Modeling the Components of Management Quality to Measure Performance of Indian Private Sector Banks

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This paper makes an attempt to identify the key components of management quality and model their interrelations to measure the performance of Indian private sector banks under CAMELS framework. Calibration of management quality is not available in literature and hence it is important to identify and measure the interrelations among those to arrive at few driving components among many. The paper uses Delphi embedded fuzzy interpretive structural modeling (FISM) to model the interrelationship. Further MICMAC analysis is used to cluster components into four groups according to their driving power and dependence in the system

Key Words: Fuzzy ISM, MICMAC, Private Banks, modeling, CAMELS

1. Introduction

Post liberalization Indian financial sector has witnessed a significant competition because of its integration with the rest of the world. The concept of Banks and Banking has undergone a paradigm shift. Before the financial reforms Indian banks were in a protected environment created by the government of India and probably that has made them operationally inefficient (Sangmi and Nazir, 2010). However with RBI taking effective measure as proposed by Narsimahan committee, the landscape of Indian banking has witnessed a metamorphic turn around. Indian banks were directed to re-define their objectives, policies, processes, methodologies and technologies that have direct linkage with the performance of the banks to match an ever increasing competition in the industry. Thus these banks were not only told to follow norms but also to continuously monitor the financial health of the Banks.

This need to evaluate banks on a period to period basis attracted lot of attention among the researchers in this domain. Sangmi and Nazir (2010) talked about the contribution of different researchers in the evaluation of Indian banks. In their article they talked about application of CAMELS framework in the performance evaluation. This framework was proposed by Basel committee in 1988 and is based on the evaluation of five critical elements of a financial institution's operations: Capital adequacy, Asset quality, Management soundness, Earnings and profitability and Liquidity with Sensitivity to market risk added as another dimension in 1997.

A lot of researchers including Elliott et al. (1991) and Thomson (1991) have used this framework to measure the performances of the financial institutions. In the paper on the causes of banks failure in 1980's Thomson has found the CAMEL rating useful. The use of CAMELS framework in the emerging economies is also available. Wirmkar and Tanko (2008) studied Banking performance of major Nigerian banks using CAMELS framework. Kapil and Kapil (2005) identified the relationship among stock performance and CAMELS rating. Sing and Kohli (2006) used CAMELS framework to rank Indian banks and also performed SWOT analysis. Gupta and Kaur (2008) assessed Indian private sector banks using the framework and identified top and bottom five banks. Sangmi and Nazir (2010) used the same framework to compare the performance of two commercial banks using CAMELS framework. Prasad et al. (2011) evaluated public and private sector banks using the same framework.

From the above literature one can see that all the studies have assessed the performance of the Banks both in India and abroad using six different dimensions as per the framework. Each dimension comprises of different components through which the performance were evaluated. The components across dimensions such as Capital adequacy, Asset quality, Earnings or Liquidity had components that are almost same across the studies (Kapil and Kapil, 2005; Sing and Kohli, 2006; Gupta and Kaur, 2008; Prasad et al., 2011). However the components of Management quality are not the same across different studies. There is a significant spread among components that are considered by different researchers under Management quality. It may be because the dimension conforms to a good amount of subjectivity and possible interrelations among components. It is interesting to note that either the researchers have assumed independence among these components or ignored their interrelations while evaluating banks performances. Though couple of researchers including Dave et al. (2008) pointed out the importance and significance of the complexity of interrelations among components, no attempt was made to measure such interrelations.

Based on the above discussion this paper makes an attempt to identify the components of Management quality for the performance evaluation of new private banks in India through an extensive literature review. Further we plan to do a

structural analysis of the interrelations among these components using Delphi embedded fuzzy interpretive structural modeling (FISM). The interdependencies among these components under Management quality will be captured through a directed graph. Furthermore MICMAC analysis demonstrates how the components can be classified into different clusters corresponding to their driving power and dependency.

2. Delphi Technique

The Delphi technique had evolved since early 1950s as a decision making tool mainly for the military. Its objective is to solicit reliable responses from a panel of experts regarding a particular problem, decision or dilemma. This research tool allows researchers to combine the reports or testimony of a group of experts into one, useful statement through an iterative convergence method (Wanda and Tena, 2004). Delphi method is widely used by researchers because of its effectiveness in studies related to structuring the process of communication and in developing consensus (Refaat, 1998; McCarthy, 2001; Okoli et al., 2004; Gregory et al., 2007 and Azizollah et al., 2008). The method maintains anonymity among the experts and thus avoids possible influence or biasedness.

3. Interpretive Structural Modeling

Interpretive structural modeling as a tool evolved in seventies to identify possible interaction among the multiple factors considered in a study. It provides an order and direction to the complex relationships between the system elements (Sage, 1977). The outcome of the model is a directed graph that captures the overall structure of the system and provides a hierarchy among the factors with respect to their driving power in the system. Extensive use can be seen in the field of Supply chain and operations management where the researchers identified mainly the interrelations among the enablers or risks in different types of supply chain management (Mandal and Deshmukh, 1994; Faisal et al, 2006; Gorane and Ravikanth, 2013). MICMAC analysis captures the position of the performance components or factors in a two dimensional plane with respect to the driving power and dependence of the components within the system. Embedding fuzzy sets with MICMAC captures the ambiguity in such relationship in a better way by providing a scale between 0 and 1 (Mandal and Deshmukh, 1994).

The Various Steps Involved in ISM are as follows

Identification of the various factors and sub factors (performance components) that are relevant to the problem situation and is done using an extensive literature review of existing research works or by doing a survey. The next step is to identify and establish the contextual relationships among the factors or components considered in the study. This is generally done through pair wise comparison between the components and the responses are gathered from the domain experts. Next step is the development of structural self-interaction matrix (SSIM) of components using the pair wise comparison inputs. Further the SSIM is converted to reachability matrix using 0 and 1 after checking for transitivity in the relationship.

The reachability matrix is then partitioned into different levels based on the driving power and dependence of the components in the reachability matrix and a directed graph indicating the relationships (one way or two ways) is drawn. This directed graph which is an outcome of ISM provides a hierarchy among the components in the system. The highest level refers to those components that hardly influence others in the system. Similarly the lowest level indicates higher influence in the system.

4. Identification of Components of Management Quality

Based on the above literature and after consulting the experts for their valuable input, seven components are identified within the Management quality dimension those are present across multiple research works. Table 1 demonstrates these seven components with the most prominent literatures supporting their existence in the performance evaluation of Banks. Once the components were identified a three stage Delphi process was conducted to get a convergence among the expert opinions.

Table 1 *Components under Management Quality*

References in Literature (component coverage)	Components
Doumpos et al., 2009 (3,5,6,7) Sangmi and Najir, 2010 (1,3,7) Sayed and Sayed, 2013 (1,2,7) Dash and Das, 2013 (1,2,7) Chandani et al., 2014 (1,3,5,6)	1. Business per employee
	2. Profit per employee
	3. expenditure per employee
	4. Information technology systems
	5. Internal control system
	6. Top Management competencies
	7. Operating expense ratio

5. Delphi –Fuzzy ISM and MICMAC Framework

The objective behind using ISM and Fuzzy MICMAC is to understand the interrelationship among the components of Management quality in the performance evaluation of the private banks in India. The steps in the entire analysis are mentioned clearly through the framework that can be seen in Fig. 1.

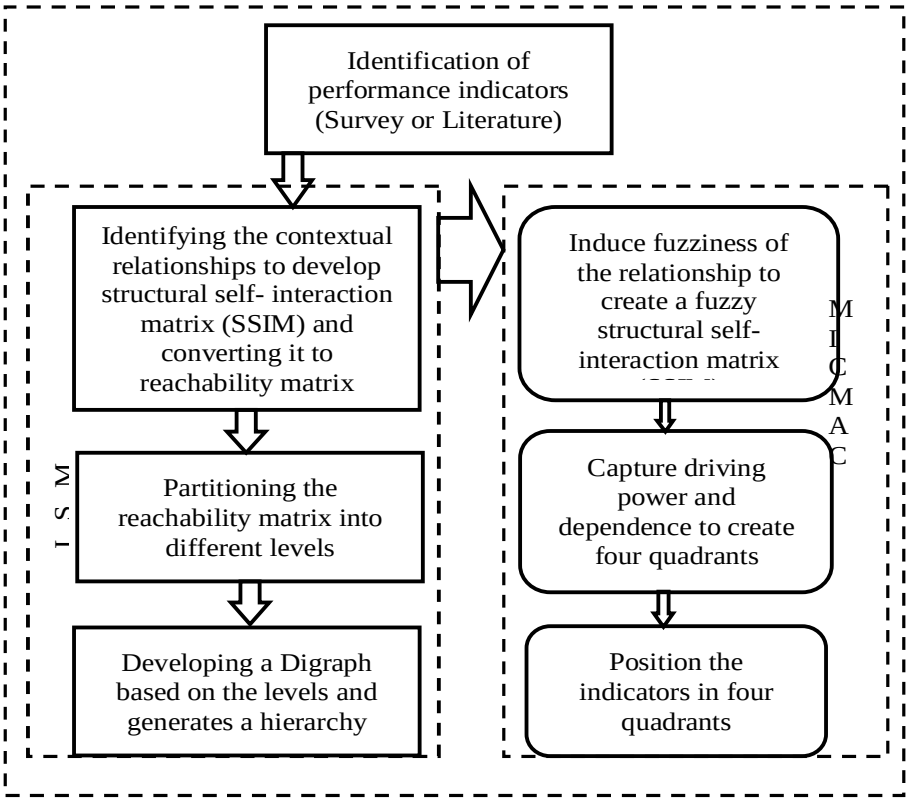

Figure 1 *Framework of ISM Fuzzy MICMAC Analysis*

Structural Self-Interaction Matrix (SSIM)

The structural self-interaction matrix (SSIM) is created with the help of expert opinion on the contextual relationship among the components. *Table 2* demonstrates the SSIM together with the power of the interrelations. To measure the relationship "leads to" is used along with four symbols A, B, C and D to denote the direction of relationship among the component *i* and component *j*.

A. : component *i* leads to component *j*
B. : component *j* leads to component *i*
C. : component *i* and component *j* leads to each other
D. : component *i* and component *j* has no relation

Table 2 *Structural self-Interaction Matrix (SSIM)*

Components	2	3	4	5	6	7
1. Business per employee	A(.8)	A(.5)	B(.7)	B(.6)	B(.8)	D(0)
2. Profit per employee		B(.4)	B(.6)	B(.8)	B(.4)	B(.6)
3. expenditure per employee			B(.6)	B(.7)	B(.9)	A(.5)
4. Information technology systems				A(.8)	B(.7)	A(.7)
5. Internal control system					C(.6, .8)	A(.7)
6. Top Management competencies						A(.8)
7. Operating expense ratio						

Reachability Matrix

The reachability matrix is created by converting the SSIM to a binary matrix by substituting A, B, C and D as 0 or 1 as per the case following the rules:

If the *(i,j)* entry of the SSIM is A, the *(i,j)* entry in the reachability matrix will be 1 and the *(j,i)* entry will be 0.
If the *(i,j)* entry of the SSIM is B, the *(j,i)* entry in the reachability matrix will be 1 and the *(i,j)* entry will be 0.
If the *(i,j)* entry of the SSIM is C, both the *(i,j)* entry and the *(j,i)* entry in the reachability matrix will be 1.
If the *(i,j)* entry of the SSIM is D, both the *(i,j)* entry and the *(j,i)* entry in the reachability matrix will be 0.
The reachability matrix is shown in *Table 3*.

Table 3 *Reachability Matrix*

Components	1	2	3	4	5	6	7
1. Business per employee	1	1	1	0	0	0	0
2. Profit per employee	0	1	0	0	0	0	0
3. expenditure per employee	0	1	1	0	0	0	1
4. Information technology systems	1	1	1	1	1	0	1
5. Internal control system	1	1	1	0	1	1	1
6. Top Management competencies	1	1	1	1	1	1	1
7. Operating expense ratio	0	1	0	0	0	0	1

The driving power and dependence are then calculated from the initial reachability matrix. The row sum of a component in the reachability matrix refers to the driving power of the corresponding component. Similarly the column sum represents the dependence. *Table 4* exhibits this.

Level Partition

From the reachability matrix the 'reachability set' and 'antecedent set' for each component are captured. The reachability set of a component is the set of all components it has influenced including itself. Whereas antecedent set consists of the component itself along with those who have influenced it in the system. Further an intersection set is also derived for all the components to generate levels.

Table 4 *Reachability Matrix with Driving Power and Dependence*

Components	1	2	3	4	5	6	7	Driving Power
1. Business per employee	1	1	1	0	0	0	0	**3**
2. Profit per employee	0	1	0	0	0	0	0	**1**
3. expenditure per employee	0	1	1	0	0	0	1	**3**
4. Information technology systems	1	1	1	1	1	0	1	**6**
5. Internal control system	1	1	1	0	1	1	1	**6**
6. Top Management competencies	1	1	1	1	1	1	1	**7**
7. Operating expense ratio	0	1	0	0	0	0	1	**2**
Dependence	**5**	**9**	**8**	**6**	**8**	**8**	**12**	

The component for whom the reachability set and the intersection set are same, is the highest level component in the ISM hierarchy that has minimum influence on the system. *Table 5* shows how the partition is made in iteration 1. Once the component is identified it is removed from the list and the same exercise is repeated to identify the next level element. The process continues till the levels of each component are found.

Table 5 *Level Partition in Iteration 1*

Components	Reachability Set	Antecedent set	Intersection set	Level
1	1,2,3	1,4,5,6	1	
2	2	1,2,3,4,5,6,7	2	I
3	2,3,7	1,3,4,5,6	3	
4	1,2,3,4,5,7	4,6	4	
5	1,2,3,5,6,7	4,5,6	5,6	
6	1,2,3,4,5,6,7	5,6	5,6	
7	2,7	3,4,5,6,7	7	

Table 6 shows the complete level partitions. These levels help create the digraph representing causality or interrelationship.

Table 6 *The Complete Partition*

Iteration	Components	Reachability Set	Antecedent set	Intersection Set	Level
1	2	2	1,2,3,4,5,6,7	2	I
2	7	7	3,4,5,6,7	7	II
3	3	3	1,3,4,5,6	3	III
4	1	1	1,4,5,6	1	IV
5	5	5,6	4,5,6	5,6	V
5	6	4,5,6	5,6	5,6	V
6	4	4,5	4,6	4	VI

MICMAC Analysis

The objective of MICMAC analysis is to create clusters among the components with respect to their driving power and dependence in the system. Here the inclusion of fuzzy scale captures the strength of the relations in a better way. Based on the analysis all the components are grouped into four clusters namely 'autonomous', 'independent', 'dependent' and 'linkage'. Autonomous components are those with less dependence and less driving power. Independent components are those with high driving power but less dependence. Dependent components are just its opposite where the linkage components are those with high dependence and driving power. These are the most sensitive components in the system.

6. Results and Discussion

The objective of this ISM model is to develop a hierarchy of components considered in this study. This directed graph helps us understand the interrelations among those components under management quality from a systemic perspective. Fig. 2 demonstrates the hierarchy including the direction of the relations.

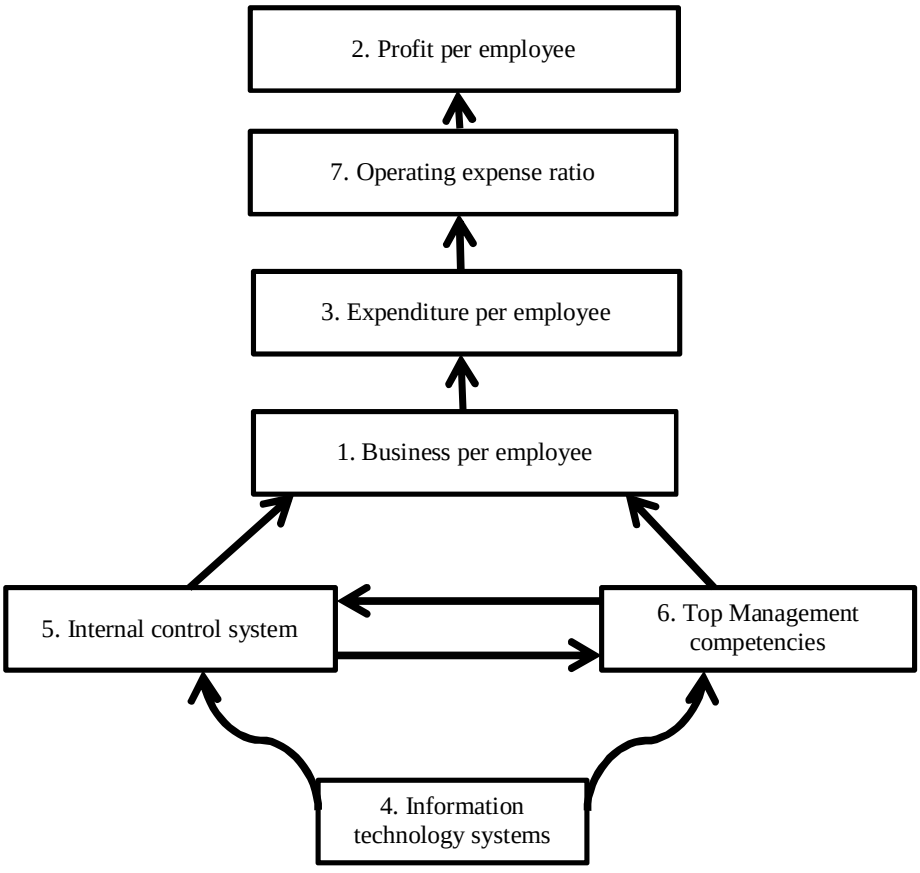

Figure 2 *The Hierarchy of Components under Management Quality*

From *Figure 2* we can see that information technology systems drive the other components under management quality. Both the Top management competencies and internal control systems are at the same level and drive others in the system

where profit per employee is the most dependent component is the system.

After considering the power of the relationships using fuzzy numbers, one can see from fig. 3 that top management competencies and internal control are the linkage components contributing maximum to the system. They are the most volatile components and affect the system more than the others. Information technology system on the other hand is independent and has less dependence with a higher driving power. Operating expense ratio is a dependent component whereas the other three are autonomous in nature.

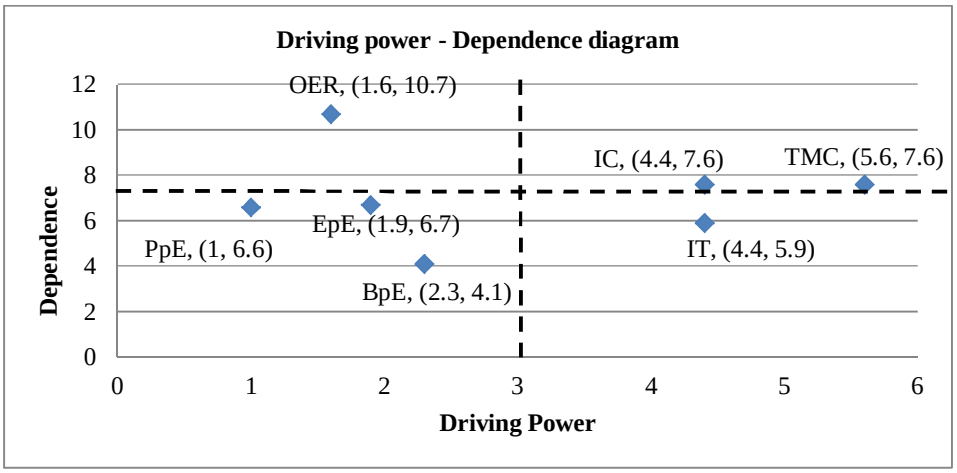

Figure 3 *Fuzzy MICMAC Analysis*

7. Conclusion

This study makes an attempt to identify and understand the interrelationships among the components of management quality within CAMELS framework. This study identifies the importance of information technology system, internal control and top management competencies as the three very important aspects that drives management quality in measuring banking performance. Though multiple components exist under management quality dimension, it is good enough to focus on these three instead of trying to monitor every other component in the dimension. The inclusion of fuzzy numbers help capture the degree of driving power and dependence in the system more accurately and thus provides a better insight. However the study can provide even better insight if fuzzy logic can be embedded into ISM while creating the hierarchy.

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