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AN INTERPRETIVE STRUCTURAL MODEL (ISM) ANALYSIS APPROACH IN STEEL RE ROLLING MILLS (SRRMs)

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ABSTRACT

Interpretive structural model(ISM) analysis is one of the tools to identify the internal and external barriers and other factors which affect the success of an organisation. This tool is found to be very much applicable in a steel re-rolling mill (SRRMs). The main aim of this paper is to develop a relationship among the important barriers of SRRMs. ISM approach starts with an identification of variables, which are relevant to the problem or issue. Then contextually relevant subordinate relations are chosen using ISM. It also helps to classify the barrier depending upon the dependence power and the driving power. Standard steps are there to get a final reachability matrix. Conclusion may attain through a diagraph from the dependence power and driving power.

KEYWORDS: Interpretive Structure Model (ISM), Steel Re Rolling Mills (SRRMs), Dependence Power, Driving Power, Final Reachability Matrix

INTRODUCTION

Interpretive Structure Modelling(ISM) may be defined as a process which is aimed at assisting the human being for better understanding what he/she believes and to recognise clearly what he/she does not know. Organisational is the most essential function. The information added (by the process) is zero. The value added is structural (Rajesh Attri et al, 2013). The ISM process transforms unclear, poorly articulated mental models of systems into a visible and well-defined model. ISM is found to be a well-proven and widely accepted system modelling approach for analyzing the interrelationships between the variables influencing the system (Warfield, 2005; Sage, 1997). It helps in problem-solving of the inter-relationship and brings into consideration a system of directly and indirectly related elements, which narrates the complex organizational issues (Warfield, 1976, Warfield, 1982, Sage. and Rouse1999). In general, there exists a direct correlation between various customer receptivity aspects. This makes ISM a more natural approach to this kind of problems. In order to have a healthy customer relationship, receptivity aspects have to be leveraged. Management research is nourished with an excess of ISM application in various fields (Agarwal, et al, 2006; Thakkar et al, 2008). In this regard, the factors influencing the external customer receptivity have been subjected to ISM. In the current study, twelve points which define the system under this is analysed in SRRMs and have been identified by referring the previous literature and then incorporating the opinion from experts of the organization and academia (Jacob p. George, Pramod VR (2013), Bolonas, et al, 2005).

Interpretive Structural Modelling was first proposed by J. Warfield in 1973 to analyse the complex socioeconomic systems. ISM is a computer-assisted learning process that enables individuals or groups to develop a map of the complex relationships between the many elements involved in a complex situation. Its basic idea is to use expert's practical

experience and knowledge to decompose a complicated system into several sub-systems (elements) and construct a multilevel structural model. ISM is often used to provide fundamental understanding of complex situations, as well as to put together a course of action for solving a problem. Anantatmula and Kanungo (2005), Warfield (1976).

SIGNIFICANCE OF SRRMs

One of the most abundant metals on the earth and most commonly used metal is steel, of which iron is the key ingredient. (John. W. Morgan and Edward Andrews, (1980). Iron is mainly used for the structural engineering applications and maritime, automobiles and general industrial applications. Iron is a transitional metal coming in the group eight in modern periodic table. Its density is 7.874g/cc and melting point is 1538^0C (B. Singh and S.K Kaushik. 2002). Steel is manufactured by the chemical reduction of iron ore, using an integrated steel manufacturing process or a direct reduction process. In the conventional integrated steel manufacturing process, iron from the blast furnace which is converted to steel in a Basic Oxygen Furnace (BOF). Steel can also be made in an Electric Arc Furnace (EAF) from scrap steels and, in some cases, from direct reduced iron. BOF is typically used for high-tonnage production of carbon steels, while the EAF is used to produce carbon steels and low tonnage specialty steels. Latest technologies are implemented in most of the SRRMs. Mainly the Thermo mechanical treatment (TMT) process is implemented there. With the TMT process good quality torrs are able to produce. They are tested for the strength and quality. The ingot / billets are able to produce either from the ores or from the scrap. Almost all factories, the raw material are the scrap. The factories are working round the clock. In order to melt the raw inventories, arc furnaces are used. The exhaust gases are removed with the draught mechanism. Oil furnaces are also used to reheat the ingot below the melting process.

Different kinds of rolling as well as machineries are also used in the factories. In order to install the whole units, a minimum of Indian money, rupees fifty crores has to be spend (Jacob and Pramod, 2013). This situation exists throughout the country. The raw inventories and machineries are importing and the source of power is supplied by the state. 440 KVA lines. Inventories are supplied to the factories. Step down transformers are installed the factory premise. Heavy materials are transported and handled by fully/partly automated or human controlled cranes. Thyrister controlled devices are also used for the electric arc furnaces. There are companies which are producing with international standards. Their products are exported to different countries. They are able to achieve foreign money through exports. In India we have Steel Authority of India (SAIL), Tata Iron and Steel Company (TISCO) etc. (INTERNET. http://www.tatasteel.com, Cited 17 July 2006). Such firms may be called international branded ones. It is customary that all the system must co ordinate during the production of steels. Proper maintenance has to be implemented to those units for the smooth functioning. Alternate accessories have to be there while the process is going on.

SIGNIFICANCE OF ISM

ISM explores the dynamic influence of different elements which brings into consideration of a system of directly and indirectly related elements. It has three dimensions by each letters. Dimension interpretive (I) is based on the judgment of a group of experts in that respective field. A group of expert decisions are collected and decides whether and how the variables are interrelated. Then, (S) is structural, since on the basis of the relationship, an overall structure is extracted from the complex set of variables. Dimension (M) the modelling which portrays the specific relationships of the variables and overall structure of the system under consideration. In other words, in ISM, I (interpretive) stand for the outcome of judgment, S (structural) stands for the extraction of outcome of a set of variables and M (model) stands for the graphical

representation of the specific relationship and overall structure. The analysis is conducted as a step-by-step procedure. (Bolonas et al. (2005), Raj T et al, 2007). Steps are given in a block diagram in a SRRM is shown below (Figure 1)

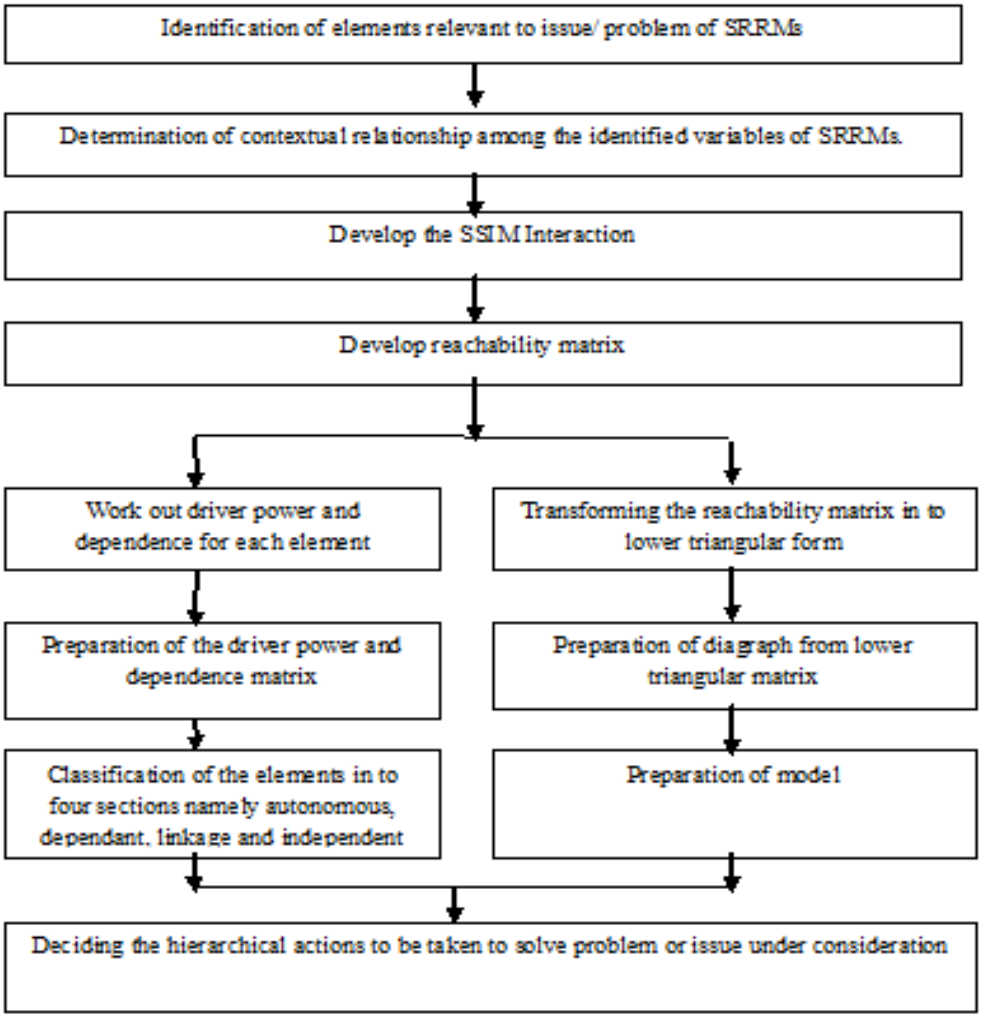

Figure 1: Step by Step Methodology for Preparing Model by Using ISM

The ISM procedure in SRRM can be described briefly as encompassing the following steps. The comments below have been specifically tailored to a hypothetical application of ISM to an enterprise risk management modelling project (Sing M.D et al 2003).

- **Organising ISM Implementation Group**

Initially, a group of expert people with knowledge, skills, and backgrounds is selected. This group should consist of experts from different areas with a wide-ranging skill-set. A coordinator is established within the group. His/her role is to promote efficient task execution, and encourage a holistic approach to the project. The coordinator should not only be knowledgeable about the firm's different departments and operations, but also have some power to control the process and make the final conclusions.

- **Identification and Selection of the Relevant Risks**

Now the group members work together is to document all the risks to which the firm is facing. This may be done

by brainstorming. However, in firms with an effective and embedded decision making process, this list of risks may already exist as a product and tool of that ongoing process (and was probably, at least in part, originally derived by group brainstorming). Twelve elements were identified and are given below; physical and chemical properties etc.

- **Obtain the Adjacent Matrix:** From the experts (if possibly via a Delphi approach involving those and/or other experts), the directed relationships among the risk factors are hypothesized. This matrix provides an initial impression of how, in what order, and through which other factors the various risk factors might ultimately be the source of a missed objective. Here, the adjective "directed" refers to the need to specify the direction of the relationship (if any) between any two risk factors – e.g., from A to B, from B to A, in both directions between A and B, or A and B unrelated.
- **Determine the Reachability Matrix:** Based on the adjacent matrix, a binary (elements are 0 or 1) matrix that reflects the directed relationships between the risk factors is created. Basically, the reachability matrix answers the question: yes or no – can we "reach" factor B by starting at factor A, where by "reach" we mean is there a direct or indirect directed relationship from A to B? (In practice, it might sometimes be possible and more convenient to construct the reachability matrix directly simply by using the expert's knowledge)
- **Decompose the Risks into Different Levels:** Here, the reachability matrix is decomposed[7] to create structural models. This is an algorithm-based process which provides for the grouping of risks into different levels, depending upon their interrelationships. This provides a multilevel interpretive structural model in which the relationships among risks are clarified.

THE TOOL OF ISM PROCESS

The central tool of ISM is reachability matrix and its partitions which are adopted as it is in the process of ISM. The basic process of ISM presented in a step-by-step manner is briefly outlined below. These steps along with the matrices and other tools are illustrated using the variables of 'change and continuity' for which the ISM is conducted (Jacob P. George, Pramod V.R, 2014)

Step I: Identify and Define Elements: The first step in any structural modeling is to identify and define the elements whose relationships are to be modeled. In the context of this paper, the forces of change and continuity are the elements which are identified from the literature and in consultation with domain experts.

Step II: Define Contextual Relationship: In order to develop the model of the structure relating the elements, it is crucial to state the contextual relationship between the elements. Expert inputs are solicited to capture the contextual relationship among the elements.

Step III: Interpretation of Relationship: This is the first step forward over the traditional ISM. Though ISM too captures the contextual relationship, it remains silent on how that relationship really works.

Step IV: Interpretive Logic of Pair-Wise Comparison: In ISM, the elements are compared to develop SSIM (Self Structural Interaction Matrix), the interpretation of which indicates direction of the relationship only. ISM makes use of the concept of interpretive matrix to fully interpret each paired comparison by answering the interpretive query as

mentioned in step III. For paired comparison, the *ith* element is compared individually to all the elements from *(i+1) th* to the *nth* element. For each link the entry could be 'Yes(Y)' or 'No(N)' and if it is 'Yes', then the reason is to be provided. This reveals the interpretive logic of the paired relationships in the form of 'Interpretive Logic - Knowledge Base' (Sushil (2009).

Step V: Reachability Matrix and Transitivity Check: The paired comparisons in the interpretive logic – knowledge base are translated in the form of reachability matrix by making entry 1 in *i-j* cell, if the corresponding entry in knowledge base is 'Y', or else it should be entered as 0 for the corresponding entry 'N' in knowledge base. This matrix is checked for the transitivity rule and updated till full transitivity is established, as shown in Appendix 1.1 for the 'change forces' and Appendix 2.1 for 'continuity forces'.

Step VI: Level Partition on Reachability Matrix: The level partition is carried out similar to ISM to know the placement of elements level-wise (Warfield, 1974; Saxena *et al.*, 2006). Determine the reachability and antecedent sets for all the elements. The intersection of the reachability set and the antecedent set will be the same as the reachability set in case of the elements in a particular level. The top level elements satisfying the above condition should be removed from the element set and the exercise is to be repeated iteratively till all the levels are determined. For the results of various steps of iterations refer to Appendix 1.2 (for change forces) and Appendix 2.2 (for continuity forces).

Step VII: Developing Diagraph: The elements are arranged graphically in levels and the directed links are drawn as per the relationships shown in the reachability matrix. A simpler version of the initial diagraph is obtained by eliminating the transitive relationships step-by-step by examining their interpretation from the knowledge base. Only those transitive relationships may be retained whose interpretation is crucial (Appendix 1.3 for (Thakkar et al, 2008) change forces and Appendix 2.3 for continuity forces).

Step VIII: Interaction Matrix: The final diagraph is translated into a binary interaction matrix form depicting all the interactions by 1 entry (Appendix 1.4 for change forces and Appendix 2.4 for continuity forces). The cells with 1 entry are interpreted by picking the relevant interpretation from the knowledge base in the form of interpretive matrix.

Step IX: Total Interpretive Structural Model: The information contained in the interpretive matrix and the diagraph is used to obtain the TISM. The nodes in the diagraph are replaced by the element definition and are placed in boxes. The interpretation in the cells of interpretive matrix is depicted by the side of the respective links in the structural model. This leads to total interpretation of the structural model in terms of the interpretation of its nodes as well as links, as depicted in Figure 1 for change forces and Figure 2 for continuity forces.

OBJECTIVES OF ISM IN SRRMS

The main objectives of this research in SRRMs are

- To discuss professional implications and suggest guidelines for future research in SRRMs,
- To establish a relationship among the external customer receptivity aspects,
- To obtain their driving power and dependence of the external customer receptivity aspects in SRRMs,
- To categorize the in to four clusters depending on their driving power and dependence.

Customer Receptivity Aspects

There is a limited number of papers evaluating the customer receptivity elements on SRRMs based on their inter dependencies. The available literature on customer receptivity aspects is mainly focused on questionnaire based survey rather than the complex modelling approach. The elements considered for the study are;

- Physical & chemical properties
- Customer requirements
- Cost of TMT bars
- Marketing techniques
- Government control & assistance
- Response to customer needs
- Complaint handling
- Testing lab facilities
- Comparative price
- Brand name & availability
- Production process
- Feedback analysis

Procedure of Model Development

From the above mentioned 12 numbers of elements, we are able to analyze and develop the ISM techniques. The procedural steps of ISM are well documented in literature world at present. (Mandal and Deshmukh, (1994); Warfield, (1974); Thakkar et al., (2005) the model has been developed by the judgment of academicians and experts in that field. By brainstorming with various executives of different SRRM companies and academicians, the relationships among them have been identified.

Next procedure is to develop a Structural Self-Interaction Matrix (SSIM) which shows the direction of contextual relationships among the elements by symbolic interactions (Figure 2). To represent them in the table, four symbols are used in the matrix formation. (Pramod, V.R. and Banwet, D.K. (2010), (Rajesh K.S et al, 2007)

V-The enabler i ameliorate/improve to achieve enabler j

A-The enabler j ameliorate/improve to achieve enabler i

X- The enablers i and j ameliorate/improve to achieve each other

O- The enablers i and j are unrelated.

A table is prepared (Table 1) below show the Inter relationship between given 12 aspects of SRRMs.

Table 1: Structural Self-Interaction Matrix (SSIM) of SRRM

	Physical & Chemical Properties	Customer Requirements	Cost of TMT Bars	Marketing Techniques	Government Control & Assistance	Response to Customer Needs	Complaint Handling	Testing Lab Facilities	Comparative Price	Brand Name & Availability	Production Process	Feedback Analysis
Physical & chemical properties	1	X	V	V	A	A	V	X	V	O	A	V
Customer requirements		1	A	A	A	X	V	A	X	X	O	V
Cost of TMT bars			1	A	A	V	A	V	V	A	V	A
Marketing techniques				1	V	V	O	O	V	V	A	V
Government control & assistance					1	V	O	A	V	V	O	V
Response to customer needs						1	X	V	A	V	O	X
Complaint handling							1	V	A	A	V	X
Testing lab facilities								1	V	V	A	X
Comparative price									1	V	A	V
Brand name & availability										1	V	V
Production process											1	O
Feedback analysis												1

INITIAL REACHABILITY MATRIX

Now the SSIM has been converted into a metrics of binary elements named as Initial Reachability Metrics. This is developed by appropriately assigning V, A, X and O by 1 and 0. F Following rules have been applied to complete this step.

- If the (i, j) entry in the SSIM is V then substitute in the (i, j) entry in the reachability metrics as 1 and (j, i) entry as 0.
- If the (i, j) entry in the SSIM is A then substitute in the (i, j) entry in the reachability metrics as 0 and (j, i) entry as 1.
- If the (i, j) entry in the SSIM is X then substitute in the (i, j) entry in the reachability metrics as 1 and (j, i) entry as 1.
- If the (i, j) entry in the SSIM is O then substitute in the (i, j) entry in the reachability metrics as 0 and (j, i) entry as 0.

Following these rules, the initial reachability metrics has been developed. It is shown in Table 2.

Table 1 is a structural Self Interaction Matrix which is the initial step for the ISM. The above table shows only the inter relationship between the twelve elements of SRRMs. Only half of the matrix is filled with letters V, A, X and O. Next step is the completion of full matrix based on the principle of development of initial reachability matrix stated above. Then we have to develop the matrix by checking the transitivity (Table 3) (Chidambaranathan S)

Table 2: Initial Reachability Matrices

	Physical & Chemical Properties	Customer Requirements	Cost of TMT Bars	Marketing Techniques	Government Control & Assistance	Response to Customer Needs	Complaint Handling	Testing Lab Facilities	Comparative Price	Brand Name & Availability	Production Process	Feedback Analysis
Physical & chemical properties	1	1	1	1	0	0	1	1	1	0	0	1
Customer requirements	1	1	0	0	0	1	1	0	1	1	0	1
Cost of TMT bars	0	1	1	0	0	1	0	1	1	0	1	0
Marketing techniques	0	1	1	1	1	1	0	0	1	1	0	1
Government control & assistance	1	1	1	0	1	1	0	0	1	1	0	1
Response to customer needs	1	1	0	0	0	1	1	1	0	1	0	1
Complaint handling	0	0	1	0	0	1	1	1	0	0	1	1
Testing lab facilities	1	1	0	0	1	0	0	1	1	1	0	1
Comparative price	0	1	0	0	0	1	1	0	1	1	0	1
Brand name & availability	0	1	1	0	0	0	1	0	0	1	1	1
Production process	1	0	0	1	0	0	0	1	1	0	1	0
Feedback analysis	0	0	1	0	0	1	1	1	0	0	0	1

In Table 2, the completed initial reachability matrices are given by completely changing the element's relationship in binary numbers of zeros and ones. Since it is found that some more relationship among the elements are relevant for the final reachability matrix, the Table 3 is prepared by considering the transitivity as the conditions stated below. In order to get a final form, in Table 3 the zeros for transitivity is given in bold numbers. The final reachability matrices are received by given in Table 4.

Here, the step for the transitivity were also taken into account and established the relationship between various enablers. If a variable A leads to another variable B and if the variable B leads to a third variable C, as per the rule of transitivity A leads to C. In other words, if A leads to B and B lead to C, then A lags to C. Through this step the final reachability matrix is developed (Table 3)

Table 3: Initial Reachability Matrices with Transitivity

	Physical & Chemical Properties	Customer Requirement	Cost of TMT Bars	Marketing Techniques	Government Control & Assistance	Response to Customer Needs	Complaint Handling	Testing Lab Facilities	Comparative Price	Brand Name & Availability	Production Process	Feedback Analysis
Physical & chemical properties	1	1	1	1	0	0	1	1	1	0	***0***	1
Customer requirements	1	1	**0**	0	0	1	1	0	1	1	***0***	1
Cost of TMT bars	0	1	1	0	***0***	1	0	1	1	0	1	0
Marketing techniques	0	1	1	1	1	1	0	0	1	1	0	1
Government control & assistance	1	1	1	0	1	1	0	0	1	1	0	1
Response to customer needs	1	1	0	0	0	1	1	1	0	1	0	1
Complaint handling	0	0	1	0	0	1	1	1	0	0	1	1
Testing lab facilities	1	1	0	0	1	0	***0***	1	1	1	0	1

Table 3: Contd.,

Comparative price	0	1	***0***	***0***	0	1	1	0	1	1	0	1
Brand name & availability	0	1	1	***0***	0	***0***	1	0	***0***	1	1	1
Production process	1	0	0	1	0	0	0	1	1	0	1	0
Feedback analysis	0	0	1	0	0	1	1	1	0	0	***0***	1

Table 4: Final Reachability Matrixes of SRRM

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Driving Power**
1) Physical & chemical properties	1	1	1	1	0	0	1	1	1	0	**1**	1	***9***
2) Customer requirements	1	1	**1**	0	0	1	1	0	1	1	**1**	1	***9***
3) Cost of TMT bars	0	1	1	0	**1**	1	0	1	1	0	1	0	***7***
4) Marketing techniques	0	1	1	1	1	1	0	0	1	1	0	1	***8***
5) Government control & assistance	1	1	1	0	1	1	0	0	1	1	0	1	***8***
6) Response to customer needs	1	1	0	0	0	1	1	1	0	1	0	1	***7***
7) Complaint handling	0	0	1	0	0	1	1	1	0	0	1	1	***6***
8) Testing lab facilities	1	1	0	0	1	0	**1**	1	1	1	0	1	***8***
9) Comparative price	0	1	**1**	**1**	0	1	1	0	1	1	0	1	***8***
10) Brand name & availability	0	1	1	**1**	0	**1**	1	0	**1**	1	1	1	***9***
11) Production process	1	0	0	1	0	0	0	1	1	0	1	0	***5***
12) Feedback analysis	0	0	1	0	0	1	1	1	0	0	**1**	1	***6***
Dependence	**6**	**9**	**9**	**5**	**4**	**9**	**8**	**7**	**9**	**7**	**7**	**10**	**90**

Table 4 is the final form of the inter relations of all the twelve elements. Thus we call Table 4 as the Final Reachable matrixes. Then count each rows ones to get the driving power and sum of the each row is the dependence. Table 4 shows the total of driving power is 90 and the number of the dependence is also 90. These driving power and dependence helps to classify the enablers into four clusters namely autonomous, dependent, linkage and independent. These four clusters position is determined by the separation of antecedent set and reachability set. From these two sets determine the intersection set. Table is prepared for each one (Table 5, Table 6, Table 7, Table 8 and Table 9) the common enabler is identified in each level. Level I to Level V is evaluated.

Table 5, Table 6, Table 7, Table 8 & Table 9 (Relationship of reachability set with antecedent set to get intersection set and level I to level V)

Table 5

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1) Physical & chemical properties	1,2,3,4,7,8,9,11,12	1,2,5,6,8,11	1,2,8,11	
2) Customer requirements	1,2,3,6,7,9,10,11,12	1,2,3,4,5,6,8,9,10	1,2,6,9,10	I
3) Cost of TMT bars	2,3,5,6,8,9,11	1,2,3,4,5,7,9,10,12	2,3,5,9	
4) Marketing techniques	2.3.4.5.6,9,10,12	1,4,9,10,11	4,	
5) Government control & assistance	1,2,3,5,6,9,10,12	3,4,5,8	5,	
6) Response to customer needs	1,2,6,7,8,10,12	2,3,4,5,6,7,9,10,12	2,6,9,12	
7) Complaint handling	3,6,7,8,11,12	1,2,6,7,8,9,10,12	6,7,8,12	
8) Testing lab facilities	1,2,5,7,8,9,10,12	1,3,,6,7,8,11,12	1,8,12	
9) Comparative price	2,3,4,6,7,9,10,12	1,2,3,4,5,8,9,10,11	2,3,4,9,10	
10) Brand name & availability	2,3,4,6,7,9,10,11,12	2,4,5,6,8,9,10	2,4,6,9,10	I
11) Production process	1,4,8,9,11	1,2,3,7,10,11,12	1,11	
12) Feedback analysis	3,6,7,8,11,12	1,2,4,5,6,7,8,9,10,12	3,6,7,8,12	

Table 6

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1) Physical & chemical properties	1,3,4,7,8,11,12	1,3,4,5,8,11	1,3,4,8,11	
3) Cost of TMT bars	3,5,8,11	1,3,4,5,7,12	3,5	
4) Marketing techniques	3,4,5,12	1,4,11	4,	
5) Government control & assistance	1,3,5,12	3,4,5,8	3,5	
6) Response to customer needs	1,7,8,12	3,4,5,7,12	7,12	II
7) Complaint handling	3,7,8,11,12	1,7,8,12	7,8,12	II
8) Testing lab facilities	1,5,7,8,12	1,3,7,8,11,12	1,7,8,12	II
9) Comparative price	3,4,7,12	1,3,4,5,8,11	3,4	
11) Production process	1,4,8,11	1,3,7,11,12	1,11	
12) Feedback analysis	3,7,8,11,12	1,4,5,7,8,12	7,8,12	II

Table 7

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
1) Physical & chemical properties	1,3,4,11	1,3,4,5,11	1,3,4,11	III
3) Cost of TMT bars	3,5,11	1,3,4,5	3,5	
4) Marketing techniques	3,4,5	1,4,11	4,	III
5) Government control & assistance	1,3,5	3,4,5	3,5	
9) Comparative price	3,4,11	1,3,4,5,11	3,4,11	III
11) Production process	1,4,11	1,3,11	1,11	

Table 8

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
3) Cost of TMT bars	5,	1,5	**5,**	**IV**
5) Government control & assistance	1,5	3,5	**5,**	**IV**
11) Production process	1,	1,	1,	

Table 9

Variable	Reachability Set	Antecedent Set	Intersection Set	Level
11) Production process	1,	1,	1,	V

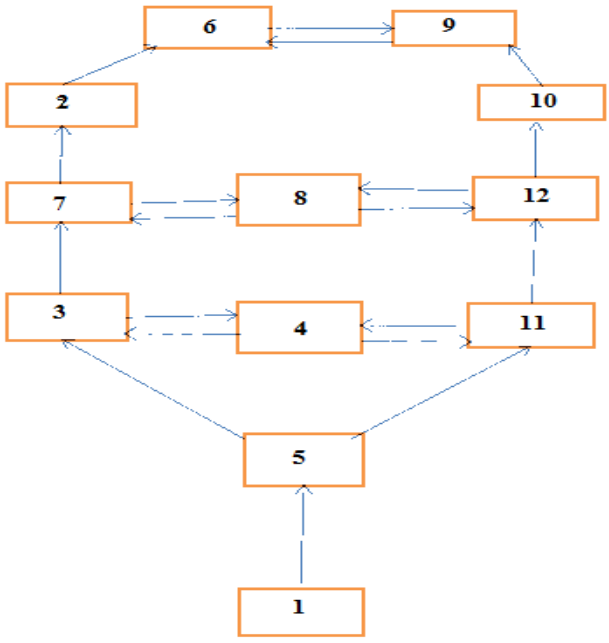

Figure 2: Diagraph SRRM (ISM for Customer Receptivity Aspects)

MICMAC ANALYSIS

The Main aim of this MICMAC analysis is to sort out the variables according to their driving power and dependence. By the study (Faisal et al., 2006) which is based on the driving power and dependence, enablers have been classified into four clusters. They are (i) autonomous (ii) dependent (iii) linkage and (iv) independent enablers (Mandal and Deshmukh, 1994). The driving power and dependence of each of these enablers are imported from Table 9. From the Table 5 to Table 9, a driver power-dependence diagram is constructed as shown in Figure 3. From the Diagram 3, a better understanding, example of variable 12 is illustrated here. In Figure 3, driving power is shown vertically and dependence is shown horizontally. Variable 12 is having driving power 6 and allocated. Cluster I includes autonomous variables. They have low driving power and low dependence. They can be isolated from the system. Cluster II consists of dependent variables that have low driving power and high dependence. Cluster III contains linkage variables that have high driving power and high dependence (Mahsa Pishdar et al, 2014).

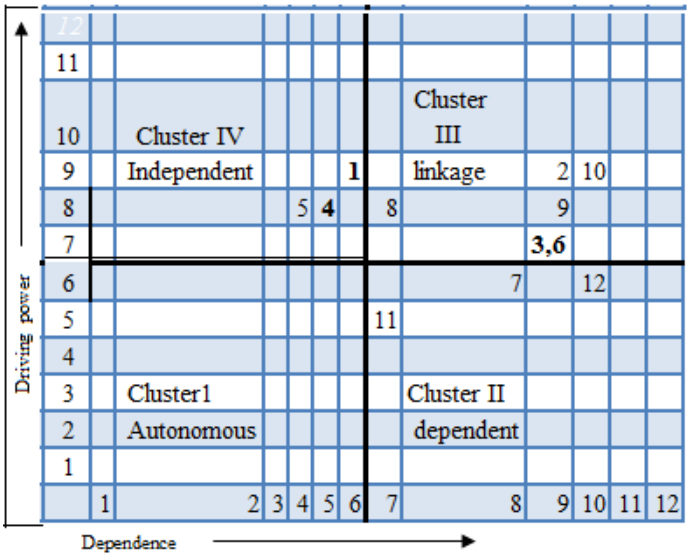

Figure 3: MICMAC Analysis

According to MICMAC analysis, the driving power and variable's dependency level which is got from sum of the relevant row and column (in order) to the variables in the modified reachability matrix, we can divide the variables into four groups; dependent variables, independent variables, key variables and linking variables. As a result of this categorization we will be able to appreciate the considered system much better Figure 3 Independent variables are a kind of variables that have a little interaction with the system and they are somehow, distinct from that. As you can see in Figure 3, none of the variables of identity mix in this study are independent variables. Dependent variables have a little guidance power but they are extremely dependent to the system. In this study, some variables such as, interactions, innovation and symbolism are dependent variables. These variables can seldom affect other variables but they are affected by others more. Linking variables have a great guidance power and high degree of dependency. They not only affect the other variables, but also depend on other variables. As you can see in Figure 3, behaviour is a kind of linking variable. When we say behaviour is a linking variable, it means that behaviour can affect other variables in the system and also, get the impact of them (Raj T., Shankar R. and Suhaib M, 2007)

Advantages of ISM Approach

ISM offers following advantages.

- It depicts a graphical representation and a structured model of the original problem situation that can be communicated more effectively to others.
- The process is efficiency depending on the use and context of transitive inference may reduce the number of the required relational queries by from 50-80 percent.
- It is a learning tool by forcing participants to develop a deeper understanding of the meaning and significance of a specified element list and relation.
- It permits action or policy analysis by assisting participants in identifying particular areas for policy action which offer advantages or leverage in pursuing specified objectives.
- Since it is systematic process the computer is programmed to consider all possible pair wise relations of system elements, either directly from the responses of the participants or by transitive inference.
- It helps the quality of interdisciplinary and interpersonal communication within the context of the problem situation by focusing the attention of the participants on one specific question at a time.
- It encourages issue analysis by allowing participants to explore the adequacy of a proposed list of systems elements or issue statements for illuminating a specified situation.
- No knowledge of the underlying process is required of the participants; they simply must possess enough understanding of the object system to be able to respond to the series of relational queries generated by the computer
- It guides and records the results of group deliberations on complex issues in an efficient and systematic manner (Watson R, 1978)

Limitations of ISM Approach

Since there may be many variable to a problem or issue complexity increases in ISM methodology. If there are considerable and limited number of variables in the development of ISM model will be easier. Other variables which are least affecting a problem or issue may not be taken in the development of ISM model. Experts not experienced help are only taken in analyzing the driving and dependence power of the variable of a problem or issue. These models are not statistically validated. Structural Equation Modelling (SEM), also commonly known as linear structural relationship approach has the capability of testing the validity of such hypothetical model (Jacob P. George, Pramod V R, 2013)

CONCLUSIONS

By using the interpretive structural Modelling technique, we level the identity mix variables, in order to determine the way these variables affects each other. MICMAC analysis indicates that variables of characteristic and effects have a key role in structuring the corporate identity in SRRMs. So, for improving the systems in SRRM, we should consider them much more. For doing the studies in the future, we recommend you to apply the fuzzy interpretive structural equations technique, in order to determine the levels of variables. Using fuzzy MICMAC analysis and also, a combination of these

techniques with other ranking techniques will be of use. Examining the way that brand equity affects the customer loyalty and determining the differences of these effects will be striking.

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