

# Knowledge Sharing in Organizations: Modeling the Barriers, an Interpretive Structural Modeling Approach

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*Abstract— In globalization of business, knowledge management (KM) is providing a systematic approach for identifying, creating, retaining and disseminating the knowledge among the employees of any organization, who integrate this knowledge for the achievement of greater organizational benefit. The development of KM has led to the identification of various enablers for its implementation. KM widely supports the supply chain management activities. The objective of this paper is to develop the relationships among the identified KM barriers. The interpretive structural modelling (ISM) methodology has been used to evolve mutual relationships among these 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 implementation. The study concludes with discussion and managerial implications.*

## I. INTRODUCTION

Due to global competition in recent years, KS has been identified as basic facilitator for the effective KM which can assist in optimizing business goals (M. Singh, R. Shankar 2006). These business goals can't be achieved until Indian SMEs understand about Knowledge Sharing barriers (KSBs), their mutual relationship so that those barriers which support other barriers (called “driving barriers”) and those which are most influenced by others (called “driven barriers”) are identified. Hence, effective KM implementation is only possible with the effective KS (Alam et al., 2009). Many researchers have discussed KM Barriers in details (Singh and Kant, 2008; Kant and Singh, 2009; Abdolshah and Abdolshah, 2011). Singh and Kant (2008) have discussed the mutual effect of these KM barriers over each other. This Chapter is focused on Knowledge Sharing barriers (KSBs) in SMEs context and includes the survey on Indian SMEs about these identified KSBs to provide a broader view.

**Table 1 Knowledge Sharing Barrier**

KSB Number	KSB	References
1.	Lack of culture	[1][2][5][6][8][10]
2.	Lack of ownership of the KM Problem	[1][6][10]
3.	Lack of trust	[1][2][4][7][8][11]

4.	Lack of strategic Issues	[7][10]
5.	Lack of motivation	[1][8][10][12]
6.	Lack of top management support	[1][3][8][9][11][12]
7.	Lack of methods and processes	[1][7]
8.	Resistance to change	[1][10]
9.	Lack of financial resources	[1][6][10]
10.	KM is not well understood	[1][2][6][8]

ISM is a well established methodology for identifying relationships among specific items which define a problem or an issue (Warfield, 1974; Sage, 1977). Therefore, in this research. KSBs have been analyzed using the ISM approach, which shows the interrelationships of various KSBs, their driving power, and their dependencies. The ten KSBs (Table 4.) under consideration in this study were identified from the literature review and the opinion of the experts, both from industry and the academia. The main objectives of this paper are to identify and rank the KSBs in organization, to establish relationships among these identified KSBs using ISM, to discuss the organizational implications of this research and to suggest directions for future research.

### 1. Literature Review of Knowledge Sharing Barriers

#### 1.1 Lack Of Top Management’s Commitment

The top management of the organization is directly responsible for shaping the organization culture, vision, policies, financial resources, training, infrastructure, information technology, transparent rewards and recognition systems and adoption of new management technologies such as KM (W. Jager, R. Straub 1999). KM in return can enhance net profit and revenues and it helps to attract the employees for long lasting stay. Major problem most of the SMEs is that the owner of organization is key in decision making body. Top management is responsible and have important role to support the KS practices.

#### 1.2 Concept Of KM Is Not Well Understood

KS may be hindered if concept of KM is not well understood by the all stakeholders of the organization (Kant, R. and Singh, M. D. (2008c). It is observed that greater productivity can be achieved by effective KS (Nunes et al., 2006).KS implementation requires proper and clear drafted guidelines which requires support and involvement of the top

management. Therefore, a better understanding of the Critical Success Factors (CSFs) for implementing KS in SMEs is needed in order to ensure the success of their efforts (Migdadi, 2009).

### 1.3 Lack Of Strategic Planning

Strategic planning helps in successful KS. It involves the deployment of an organization's capabilities and resources to achieve KS goals. Lack of strategic planning will obstruct the KS practices (Apulu and Latham, 2009). It is very important for SMEs to have a long term sustainable strategic planning regarding KS (Edvarrm, 2008). They should not wait till any competitor enter in same area or revenues are reduced due to external conditions such as government policies or some global issues.

### 1.4 Lack Of Methods and Processes

Even though top management commitment, better organizational structure and good technological infrastructure support, KS activities may be unsuccessful due to lack of methods and processes. Successful KS implementation requires a set of methods and processes (Singh et.al. 2006). Methods and processes categorize all activity which is going to be critical during the KM implementation.

### 1.5 Lack Of Financial Resources

Financial resources are one of the key variables that support the infrastructure and manpower requirements for KS. KS needs huge support from infrastructure, which requires huge funds (Apulu and Latham, 2009). Along with technology, another important aspect of KM is the people. They require training and education, motivational aids, etc., and all of these require finances. An organization requires the allocation of funds and other resources for KM implementation (Singh et al., 2003; Kant and Singh, 2009).

### 1.6 Lack Of Organizational Culture

Organizational culture defines the core beliefs, values norms and social customs that govern the way individuals act and behave in an organization (Almahamid et al., 2010). Most knowledge is shared socially, e.g., unofficial discussion, face-to-face or telephone conversations (A. Riege 2005). An organizational culture supportive KM has high values knowledge. It encourages knowledge creation, sharing and application. Lack of organizational culture will eradicate KS because it is principally based on organization culture.

### 1.7 Lack Of a Motivation, Rewards and Recognition

The effectiveness of both reward and recognition systems will motivate people to share their knowledge. Absence of any transparent rewards and recognition systems will hamper the KS (Valmohammadi, 2010). There is a need for KS strategy which must be supported by top management and requires a good KM infrastructure, staff retention, and incentives to encourage knowledge sharing (Singh et al.,

2006; Siemsen et al., 2008). KS mechanisms have a positive relationship between monetary rewards and KS (Bartol and Srivastava, 2002). Motivated employees poses greater affective and continuance commitment and lower employee turnover intentions (Yang, 2009).

### 1.8 Lack Of Trust

KS is impossible without mentioning the word trust (Hsu et al., 2007; Alam et al., 2009). Most people are unlikely to share their knowledge without a feeling of trust. Trust that people do not misuse their knowledge or take unjust credit for it, or trust that knowledge is accurate and credible due to the information source. It is mostly in informal networks that people trust each other, voluntarily share knowledge and insights with each other, and collaborate actively and willingly.

### 1.9 Resistance to Change

KM implementation depends on the three pillars of any organization, top management involvement and commitment, then employee attitude and support and lastly the type of infrastructure requirements such as IT (Alam et al., 2009). The success and failure of KS implementation depends on these three pillars and if any one remains weak then it hampers or creates resistance for KS strategy.

### 1.10 Lack Of Ownership Of KM Problem

Lack of ownership of problem will lead to frustrating situating for any organization. This is due to which employee not ready to take up the jobs seriously and properly. No employees will take the extra responsibilities. This situation is basically due to absence of culture in the organizations. So, Lack of ownership of problem act as a serious barrier for KM implementation (Liebowitz, 1999; Abdolshah and Abdolshah, 2011). Indian SMEs must see this problem very seriously because lack of ownership of problem can make the situation difficult for KM implementation.

## II. ISM METHODOLOGY AND MODEL DEVELOPMENT

ISM is primarily intended as a group learning process, but can also used individually. The ISM process transforms unclear, poorly articulated mental models of systems into visible, well-defined models useful for many purposes (Sage, 1977). A set of different directly and indirectly related variables are structured into a comprehensive systemic model. The model so formed portrays the structure of a complex issue, a system of a field of study, in a carefully designed pattern implying graphics as well as words. Many researchers have used ISM methodology to impose order and direction on the complexity of relationships among variables of a system (Table 2). ISM is interpretive because judgment of the group decides how the variables are related. It is structural as on the basis of relationship, an overall structure is extracted from the complex set of variables. It is a

modeling technique as the specific relationships and overall structure are portrayed in a graphical model. For complex problems, like the one under consideration, a number of KSBs may be affecting the KM implementation. However, the direct and indirect relationships between the KSBs describe the situation far more accurately than the individual factor taken into isolation. Therefore, ISM develops insights into collective understandings of these relationships.

**Table 2 ISM as reported in literature**

Author	Details
Faisal et al. (2006)	To evolve mutual relationships among the enablers of risk mitigation.
Mandal and Deshmukh (1994)	Identifies relationships among vendor selection criteria
Singh and Kant (2007)	Develop interdependence among KM barriers
Singh et al. (2003)	Develop interdependence among KM enablers

The various steps involved in the ISM technique are:

1. Identification of variables which are relevant to the problem or issues – this could be done by survey;
2. Establishing a contextual relationship between variables with respect to which pairs of variables would be examined;
3. Developing a structural self-interaction matrix (SSIM) of variables which indicates pair-wise relationship between variables of the system;
4. Developing a reachability matrix from the SSIM, and checking the matrix for transitivity of the contextual relation is a basic assumption in ISM which states that if variable A is related to B and B is related to C, then A is related to C;
5. Partitioning of the reachability matrix into different levels;
6. Based on the relationships given above in the reachability matrix, drawing a directed graph (digraph), and removing the transitive links;
7. Converting the resultant digraph into an ISM-based model by replacing variable nodes with the statements; and
8. Reviewing the model to check for conceptual inconsistency, and making the necessary modifications.

The various steps, which lead to the development of ISM model, are illustrated as given below.

**A. Structural Self-Interaction Matrix (SSIM)**

Group of experts, four each from industries and academics were consulted in identifying the nature of contextual relationships among the KSBs. Though ISM methodology suggests the use of expert opinions based on management techniques such as brain storming, nominal group technique,

etc in developing the contextual relationship among the KSBs, the correlation coefficients as obtained from the questionnaire survey have also been used to facilitate the experts in identifying the nature of these relationships. A contextual relationship of ‘leads to’ type is selected for analyzing the KSBs. Keeping in the mind contextual relationship for each KSB, the existence of relationship between any two KSB (*i* and *j*) and associated direction of the relation are questioned. For developing SSIM, the following four symbols have been used to denote the direction of relationship between KSBs (*i* and *j*):

- V for the relation from *i* to *j* but not in opposite direction;
- A for the relation from *j* to *i* but not in opposite directions;
- X for both direction relations from *i* to *j* and *j* to *i*; and
- O if the relation between the KSBs does not appear valid.

The following statements explain the use of symbols V, A, X and O in SSIM.

- KSB 1 leads to KSB 8 (V).
- KSB 5 will be achieved by KSB 7 (A).
- KSB 6 and KSB 10 are unrelated (O).
- KSB 7 and KSB 9 strengthen each other (X).

**Table 3 Structural Self-Interaction Matrix**

KSB Number	KSB	1	9	8	7	6	5	4	3	2
1.	Lack of culture	A	O	V	A	A	A	A	X	V
2.	Lack of ownership of the KM Problem	A	A	A	A	A	A	A	A	
3.	Lack of trust	A	A	X	A	A	A	A		
4.	Lack of strategic Issues	A	V	V	V	A	V			
5.	Lack of motivation	A	O	A	A	A				
6.	Lack of top management support	O	V	O	V					
7.	Lack of methods and processes	A	X	V						
8.	Resistance to change	A	A							
9.	Lack of financial resources	A								
10.	KM is not well understood									

Based on contextual relationships, the SSIM is developed (Table 3).

**B. Reachability Matrix**

The SSIM has been converted into a binary matrix, called the initial reachability matrix as shown in Table 4.4 by substituting V, A, X and O by 1 and 0 as per given case. The substitution of 1s and 0s are as per the following rules:

- If the (i, j) entry in the SSIM is V, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0;
- If the (i, j) entry in the SSIM is A, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1;
- If the (i, j) entry in the SSIM is X, the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry also becomes 1; and
- If the (i, j) entry in the SSIM is O, the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry also becomes 0.
- After incorporating the transitivity as mentioned in step (4) of the ISM technique, the final reachability matrix is shown in Table 4. In Table 4, the driving power and the dependence of each KSB are also shown.

**Table 4 Initial Reach Ability Matrix**

KSB Number	1	2	3	4	5	6	7	8	9	10
1	1	1	1	0	0	0	0	1	0	0
2	0	1	0	0	0	0	0	0	0	0
3	1	1	1	0	0	0	0	1	0	0
4	1	1	1	1	1	0	1	1	1	0
5	1	1	1	0	1	0	0	0	0	0
6	1	1	1	1	1	1	1	0	1	0
7	1	1	1	0	1	0	1	1	1	0
8	0	1	1	0	1	0	0	1	0	0
9	0	1	1	0	0	0	1	1	1	0
10	1	0	1	1	1	0	1	1	1	1

**Table 5 Final Reachability Matrix**

KSB Number	1	2	3	4	5	6	7	8	9	10	Driving power
1	1	1	1	0	1	0	0	1	0	0	5
2	0	1	0	0	0	0	0	0	0	0	1
3	1	1	1	0	1	0	0	1	0	0	5
4	1	1	1	1	1	0	1	1	1	0	8
5	1	1	1	0	1	0	0	1	0	0	5
6	1	1	1	1	1	1	1	1	1	0	9

7	1	1	1	0	1	0	1	1	1	0	7
8	0	1	1	0	1	0	0	1	0	1*	5
9	1	1	1	0	1	0	1	1	1	0	7
10	1	1*	1	1	1	0	1	1	1	1	9
Depen dence	9	10	9	3	9	1	5	9	5	1	
Power											

(1\* entries are included to incorporate transitivity to fill the gap if any in the opinion collected during development of structural self-instructional matrix)

The driving power for each KSB is the total number of KSBs (including itself), which it may help achieve. Dependence is the total number of KSBs (including itself), which may help achieving it. These driving powers and dependencies are used in the classification of KSBs into four groups, i.e. autonomous, dependent, linkage, and driver KSBs.

**C.Level Partitions**

From the final reachability matrix, the reachability and antecedent set for each KSB are found (Warfield, 1974). The reachability set consists of the KSB itself and the other KSBs which it may help achieve, whereas the antecedent set consists of the KSB itself and the other KSBs which may help in achieving it. Thereafter, the intersection of these sets is derived for all the KSBs. The KSBs for whom the reachability and the intersection sets are same, occupy the top level in the ISM hierarchy. The top-level KSB in the hierarchy would not help achieve any other KSB above its own level. Once the top-level KSB is identified, it is separated out from the other KSBs. It is seen from the Table 4. That lack of ownership of the KM problem is occupied at level I. Hence, this KSB would be positioned at the top of the ISM hierarchy.

**Table 6 Partition of Reachability Matrix: First iteration**

Bar rier Nu mbe r	Reachability Set	Antecedent Set	Intersect ion Set	Le vel
1	1, 2, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	
2	2	1, 2, 3, 4, 5, 6, 7, 8, 10	2	I
3	1, 2, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	
4	1, 2, 3, 4, 5, 7, 8, 9	4, 6, 10	4	
5	1, 2, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	
6	1, 2, 3, 4, 5, 6, 7, 8, 9	6	6	
7	1, 2, 3, 5, 7, 8, 9	4, 6, 7, 9, 10	7, 9	
8	1, 2, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	
9	1, 2, 3, 5, 7, 8, 9	4, 6, 7, 9, 10	7, 9	
10	1, 2, 3, 4, 5, 7, 8, 9, 10	10	10	

Then, the same process is repeated to find out the KSBs for the next level. This process is continued until the levels of each KSB are found out (see Table 7-10). These levels (see Table 11) help in building the diagraph and the final model of ISM.

**Table 7 Partition of Reachability Matrix: Second iteration**

Barrier Number	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
3	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
4	1, 3, 4, 5, 7, 8, 9	4, 6, 10	4	
5	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
6	1, 3, 4, 5, 6, 7, 8, 9	6	6	
7	1, 3, 5, 7, 8, 9	4, 6, 7, 9, 10	7, 9	
8	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
9	1, 3, 5, 7, 8, 9	4, 6, 7, 9, 10	7, 9	
10	1, 3, 4, 5, 7, 8, 9, 10	10	10	

Barrier Number	Reachability Set	Antecedent Set	Intersection Set	Level
4	4, 7, 9	4, 6, 10	4	
6	4, 6, 7, 9	6	6	
7	7, 9	4, 6, 7, 9, 10	7, 9	III
9	7, 9	4, 6, 7, 9, 10	7, 9	III
10	4, 7, 9, 10	10	10	

**Table 8 Partition of Reachability Matrix: Third iteration**

Barrier Number	Reachability Set	Antecedent Set	Intersection Set	Level
4	4	4, 6, 10	4	IV
6	4, 6	6	6	
10	4, 10	10	10	

**Table 9 Partition of Reachability Matrix: Fourth iteration**

**Table 10 Partition of Reachability Matrix: Fifth iteration**

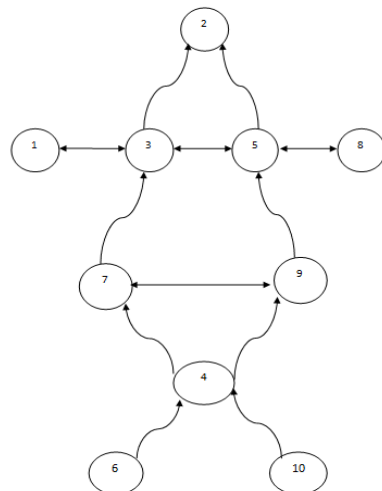
Barrier Number	Reachability Set	Antecedent Set	Intersection Set	Level
6	6	6	6	V
10	10	10	10	V

**Table 11 Levels of KM barriers**

Barrier Number	Reachability Set	Antecedent Set	Intersection Set	Level
1	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
2	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	2	I
3	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
4	4	4, 6, 10	4	IV
5	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
6	6	6	6	V
7	7, 9	4, 6, 7, 9, 10	7, 9	III
8	1, 3, 5, 8	1, 3, 4, 5, 6, 7, 8, 9, 10	1, 3, 5, 8	II
9	7, 9	4, 6, 7, 9, 10	7, 9	III
10	6	6	6	V

**D. Formation of ISM-Based Model**

The structural model is generated from final reachability matrix as given in Table 5. If there is a relationship between the KSB *i* and *j*, this is presented by an arrow which points from *i* to *j*. This graph is called a directed graph, or digraph. After removing the transitivity's see step 4 of the ISM methodology the final digraph is formed (Figure 4). This final digraph is converted to ISM-based model (Figure 4).



**Fig 1 Final Digraph Depicting the Relationship among the KS Barriers**

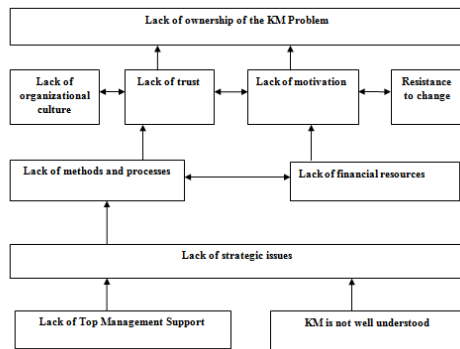


Fig 2 ISM-Model of KS Barriers

### III. CATEGORIZATION OF KM BARRIERS

All KSBs have been classified, based on their driving power and dependence power, into four categories as autonomous KSBs, dependent KSBs, linkages KSBs, and independent KSBs. The above classification of barriers is similar to the classification used by Mandal and Deshmukh (1994). The driving power and dependence power of each KSB are shown in Table 4. The driving power and dependence power diagram for KSBs are shown in Figure 4. It is observed from Table 4 that lack of top management support (KSB 6) has a dependence power of 1 and a driving power of 9 and therefore, it is positioned at a place which corresponds to a dependence power of 1 and a driving power of 9 in Figure 4. The objective behind the classification of KSBs is to analyze the driving power and dependence power of the KSBs. In this classification of KSBs, the first cluster is of autonomous KSBs that have a weak driving power and weak dependence power. The second cluster consists of dependent KSBs that have weak driving power and strong dependence power. The third cluster consists of linkage KSBs that have strong driving and dependence power. The fourth cluster includes independent KSBs that have strong driving power and weak dependence power.

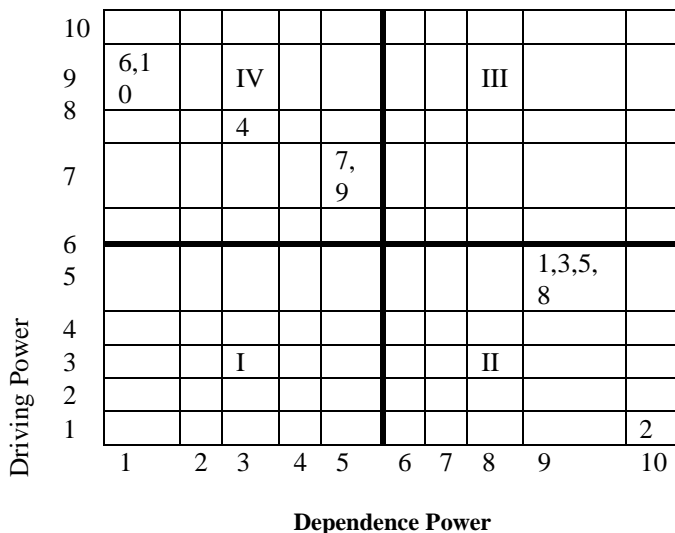


Fig 3 Driving power and dependence

### IV. DISCUSSIONS

KM has become the life line of the business organizations. The objective of the ISM model in this research is to develop a hierarchy of KSBs as well as to analyze the interaction among these KSBs that would hinder the successful KM implementation. Development of ISM model (Figure 4) and categorization of KSBs (Figure 4) have following managerial implications:

### V. ISM MODEL

From figure 2, it has been observed that Lack of ownership of the KM Problem is at the first level of the ISM model. This KSB is the major problems of the KM implementation and Lack of culture, Lack of trust, Lack of motivation and Resistance to change are occupied at (second level) might be the root cause for this. Further, Lack of methods and processes and Lack of financial resources are at third level of ISM model. Davis (1994) has stated that the barriers to technological change arise during the peak periods of change. Lack of strategic Issues is at the fourth level of the ISM model. Lack of top management support and KM is not well understood are at (fifth level).

#### A. Autonomous KSBs

The driving power- dependence power diagram (Figure 4) indicates that there are no autonomous KSB in the process of KM implementation. Autonomous KSBs are weak drivers and also weak dependent. The autonomous KSBs are relatively disconnected from the system, with which they have only few links, which may not be strong. Hence, they don't have much influence on the system. Therefore, among the twenty selected KSBs, all the KSBs have much influence in the implementation of KM. Hence top management can't take lightly any of these KSBs, if they are very serious to make KM implementation successful.

#### B. Dependent KSBs

Lack of culture (KSB 1), Lack of trust (KSB 3), Lack of motivation (KSB 5), Resistance to change (KSB 8), Lack of ownership of the KM Problem (KSB 2) are weak drivers but are strongly dependent on the others (Figure 3). They are seen at the top of the ISM hierarchy (Figure 2), therefore considered as important KSBs. Their strong dependence indicates that they require all the other KSBs to minimize the effect of these KSBs on implementing KM. The management should therefore accord high priority in tackling these KSBs. Besides tackling these KSBs, management should also understand the dependence of these KSBs on lower level of the ISM.

#### C. Linkages KSBs

There are no KSB in the linkage category that has a strong driver power and also a strong dependence (Figure 4). Any change occurring to these KSBs will have an effect on others and also a feedback on themselves. Hence, these KSBs are unstable in nature which may hinder the

successful KM implementation in the organizations. The absence of any linkage KSBs in this study indicates that no KSB is unstable among all the twenty KSBs chosen in this study.

#### D. Independent KSBs

The driving power and dependence diagram (Figure 4) indicates that independent KSBs such as Lack of top management support (KSB 6) KM is not well understood (KSB 10), Lack of strategic Issues (KSB 4), Lack of methods and processes (KSB 7) and Lack of financial resources (KSB 9). Thus management needs to address these KSBs more cautiously and may be treated as the root causes of all the KSBs. It has been observed that these KSBs help to achieve the KSBs which appear at the top of the ISM hierarchy. Therefore, it can be anecdotal that management should work out strategies to eliminate these independent KSBs for effective KM implementation.

#### VI. CONCLUSION

Finally it is interesting to examine the scope of future research. The experts' opinion has been used to analyze driving and dependence power of the barriers. Here, the framework developed depends upon the survey and opinion of experts, which may have some factor of prejudice. Through ISM, a relationship model among KSB has been developed. This model has not been statistically validated. Thus, future research focus should be to test the validity of this model. ISM is a tool which can be helpful to develop an initial model whereas tools like SEM commonly known as linear structural relationship approach has the capability of statistically testing an already developed theoretical model. LISREL software can also be used to examine the relationships derived from this model.

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