identification and modeling of barriers in the implementation of TQM, *International Journal of Productivity and Quality Management,* **28(2),** 153-179 **(2011)**

4. Ravi V. and Shankar R., Analysis of interactions among the barriers of reverse logistics, *Technological Forecasting and Social Change,* **7(2),** 1011-1029 **(2005)**

5. Sage, A.P. Interpretive Structural Modeling: Methodology for Large Scale Systems, McGraw-Hill, New York, NY, 91-164 **(1977)**

6. Singh M.D., Shankar R., Narain R. and Agarwal A., An interpretive structural modeling of knowledge management in engineering industries, *Journal of Advances in Management Research,* **1(1),** 28–40 **(2003)**

7. Raj T., Shankar R. and Suhaib M, An ISM approach for modelling the enablers of flexible manufacturing system: the case for India, *International Journal of Production Research.,* **46(24),** 6883-6912 **(2010)**

8. Trivedi Prabhat and Anoop Dubey, Implementation of KM in Indian SMEs: modeling the variables, 1st International Conference on Recent Advances in Information Technology (RAIT), **(2012)**

9. Warfield J.W., Developing interconnected matrices in structural modeling*, IEEE Transactions on Systems Men and Cybernetics,* **4(1),** 51-81 **(1974)**

10. Watson R., Interpretive Structural Modeling- A useful tool for worth assessment, *Technological Forecasting and Social Change,* **1(1),** 165-185 **(1978)**