

Modeling the Knowledge Sharing Barriers using an ISM approach

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Abstract. Knowledge sharing is the foundation stone to knowledge-management (KM). Variables hinder knowledge sharing (KS) in the organizations are known as Knowledge Sharing barriers (KSBs). The objective of this paper is to identify the critical KSBs and their mutual influences. Identification of KSBs which are at the root of the hierarchy (called driving KSBs) and those which are at the top of the hierarchy (called dependent KSBs) is the main aim of this research work. The interpretive structural modeling (ISM) methodology has been used to evolve mutual relationship among KSBs. It is observed that two KSBs, namely “lack of top management commitment” and “KM is not well understood”, have high driving power and therefore deserve serious attention. Arrangement of KSBs in a hierarchy and their categorization into driver and dependent categories is an exclusive effort in the area of KM. The study concludes with discussion and managerial implications.

Keywords: knowledge management, knowledge sharing, knowledge sharing barriers, Driving KSBs, dependence KSBs, interpretive structural modeling.

1. Introduction

The globalization of business has gone through major changes during recent years. In this business environment, many organizations are facing stiff competition in the domestic as well as in the global market from their multinational counter part. In this competitive business environment, knowledge has become the key economic resource and the only source of competitive advantage. The concept of knowledge and its management has gained prominence due to the fact that resource-based competitive advantages are no longer sufficient in the knowledge based economy. It also facilitates knowledge flow and sharing to enhance the productivity of individuals and hence the organizations.

In the present business environment, KS has been identified as basic facilitator for the effective KM, which can help in optimizing business goals [13]. The goals of the organizations can not be achieved until they are not able to understand KSBs and their mutual relationships. Driving barrier supports to the other barriers and driven or dependent barrier influenced by others. Hence these barriers hinder the effectiveness of KM.

ISM is well established methodology for identifying and summarizes the mutual relationships among the specific items which define a problem or an issue [10]. In this research, ISM methodology is used to impose order on the complexity of such KSBs. It is also used to define their driving and dependence power. In the present research, twenty four KSBs have been considered. These factors are primarily internal to the organizations, including lack of top management commitment, KM is not well understood, lack of

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integration of KM, and lack of organizational culture [9]. The opinions from a group of experts were used in developing the relationship matrix, which is later used in the development of the ISM model. The anticipated ISM model described in this paper captures the interactions among different KSBs.

The main objective of this paper is to establish relationships among the identified KSBs using ISM, to discuss the organizational implications and to suggest directions for future research. This paper is organized into five sections, including the introduction and literature to identify the KSBs. The third section presents the ISM methodology with steps. The fourth section presents the development of ISM model and fifth section deals with conclusions, result and directions for future research.

2. Literature Review of Knowledge Sharing Barriers

Riege (2005) has categorized the knowledge sharing barriers in three categories: individual KSBs, organizational KSBs and technological KSBs. Twenty four KSBs have been chosen on the basis of literature reviewed and the opinions of experts from both industry and academia to implement the successful knowledge sharing strategies in the business organizations as indicated in table 1.

Table 1. Knowledge Sharing Barriers (KSBs)

Knowledge Sharing Barriers (KSBs)	Singh <i>et al.</i> (2006)	Singh & Kant (2007)	Kant & Singh (2008)	Wong (2009)	Ahmad & Dagthous (2010)
1. Lack of top management	√	√	√		
2. KM is not well understood	√		√		
3. Lack of Integration of Knowledge Management			√	√	
4. Lack of Financial Resources	√	√	√	√	√
5. Lack of Organizational Culture	√	√	√	√	√
6. Lack of Transparent Reward system	√	√	√	√	√
7. Lack of Infrastructure supporting Knowledge Sharing				√	√
8. Emphasis on individual rather than Team				√	√
9. Lack of Priority of Knowledge Retention	√	√	√	√	√
10. Lack of time	√			√	
11. Fear of Job Security			√		√
12. Lack of trust	√	√			
13. Lack of Training			√		√
14. Unrealistic expectation of Employees			√		
15. Reluctance to use IT system	√		√		√
16. Staff Defection and Retirement	√		√		√
17. Lack of Integration of IT System	√	√	√	√	√
18. Lack of Documentation		√		√	√
19. Age Differences				√	√
20. Gender Differences			√	√	√
21. Differences in national Culture	√	√			
22. Lack of Social Network		√		√	√
23. Insufficient Analysis of Past Mistakes	√		√		
24. Unawareness about new Technologies and systems		√	√		√

3. ISM Methodology and Model Development

Interpretive Structural Modeling was first proposed by J. Warfield in 1973 to analyze the complex socioeconomic systems. ISM is interpretive in that the judgment of the group decides whether and how the variables are related. It is structural on the basis of relationship, an overall structure is extracted from the complex set of variables. It is a modeling technique in that the specific relationships and overall structure are portrayed in a graphical model. Many researchers have used the ISM methodology to impose order and direction on the complexity of relationships among variables of a system (Table 2).

Table 2. ISM as Reported in Literature.

Author	Details
Mandal & Deshmukh (1994)	Identifies relationships among vendor selection criteria.
Singh <i>et al.</i> (2003)	Develop interdependence among KM variables.
Jharkharia & Shankar (2004)	To evolve mutual relationships among IT based enablers of Supply Chain Management
Ravi <i>et al.</i> (2005)	To model the reverse logistics variables typically found in computer hardware supply chains.
Faisal <i>et al.</i> (2006)	To evolve mutual relationships among the enablers of risk mitigation.
Singh & Kant (2007)	Develop interdependence among KM barriers.
Singh & Kant (2008)	Develop interdependence among the enablers of IT enablement of KM.
Raj <i>et al.</i> (2008)	Modeling the enablers of flexible manufacturing system: the case for India.
Kant & Singh (2008)	Knowledge Management Implementation: Modeling the Barriers.

3.1. Structural Self-Interaction Matrix (SSIM)

ISM methodology suggests the use of expert opinions based on management techniques such as brainstorming or nominal group technique in developing the contextual relationship among the KSBs. Groups of experts, five from industry and five from academics were consulted in identifying the nature of contextual relationships among the KSBs. These experts were well-acquainted with KM and its various implementation issues. A contextual relationship is selected for analyzing the KSBs. Keeping the contextual relationship for each KSB in mind, the existence of a relationship between any two KSB (*i* and *j*) and associated direction of the relationship is questioned. For developing SSIM, the following four symbols have been used to denote the direction of relationship between KSBs (*i* and *j*):

- V is used for the relation from KSB *i* to KSB *j* (i.e. if KSB *i* influences or reaches to KSB *j*).
- A is used for the relation from KSB *j* to KSB *i* (i.e. if KSB *j* reaches to KSB *i*).
- X is used for both direction relations (i.e. if KSB *i* and *j* reach to each other).
- O is used for no relation between two KSB (i.e. if KSB *i* and *j* are unrelated).

Table 3. Structural Self-Interaction Matrix (SSIM):

KSB	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	
1	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	X
2	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	
3	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	
4	O	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	A				
5	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V					
6	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V					
7	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	O							
8	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V								
9	V	V	V	V	V	V	V	V	V	V	V	V	V	V	O									
10	V	V	V	O	O	O	V	V	V	V	V	V	V	V										
11	V	V	V	V	V	V	V	V	V	V	V	V	V											
12	V	V	V	V	V	V	V	V	V	V	O	X												
13	V	V	V	V	V	V	V	V	V	V	O													
14	A	V	V	V	V	V	V	V	V	V														
15	O	V	V	V	V	V	V	O	O															
16	O	V	V	V	V	V	X	A																
17	O	V	V	V	V	V	A																	
18	O	V	V	V	V	V																		
19	O	V	V	O	O																			
20	O	V	V	O																				
21	O	V	V																					
22	O	V																						
23	O																							

3.2. Development of the Reachability Matrix

The next step is to develop the reachability matrix from SSIM. This is obtained in two sub-steps. In the first sub-step, the SSIM format is converted into the initial reachability matrix format by transforming the information of each cell of SSIM into binary digits (i.e. ones or zeros) in the initial reachability matrix. This transformation has been done with the following rules:

1. If the cell (*i*, *j*) is assigned with symbol V in the SSIM, then, this cell (*i*, *j*) entry becomes 1 and the cell (*j*, *i*) entry becomes 0 in the initial reachability matrix.
2. If the cell (*i*, *j*) is assigned with symbol A in the SSIM, then, this cell (*i*, *j*) entry becomes 0 and the cell (*j*, *i*) entry becomes 1 in the initial reachability matrix.
3. If the cell (*i*, *j*) is assigned with symbol X in the SSIM, then, this cell (*i*, *j*) entry becomes 1 and the cell (*j*, *i*) entry also becomes 1 in the initial reachability matrix.
4. If the cell (*i*, *j*) is assigned with symbol O in the SSIM, then, this cell (*i*, *j*) entry becomes 0 and the cell (*j*, *i*) entry also becomes 0 in the initial reachability matrix.

In addition, there is one basic concept which is essential to understand the ISM methodology termed as the concept of transitivity. Transitivity can be explained as element 'x' relates to element 'y' (i.e. xRy) and element 'y' relates to element 'z' (yRz), then transitivity implies element 'x' will also relate to element 'z' (xRz). [14]. Thus after imposing the transitivity relationships by 1* initial reachability matrix can be converted to final reachability matrix.

3.3. Partitioning the Reachability Matrix

Once the reachability matrix has been created, it must be processed to extract the digraph or structural model. Based on the suggestions of different researchers the reachability sets and antecedent sets for each KSB are found from the final reachability matrix.

The reachability set consists of the KSB (i) itself and the other KSBs which are reachable from that particular KSB (i). Every KSB (j) which contains 1 or 1* in the row of considered KSB (i), represents the reachability set and sum of 1 and 1* is known as driving power for corresponding KSBs. Similarly, the antecedent set consists of the KSB (i) itself and the other KSBs which may reach the KSB (i). Every KSB (i) which contains 1 or 1* in the column of considered KSB (j), represents the antecedent set and sum of 1 and 1* is known as dependence power for corresponding KSBs. After finding the reachability set and antecedent set for each KSB, the intersection for these sets is derived for all the KSBs and levels of different KSBs are determined as reachability and intersection set become common. Once the top level KSB is identified, it is removed from consideration and other top level KSBs are found. This procedure is continued till all levels of the structure are identified. These identified levels help in the development of digraph and the final model. Top level KSB is positioned at the top of digraph and so on.

In the present work, the twenty four KSBs, along with their reachability set, antecedent set, intersection set and levels, may be calculated. Level identification process of these KSBs can be completed in sixteen iterations, which can be summarized as table 4.

Table 4. Partitioning of reachability matrix showing all the levels of KSBs

S.No.	Reachability set	Antecedent set	Intersection set	Levels
1	1,2	1,2	1,2	XVI
2	1,2	1,2	1,2	XVI
3	3	1,2,3	3	XV
4	4	1,2,3,4,5	4	XIII
5	5	1,2,3,5	5	XIV
6	6	1,2,3,4,5,6	6	XII
7	7	1,2,3,4,5,6,7	7	XI
8	8	1,2,3,4,5,6,8	8	XI
9	9	1,2,3,4,5,6,7,8,9	9	X
10	10	1,2,3,4,5,6,7,8,10	10	IX
11	11	1,2,3,4,5,6,7,8,9,11	11	IX
12	12,13	1,2,3,4,5,6,7,8,9,10,11,12,13	12,13	VIII
13	12,13	1,2,3,4,5,6,7,8,9,10,11,12,13	12,13	VIII
14	14	1,2,3,4,5,6,7,8,9,10,11,12,13,14,24	14	VI
15	15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,24	15	V
16	16,17,18	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,24	16,17,18	IV
17	16,17,18	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,24	16,17,18	IV
18	16,17,18	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,24	16,17,18	IV
19	19	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,24	19	III
20	20	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,20,24	20	III
21	21	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,21,24	21	III
22	22	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,24	22	II
23	23	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24	23	I
24	24	1,2,3,4,5,6,7,8,9,10,11,12,13,24	24	VII

4. Development of ISM Model

Based on the level obtained by table 4 and final reachability matrix, an initial digraph including transitivity links can be obtained. After removing the indirect links, a final digraph can be developed. In this development, the top level KSB is positioned at the top of the digraph and second level KSB is placed at second position and so on, until the bottom level is placed at the lowest position in the digraph. Next, the digraph is converted into an ISM model by replacing nodes of the elements with statements as shown in figure 1.

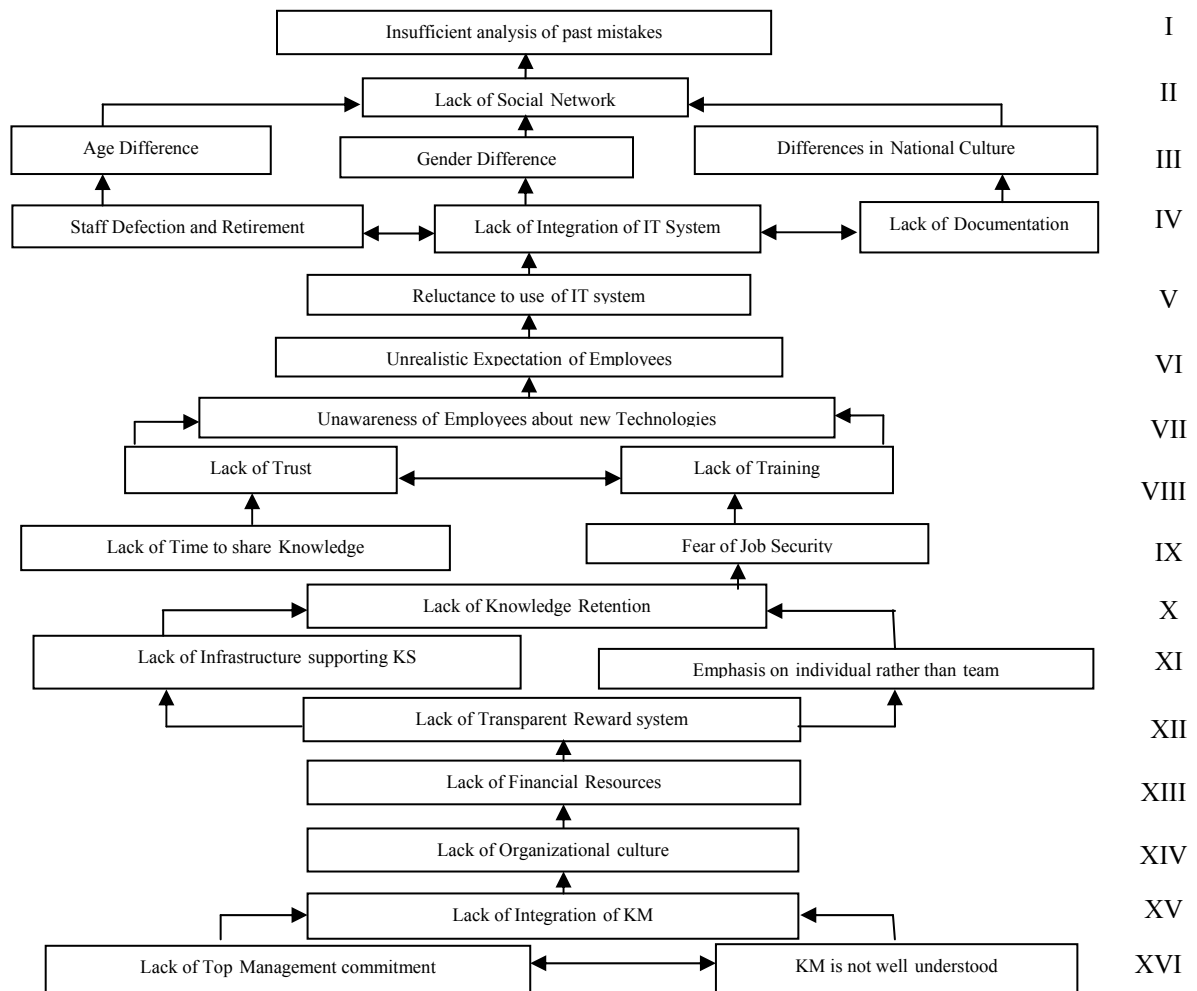


Figure 1. Interpretive structural model showing the levels of KSBs.

5. Conclusion and Result

The results of this study can help in the strategic and tactical decisions for an organization to move from a traditional system to KM system. The main strategic decision relies on the commitment of top management for the adaptation of KM. Once the top management commits itself it will help the organization to implement the KM and the firm can sample some strategic and tactical benefits such as: better competitive edge, development of engineering and management expertise, ability to introduce new products faster to the market, reduced work-in-process, improved quality, improved response to demand variation as per latest technology, improved working conditions and improved ability to design or process change-over with integration of IT systems.

The levels of different KSBs are important in better understanding and their implications in successful implementation of KM. An insight into the ISM model indicates the operational level KSBs that are very much powerful to hamper the successful operation and implementation of KM.

6. References

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