

# Ranking of Elements Negatively Influencing Application of Latest Methods in Library Sciences Using Interpretive Structural Modelling

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## ABSTRACT

*Libraries are the portals to all of the world's knowledge. For effective usage, they must be kept upgraded with time. This paper provides a holistic view of the main barriers which negatively influence the implementation of latest technologies in modern libraries. Fourteen barriers were initially recorded through a web based survey of various Information and Library Science journals and commentaries. The barriers were then refined using expert review questionnaire and then analyzed using the Interpretive Structural Modeling to identify the most dominant barriers hindering the implementation of latest methods in modernization of libraries. Moreover this methodology is efficient in pointing out the barriers based on dependence and driving power. This research can be of use in establishing high quality research methods by keeping track of the barriers that hinder the progression of library and information sciences in developing countries.*

**Keywords:** Barriers, ISM, Library Science, LIS, Research.

## 1. INTRODUCTION

In discussion of Information and library sciences, it is a striking fact that the effectiveness of libraries in contributing to the research quality has deteriorated in many countries due to some hurdles. In the present dynamic informative landscape, libraries face a lot of challenges due to rapid development of culture, education, technology, science etc. For maximum productivity, the factors hindering the advancement of libraries into quality research hubs must be carefully focused and known so as to plan strategically on the methods to overcome the barriers.

Ranganathan wrote a book titled the 'five laws of library science'. The term "library science" was popularized much later through this book[1]. Formal entry of LIS in higher education was in the form of a School of Library Economy in the USA in 1884 as a part of international movement towards systemizing library education at the time [2]. The past successful and unsuccessful experiences in the field of library sciences must be explored from multiple perspectives in order to develop all types of libraries more triumphantly. In general, barriers in this context can be understood as physical or immaterial "obstacles hindering, delaying or preventing access to information" [3].

## 2. LITERATURE REVIEW

In context of the situation in developing countries, Zakari Mohammed's work is relevant in highlighting the factors that obstruct the growth of LIS research in Nigeria. The barriers identified by the author, such as the poor dissemination of research data, lack of cross-disciplinary research collaboration, academic and professional ineptitude, inadequate funding, social indifference to research, and ineffective use of the knowledge and skills gained from doing research still appear to be common among most of the developing world[4]. “The volume of research needed to address the range of technologies, issues, and services facing us may overwhelm our capacity to respond” – this was stated by O’Connor and Park. Also related issues, such as the quality of the research, will continue to be a concern [5]. Kanwal Ameen quotes that in Pakistan, the public-sector education system is still very traditional which is largely based on textbooks and classroom teaching instead of resource-based learning, thereby not promoting critical thinking among students at any level of education [6]. The library collection is not adequate; the level of digital modernization and standardization is not high; resource sharing is not comprehensive enough; and the librarians overall qualities need to be enhanced [7]. Information sources available in print and services based on available collection of a single library weakened the traditional libraries. Access to information through secondary sources and having limited access points to search the information also became a factor to weaken the traditional libraries. Staff requirement was an issue as more repetitive tasks were involved in library functions and operations. Staff awareness and participation before installation is crucial for the successful implementation of new systems or services. The existing library staff should have computer literacy and professional experience and motivation for the involvement at all levels for developing new system/service.

## 3. RESEARCH METHODOLOGY

The paper is based on exploratory research techniques and web-based systematic literature survey. Available material on the internet was also explored. The paper has been classified on the basis of the theme and further the most suitable findings, which is useful for this study has been chosen. In this research, questionnaire based survey has been employed to understand the barriers negatively influencing application of latest methods in library sciences. The research on identification and ranking of barriers can be carried out in four stages:

STAGE 1: Secondary Literature Survey to identify barriers.

STAGE 2: Expert Review to refine barriers.

STAGE 3: ISM methodology to find the levels of barriers.

STAGE 4: Framing of ISM model.

### 3.1 Stage 1 -Summary of Barriers identified through Secondary Literature Survey

The variables which impact on the application of latest methods in library sciences can be divided into two sections. These are determinants of whether modernisation of libraries using required technologies will be successful or not. Depending on their actions, these variables can either act as drivers promoting entry or as barriers causing challenges to its embedment within the organization. Those actions which produce a positive result will be denoted by the term drivers and conversely those producing a negative effect as barriers. The literature search revealed a collated set of drivers and barriers to entry. As the present study deals with only barrier assessment of introduction of latest methods, the various barriers identified are listed below in table 1.

**Table1- Barriers Identified**

Sl.no	Barrier for implementation
1	Lack of seniors guidance
2	Lack of access to relevant literature
3	Lack of research culture and encouragement
4	Lack of coordination in research communities
5	Lack of critical thinking
6	Lack of research-oriented academic programs
7	Lack of synthesising and using the acquired knowledge
8	Lack of ICT Competencies
9	Lack of financial support
10	Lack of Socio-Cultural barriers
11	Institutional barriers
12	Lack of proper restoration
13	Lack of organizational working strategies
14	Deteriorating usage and applications

### 3.2 Stage 2 - Refining of Barriers through an Expert Review

The secondary literature survey resulted in identifying 14 barriers. These barriers were then refined through an expert review. The expert committee consisted of academicians, librarians from Engineering colleges and public libraries. As per expert suggestion, few of the variables were removed. A questionnaire was then prepared based on the final list of barriers and circulated among the experts. The final list of 7 barriers after elimination & modification of variables are given below in table 2.

**Table 2- Barriers Refined**

Sl.no	Barrier for implementation
1	Lack of peers'/seniors' guidance
2	Lack of access to relevant literature
3	Lack of research culture and encouragement
4	Lack of coordination in research communities
5	Lack of critical thinking
6	Lack of research-oriented academic programs
7	Lack of synthesising and using the acquired knowledge

### 3.3 Stage 3- ISM Methodology to Find the Levels of Barriers

First proposed by J. Warfield in 1973, interpretive structural modelling (ISM) is an effective methodology for dealing with complex issues. It enables individuals or groups to develop a map of the complex relationships between the many elements involved in a complex situation. 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 [8]. ISM is a combination of three modelling languages: words, digraphs and discrete mathematics, to offer a methodology for structuring complex issues. ISM is particularly useful and interpretive as judgment of working participants in a group for the study decides whether and how the variables are related [9]. The various steps, which lead to development of an ISM, are as follow [10]:

*Step 1:* identify issues/variables to be studied.

*Step 2:* then the contextual relationship among the variables identified in step 1, with respect to which pairs of variables are examined.

*Step 3:* to indicate pair wise relationship among variables, a structural self-interaction matrix (SSIM) is developed.

*Step 4:* from the SSIM a reachability matrix is developed. The matrix is checked for transitivity. The transitivity of the contextual relationships is a basic assumption made in ISM and it states that if variable X is related to variable Y and variable Y is related to variable Z, then variable X is necessarily related to variable Z.

*Step 5:* partitioning of levels is done of the reachability matrix obtained in Step 4.

*Step 6:* a directed graph is drawn based on the contextual relationships in the reachability matrix, and the transitive links are removed.

### 3.3.1 SSIM (Structural Self-Interaction Matrix)

As mentioned earlier in Section 3.2, with the consultation of librarians and the academia experts, the nature of the contextual relationships among the barriers was identified. Following four symbols have been used for developing SSIM to denote the direction of relationship between two barriers i and j:

- V—barrier ‘i’ will lead to barrier ‘j’;
- A—barrier ‘j’ will lead to barrier ‘i’;
- X—barrier ‘i’ and ‘j’ will lead to each other;
- O—barrier ‘i’ and ‘j’ are unrelated.

SSIM has been developed on the basis of contextual relationships in table 3.

**Table 3- SSIM (Structural Self-Interaction Matrix) Matrix**

Sl.no	Barrier for implementation	2	3	4	5	6	7
1	Lack of peers'/seniors' guidance	V	V	V	V	V	A
2	Lack of access to relevant literature		V	V	O	O	V
3	Lack of research culture and encouragement			O	V	A	O
4	Lack of coordination in research communities				X	V	O
5	Lack of critical thinking					V	A
6	Lack of research-oriented academic programs						V
7	Lack of synthesising and using the acquired knowledge						

### 3.3.2 Reachability Matrix

The SSIM obtained from the previous section is converted into initial reachability matrix, which is a binary matrix, by substituting V, A, X, O by 1 or 0 and using following rules:

- The (i, j) value in the reachability matrix will be 1 and (j,i) value will be 0, if (i, j) value in the SSIM is V.
- The (i, j) value in the reachability matrix will be 0 and (j, i) value will be 1, if (i, j) value in the SSIM is A
- The (i, j) and (j, i), both values will be 1 in the reachability matrix, if (i, j) value in the SSIM is X.
- The (i, j) and (j,i), both values will be 0 in the reachability matrix, if (i, j) value in the SSIM is O.
- The initial and the final reachability matrices are shown in Table 4 and Table 5 respectively.

### 3.3.3 Level's Partitioning

The level's partitioning is done to get the importance level of each barrier. From the final reachability matrix, the reachability and antecedent set [11,12] for each barrier have been obtained. The reachability set of a barrier is the set of barriers influenced by it and the barrier itself, whereas the antecedent set of a barrier is the set of barriers which may influence it and the barrier itself. Reachability set, antecedent set and intersection sets for all the barriers have been found. In the ISM hierarchy, the barrier having same reachability and intersection has been assigned as level 1 barrier-top level.

Level 1 is then discarded for the next iteration to find further levels. This iterative procedure is repeated till the level of each barrier is found. These levels have been summarised in table.

**Table 4- Initial Reachability Matrix**

Sl.no	Barrier for implementation	1	2	3	4	5	6	7
1	Lack of peers'/seniors' guidance	1	1	1	1	1	1	0
2	Lack of access to relevant literature	0	1	1	1	0	0	1
3	Lack of research culture and encouragement	0	0	1	0	1	0	0
4	Lack of coordination in research communities	0	0	0	1	1	1	0
5	Lack of critical thinking	0	0	0	1	1	1	0
6	Lack of research-oriented academic programs	0	0	1	0	0	1	1
7	Lack of synthesising and using the acquired knowledge	1	0	0	1	1	0	1

**Table 5- Final Reachability Matrix**

Sl.no	Barrier for implementation	1	2	3	4	5	6	7
1	Lack of peers'/seniors' guidance	1	1	1	1	1	1	1
2	Lack of access to relevant literature	1	1	1	1	1	1	1
3	Lack of research culture and encouragement	0	0	1	1	1	1	0
4	Lack of coordination in research communities	0	0	1	1	1	1	1
5	Lack of critical thinking	0	0	1	1	1	1	1
6	Lack of research-oriented academic programs	1	0	1	1	0	1	1
7	Lack of synthesising and using the acquired knowledge	1	1	1	1	1	1	1

### 3.4. Stage4- Framing of ISM Model

Once all levels are found, these levels have been summarized in Table 6. From the final reachability matrix Table 5, the model is generated by vertices and edges [13].

In this model development, the top level factor is positioned at the top of the digraph and second level factor is placed at second position and so on, until the bottom level is placed at the lowest position in the digraph. Digraph is converted into an ISM model by replacing nodes of the factors with statements [14].

Table 6-Variou Level of Barriers

LEVEL	BARRIERS
1	Lack of critical thinking, Lack of research oriented academic programs, Lack of research culture and encouragement
2	Lack of synthesising and using acquired knowledge, Lack of coordination in.
3	Lack of senior guidance, Lack of access to relevant literature

Out of 7 barriers, two are lying at the bottom level,three are lying at top level and two at the intermediate level of ISM model. After removing the transitivity's as described in the ISM methodology, ISM model has been made as shown in figure 1.

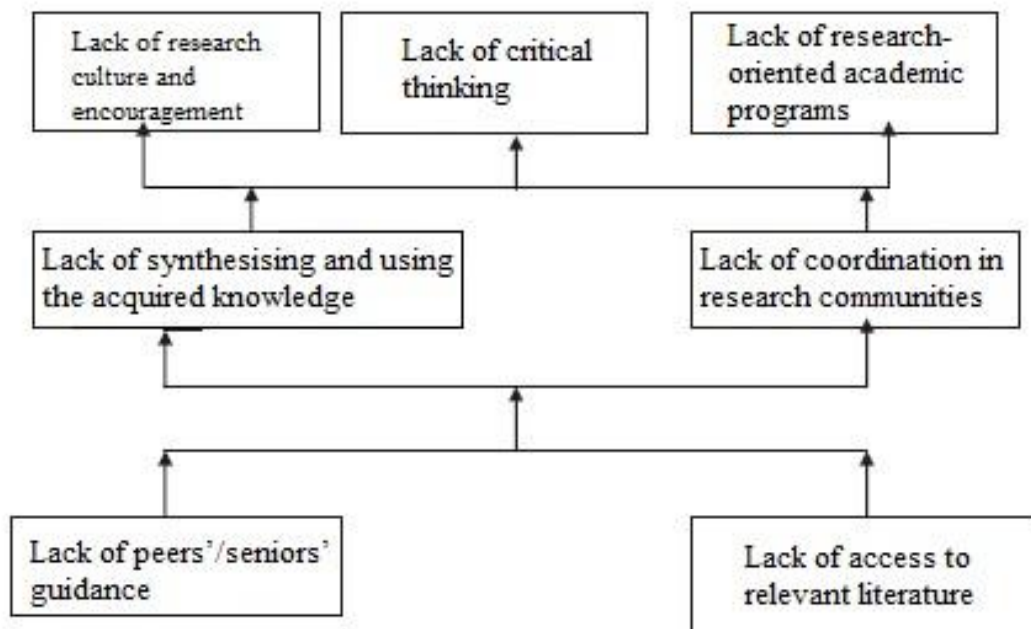


Fig 1:ISM Model for Barriers Negatively Influencing Application of Latest Methods in Library Sciences Using Interpretive Structural Modelling

#### 4. CONCLUSIONS

The analysis done in this paper demonstrates that lack of senior guidance and lack of access to relevant literature form the basic seeds of all the barriers that hinder the application of latest methods in modernisation of libraries. This means that they are the driving barriers and overcoming those barriers will considerably reduce the impact of the above barriers. The barriers selected in this paper are through secondary literature survey which maybe incomplete or their relations can differ from the derived model. The ISM model obtained here gives the interaction of the various barriers which can be used by organizations to make tactical decisions in adopting suitable methods to modernise the libraries using latest technologies.

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