Barriers Analysis of Bank Queuing System using ISM and MICMAC Approach

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***Abstract*-- In practical approach the arrival rate of customers are not uniform in the banks. Long waiting line of customers is always a major problem in view of customers as well as banks. In this paper author has identified the major barriers that affect the bank queuing system and found contextual relationship among the various barriers, Interpretive Structural Modeling (ISM) technique is used to develop contextual relationship model and also found the driving and dependence power between the identified barriers using MICMAC analysis.**

Key Words:- Interpretive Structural Modeling (ISM), MICMAC Analysis, Factors affecting the Bank Queuing System

I. INTRODUCTION

There was always a problem when one has to deal with the complex problems or factors involved in the system and to identify thereby troubleshooting them. The complexity in nature of process is due to the presence of a large number of factors affecting the process. Therefore, to understand the vitality of each factor contributing to resist in smooth working of system is always a necessity. When there are a large number of inter-dependent and complex factors then it becomes difficult deal with the system, and to deal with such a complex system, the clarity in definition of factors is a prime necessity. When there are a large number of inter-dependent and complex factors then it becomes difficult deal with the system, and to deal with such a complex system, the clarity in definition of factors is a prime necessity. Hence there arise a need of generation of such a methodology which aids to the process of problem identification a solving them by clearly defining a structure of the relationship among the various factors involved in the system and the hierarchy present among those factors. This issue leads to generation of Interpretive Structural Modeling(ISM) technique which clearly describes the factors involved and the relationship among those factors.

Interpretive Structural Modeling (ISM) is defined as a process which is aimed to assist the human to understand the nature and importance of various involved in any complex system. The ISM Technique aids in problem solving by visualizing the non-clear, less defined problems into well defined models. Interpretive Structural Modeling (ISM) technique starts with identification of factors thereby generating relationship among them by using mathematical tools. In ISM technique some elementary notations are used to operate with the relationship existing between the factors involved in the system.

II. LITERATURE REVIEW

M.S.R. Murthy et. al (2014) studied the waiting lines in Bank's ATM in a city. The bank provides one ATM in every branch of the bank. In ATM, bank customers arrive randomly and the service time is also random. **Mohammad Shyfur Rahman chowdhury** et. al (2013) describe several common queuing situations and present mathematical models for analyzing waiting lines following certain assumptions. Those assumptions are that (**1**) Arrivals come from an infinite source or a very large population, (**2**) Arrivals are following Poisson's distribution, (**3**) Arrivals are treated on a FIFO basis and there is a condition of not to consider balking or reneging, (**4**) Service Rates and Service time follows the negative exponential distribution or are constant, and (**5**) The average service rate is always greater than the average arrival rate. **Toshiba Sheikh** et al. **(**2013) focuses on the M/M/Z/∞: FCFS model is converted into M/M/1/∞:FCFS to know which one of the above mentioned two is more efficient, a line or more lines. **Priti Bajpai** et al. (2013) is to determine customer behavior in queues in four different situations in India. **Tian Hao**. et al. (2011) focuses on improving the QUEING system of bank based on Business Process Re-Engineering (BPR). **Donald Hammond** et. al (1995) In this paper an application study to find cost effective bank teller management policies for providing high quality service levels at reasonable costs in a modern banking system. **Rituraj Chandraker** et.al (2013) is used ISM to identified the contextual relationship among major factors that affects the Bullwhip effect and factors that affects the implementation of GSCM, and has derived a Multi-level model of these factors.

III. Problem Selection

Long waiting line of customers to be served is always a major problem in view of customers as well as banks. Waiting in the queue for a long time for getting service is a loss of valuable time for the customers who are waiting to be served. These waiting times can be reduced if the numbers of service stations can be increased as waiting time is inversely proportional to number of service stations. But making a large Number of service stations is not a wise decision, as service is not free of cost. So to proper use the available resources considering the

above two issues with equal importance, For solving such a problem of complex system ISM and MICMAC analysis has to be done.

IV. METHODOLOGY

The method of Interpretive Structural Modeling Technique includes breaking up of the complicated problem of system into a number of small sub-system (or small elements) and then minutely observing the various problem creating elements by using practical approach, experience of the experts and their concerned knowledge. The ISM technique is performed in a sequenced manner consists of number of steps described below:

1. **Analysis of Factors (Elements) involved** : This steps involves determining all the factors involved in the system which results to barriers in smooth working of the system. The factors involved in the bank Queuing Models are mentioned below in Table-1:

TABLE I FACTORS AFFECTING THE BANK QUEUING MODELS

Sr.	FACTORS	DESCRIPTION
1	Jockeying	When the customer enters one queue and after sometime he/she switches to a different queue in an effort to reduce the waiting time.
2	Reneging	The customer enters the line but later it decides to leave the queue before being served.
3	Number of Service Stations	The number of Service Stations is always a factor of concern, optimum number of service stations is always desirable, more or less numbers of service station will increase cost.
4	Throughput time of Service Provider	During calculation of service rate, standard time is taken, but in actual practice it will always mismatch, and due to fatigue, service time increases.
5	Illiteracy of Customers	Information's filled by illiterate customers are sometime wrong or sometime incomplete, which increases service time.
6	Technical Errors	Some of the Factors like Electricity cut-off or sometime Server down due to error in networking connections affect servicing, as it completely stops the service.
7	Wrong Forecast	Forecasting and preparing for the forecasted assumption is a good managerial decision, but wrong assumption will misalign the service rate and customer arrival rate.
8	Seasonal or Off-seasonal Factors	Some of the factors like festival season or salary time i.e starting of month results into increase of customer arrival rate which leads to continuous increase in length of the queue
9	Balking	The customer on watching the long length of the Queue decides not to enter the waiting line(Queue).

2. **Building of Contextual Relationship by making Structural Self-Interaction Matrix(S.S.I.M).** In Structural Self-Interaction Matrix (S.S.I.M) direction of relationship between the factors (i and j) are determined by using the four symbols of S.S.I.M Matrix described below:

i.) **V**:Denotes that factor i results to factor j.
ii.) **A**: Factor j results to factor i.
iii.) **X**: Factor i results to factor j also factor j results to factor i.
iv.) **O**: i and factor j are independent of each other.

3. **Construction of Initial Reach Ability Matrix:** The Structural Self-Interaction Matrix formed in step-2 is converted into binary form replacing the different values of Structural Self-Interaction Matrix by either "0" or "1".

   V: (i,j) = 1, (j,i) = 0; **A**: (i,j) = 0, (j,i) = 1

   X: (i,j) = 1, (j,i) = 1; **O**: (i,j) = 0, (j,i) = 0

4. **Obtaining Final Reach Ability Matrix (FRAM)**: In FRAM transitivity of matrix is checked and in case of error found in transitivity, the error is located and is corrected.
5. **Level Determination:** The Final Reach Ability Matrix obtained in Step 5 is grouped into different levels on the basis of the dominance of factors in the problem. A number of iterations are done to make determine level
6. **Development of ISM model:** In this model the factors are arranged according to their level, factor of first level is placed at the top and the further levels are arranged in the descending order.
7. **MICMAC Interpretation:** The MICMAC analysis is done for showing driving and dependence power, it is represented in a graphical format.

V. RESULT

1. **Analysis of Factors (Elements) involved** : Total 09 factors have been identified through literature and practical approaches those influence the Queuing model.
2. **Structured Self Intersection Matrix:** Matrix have been developed to study the importance of factors involved in the bank queuing system.

TABLE-II : STRUCTURED SELF INTERSECTION MATRIX(SSIM) TO ANALYZE THE EFFECTS OF THE FACTORS ON BANK QUEUING.

FACTORS	9	8	7	6	5	4	3	2	1
1	V	O	O	O	A	A	A	O	
2	O	A	A	A	A	A	A		
3	V	A	A	O	O	A			
4	V	O	V	A	A				
5	V	O	V	O					
6	V	O	V						
7	V	A							
8	V								
9									

TABLE-III INITIAL REACHABILITY MATRIX FOR FACTORS AFFECTING THE BANK QUEUING SYSTEM.

FACTORS	1	2	3	4	5	6	7	8	9	
1	1	0	0	0	0	0	0	0	1	2
2	0	1	0	0	0	0	0	0	0	1
3	1	1	1	0	0	0	0	0	1	4
4	1	1	1	1	0	0	1	0	1	6
5	1	1	0	1	1	0	1	0	1	6
6	0	1	0	1	0	1	1	0	1	5
7	0	1	1	0	0	0	1	0	1	4
8	0	1	1	0	0	0	1	1	1	5
9	0	0	0	0	0	0	0	0	1	4
	4	7	4	3	1	1	5	1	8	**34** / **34**

TABLE-IV: FINAL REACH ABILITY MATRIX FOR THE FACTORS OF BANK QUEUING SYSTEM.

FACTORS	1	2	3	4	5	6	7	8	9	DRIVING POWER
1	1	0	0	0	0	0	0	0	1	2
2	0	1	0	0	0	0	0	0	0	1
3	1	1	1	0	0	0	0	0	1	4
4	1	1	1	1	0	0	1	0	1	6
5	1	1	1^t	1	1	0	1	0	1	7
6	1^t	1	1^t	1	0	1	1	0	1	7
7	1^t	1	1	0	0	0	1	0	1	5
8	1^t	1	1	0	0	0	1	1	1	6
9	0	0	0	0	0	0	0	0	1	1
DEPENDENCE POWER	7	7	6	3	1	1	5	1	8	39 / 39

TABLE-V ITERATION TO FIND LEVEL OF THE FACTORS THAT AFFECTS ON BANK QUEUING SYSTEM.

Sr.	Reachability Set	Attendance Set	Intersection	Level
1	1,2,9	1,2,3,4,5,6,7,8	1,2	2
2	2,9	1,2,3,4,5,6,7,8	2	2
3	1,2,3,9	3,4,5,6,7,8	3	3
4	1,2,3,4,7,8, 9	4,5,6,8	4,8	5
5	1,2,3,4,5,6,7,8,9	5,6,8	5,6,8	6
6	1,2,3,4,5,6,7,8,9	5,6,8	5,6,8	6
7	1,2,3,7,9	4,5,6,7,8	7	4
8	1,2,3,4,7,8,9	5,6,8	8	6
9	2,9	1,2,3,4,5,6,7,8,9	2,9	1

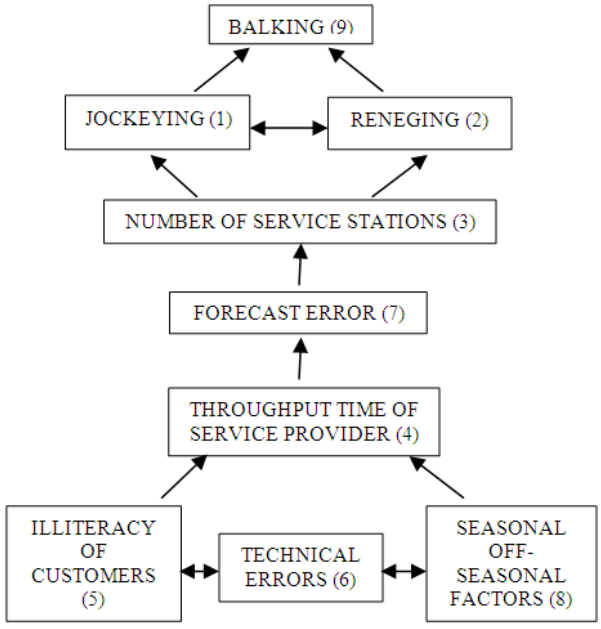
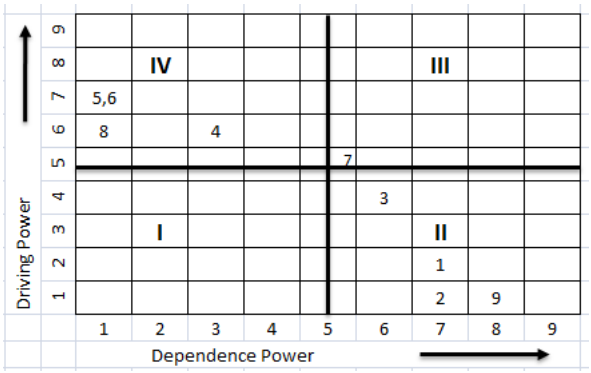


Figure-1 Hierarchical Structure of Interpretive Structural Modeling

TABLE-VI MICMAC ANALYSIS TABLE



VI. CONCLUSION

The main aim of this study is to identify the hierarchy of actions to be taken for handling different factors that affect the bank Queuing system. All the factors are arranged in this model on the basis of their relative importance. If these factors or causes are resolved, starting from the first level, it will greatly help in curbing the Bank Queuing system. From the model it is clear that Balking is the major phenomenon that must be taken care-of to control the complications in Queuing system in Bank. It is followed by Jockeying and Reneging which is yet another important factor.

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