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## **Model Development as a Research Tool: An Example of PAK-NISEA**

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### **Introduction**

Research is an inquiry process that has clearly defined parameters and has as its aim the discovery or creation of knowledge, or theory building; testing, confirmation, revision, refutation of knowledge and theory; and/or investigation of problem for local decision making (Hernon, 1991). Leedy and Ormrod (2001) put it as “the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested”.

Research provides theoretical foundations for any discipline and helps in its development. Unfortunately, research in librarianship is still in its embryonic stage and lack a body of knowledge (evidence based). Keeping this in view, Haddow (1997) stressed that if librarians fail to build a body of knowledge, it will be difficult to develop this profession. The status of librarianship’s intellectual base, the degree of scholarship, must be regarded with some suspicion. Librarians should actively seek to address these criticisms by adding their research to the growing body of knowledge. Similarly, Busha and Harter (1980) have pointed out that if librarianship is to merit the in demand designation “science,” a significant number of scholars and research workers must regularly apply scientific method to analyze relationships among the problems which librarians are obligated to explore and which they are qualified to solve. Moreover, the study of library science can attain recognition as a true science only when a general body of theory is developed.

### **Research Methods Used in Librarianship**

Koufogiannakis and Crumley (2006) have reviewed the current trends of research in librarianship and found that there are several areas which contain more research than others. Consistently, topics in information storage/access/retrieval have greater amounts of research being published, as do collections-related issues, and service activities. On the other hand, the areas of information seeking, LIS analysis, LIS education, LIS theory, history, methodology, the profession, publishing and scientific and professional communication all have less research being published. There are huge gaps in our evidence base in these latter areas and they all require further exploration to move our profession forward. Busha and Harter (1980) and Powell and Connaway (2004) have listed many research methods which are currently used in librarianship. For example:

## **Experimental Research**

It is a research method, in which the researcher attempts to maintain control over all factors that may affect the result of an experiment. In doing this, the researcher attempts to determine or predict what may occur (Key, 2002). It is a collection of research designs which use manipulation and controlled testing to understand causal processes. Generally one or more variables are manipulated to determine their effect on a dependent variable (Experiment-Resources.com, 2009).

## **Survey Research**

Survey research is one of the most important areas of measurement in applied social research. The broad area of survey research encompasses any measurement procedures that involve asking questions of respondents. Surveys can be divided into two broad categories: the questionnaire and the interview. Questionnaires are usually paper-and-pencil instruments that the respondent completes. Interviews are completed by the interviewer based on what the respondent says (Trochim, 2006b).

## **Historical Research**

Sometimes we gain the best knowledge by looking into the past rather than into the future. Historical research attempts to do just that. Through a detailed analysis of historical data, we can determine, perhaps to a lesser extent, cause and effect relationships. Historical research can also mean gathering data from situations that have already occurred and performing statistical analysis on this data just as we would in a traditional experiment. The one key difference concerns the manipulation of data. Since historical research relies on data from the past, there is no way to manipulate it. Therefore, historical research can often lead to present day experiments that attempt to further explore what has occurred in the past (AllPsych & Heffner Media Group, 2003).

## **Operations Research**

Operations research (OR) is the application of scientific method to management operations in an effort to aid managerial decision-making. Techniques of operations research are concerned with the activities of organizations, or systems, and are designed to provide management with a quantitative basis for decision making (Busha & Harter, 1980).

## **Additional Research Methods in Librarianship**

*Observation and Description:* Gorman and Clayton (2005) define observation studies as those that "involve the systematic recording of observable phenomena or behavior in a natural setting" (p. 40). It is a branch of anthropology that deals with the scientific description of specific human cultures and has a long history. It permits researchers to study people in their native environment in order to understand "things" from their perspective. Until recently, few library and information science studies have included this method; however, observation is gaining favor as LIS researchers seek to understand better the role of information in people's everyday lives (Free Library, 2009).

*The Case Study Method:* Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. Researchers have used the case study research method for many years across a variety of disciplines. Social scientists, in particular, have made wide use of this qualitative research method to examine contemporary real-life situations and provide the basis for the application of ideas and extension of methods (Yin, 1984).

*Library User Studies:* According to King (2005), information needs and expectations are continuously changing in the rapidly changing information scenario. Libraries need to re-orient their collections, services, and facilities to keep pace with these advancements. User feedback is considered as a more reliable factor in measuring the utility and effectiveness of any library. By making user surveys a regular part of the library's functions, librarians can provide a comparative 'snapshot' of usage in various temporal contexts.

*Evaluation Research:* Evaluation is a methodological area that is closely related to, but distinguishable from more traditional social research. Evaluation utilizes many of the same methodologies used in traditional social research, but because evaluation takes place within a political and organizational context, it requires group skills, management ability, political dexterity, sensitivity to multiple stakeholders and other skills that social research in general does not rely on as much (Trochim, 2006a). According to Busha and Harter (1980), studies conducted to obtain objective and systematic evidence of the success or failure of library project and programs are often categorized as evaluation research. When a program is evaluated, its relative effectiveness in terms of standards, goals, and objectives is determined and described.

*Library Surveys:* Research studies designed to survey library conditions and services with an aim of improving their overall quality. Between 1930 and 1950, the library survey was among the most frequently used methods to observe, analyze, compare, and describe general conditions in and related to libraries. Many such efforts were status surveys, designed primarily to merely evaluate library conditions rather than to test hypothesis or to explore specific research questions thoroughly (Busha & Harter, 1980).

*Community Surveys:* Closely related to library survey is another descriptive approach-the community survey. Designed to allow careful inspections of the characteristics of communities and to relate the features to library goals and objectives, community surveys are attempts to obtain a detailed working knowledge of various pertinent dimensions, geographic areas, or publics served by libraries. A purely *descriptive community survey* is designed to characterize properties and conditions of a group of people living or working together in a district or within an institution. An exploratory community survey devotes attention to interrelationships between these characteristics and the use of various library resources, programs, and services. Some community surveys are attempts to accomplish both of these tasks (Busha & Harter, 1980).

*Comparative Librarianship:* It is a systematic analysis of library development, practices, or problems as they occur under different circumstances (most usually in different countries)-considered in the context of the relevant historical, geographic, political, economic, social, cultural, and other determinant background factors found in the situations under study (Collings, 1971).

*Content Analysis:* Content analysis is a research tool used to determine the presence of certain words or concepts within texts or sets of texts. Researchers quantify and analyze the presence, meanings and relationships of such words and concepts, then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of which these are a part. Texts can be defined broadly as books, book chapters, essays, interviews, discussions, newspaper headlines and articles, historical documents, speeches, conversations, advertising, theater, informal conversation, or really any occurrence of communicative language. To conduct a content analysis on any such text, the text is coded, or broken down, into manageable categories on a variety of levels--word, word sense, phrase, sentence, or theme – and then examined using one of content analysis' basic methods: conceptual analysis or relational analysis (Colorado State University, 2009).

*Delphi Method:* Collaborative estimating or forecasting technique that combines independent analysis with maximum use of feedback, for building consensus among experts who interact anonymously. The topic under discussion is circulated (in a series of rounds) among participating experts who comment on it and modify the opinion(s) reached up to that point (BusinessDictionary.com, 2009).

*Documentary Research:* Documentary research is the use of outside sources to support the viewpoint or argument of an academic work. The analysis of the documents in documentary research would be either quantitative or qualitative analysis (or both) (Balihar, 2007). It involves the use of texts and documents as source materials: government publications, newspapers, certificates, census publications, novels, film and video, paintings, personal photographs, diaries and innumerable other written, visual and pictorial sources in paper, electronic, or other 'hard copy' form (Scott, 2006).

*Model:* Another method or device often used by scientists is the model, a verbal, mathematical, or graphical construct representing a phenomenon (Busha & Harter, 1980).

### **Model Development: A Challenging Research Method for LIS Researchers**

Model development is considered an effective research method. It assists investigators and scientists in relating more accurately to reality; it also aids them to describe, predict, test or understand complex systems or events. Thus, models often provide a framework for the conduct of research and might consist of actual objects or abstract forms, such as sketches, mathematical formulas, or diagrams. A model is an abstraction, a mental framework for analysis of a system. It involves simplified representations of real-world phenomena (Busha & Harter, 1980; Powell & Connaway, 2004, p. 60). In general terms different authors suggested the importance of:

A theoretical framework for the definition, criteria and characteristics of models;

- Practical guidelines that describe the procedural aspects of model building;
- The availability of data defining the factual situation for the model which is being constructed (Deal, 1986; Adeyemi 1975).

### **Characteristics of Models**

According to Leimkuhler (1972), following are the characteristics of models:

- Relatedness, to other models and techniques;
- Transparency, in terms of ease to interpretation;
- Robustness or sensitivity to assumption made;
- Fertility or richness in deductive possibility;
- Ease of enrichment or ability to modify and expand.

### **Important Role of Models in Research**

Models have an important role in research. These can be applied in research in terms of theoretical constructs (Adeyemi, 1975); testing and understanding multifaceted system (Busha & Harter, 1980); and creating connections between research and society (Weiss, 1979). Models provide guidance for the completion of work or the establishment of systems and refer to a representation of a real world phenomenon.

A model is a representation or abstraction of an actual object or situation. It shows the interrelationships (direct or indirect) and interrelationship of an action and reaction in terms of a cause and effect. Since a model is an abstraction of reality, it may appear less complex than reality itself. The model, to be completed, must be representative of those aspects of reality that is being investigated (Adeyemi, 1975, p.50). Busha and Harter (1980) have stressed that when models have not been properly validated, their employment as a knowledge source might be unwarranted. In addition, unless care is taken, models often invite overgeneralizations.

## Use of Model Development in LIS Research in Pakistan

Very few efforts were made for developing and proposing models at doctorate level LIS research in Pakistan. The efforts made include, a plan proposed by Khan (1991) to be executed under the aegis of University Grants Commission (Now known as Higher Education Commission) to overcome the problems faced by the university libraries in terms of inadequate materials and collections; slow and outdated technical processing; shortage of funds; lack of manpower in quantity and quality; absence of coordinated planning and lack of government attention; and social urgency. Khalid (1997) argued that co-operation and networking in library and information systems are frequently applied in developed countries. These countries are getting maximum benefits from these systems. Contrarily these systems are less used in developing countries. Keeping this gap in view, Khalid proposed a model for the initiation of cooperation and networking in countries with less developed systems. Similarly, Mahmood (2004) proposed an 'Alternative Funding Model for Libraries in Pakistan'. He argued that to improve library services in Pakistan, libraries need adequate finance, which is not available at the moment from the traditional sources. This study is directed towards finding alternative sources of funding.

Other LIS professionals who have registered in PhD program and are working to develop a model include, Khawaja Mustafa working on "A model for network of health science libraries in Karachi" and Syed Ataulah working on "Digital library initiatives in Pakistan: A proposed digital library model for the Aga Khan University" (Haider & Mahmood, 2007).

### Model Development Approach for Proposing PAK-NISEA (Pakistan National Information System for Educational Administrators)

In view of the significant global changes in almost every aspect of modern life brought about by the science and technology, the role of education is increasing by being re-defined. In the new situation education has come to be acknowledged as a vital factor for human development, which is the core of all developmental efforts. Developed world achieved extraordinary socio-economic and technological development because of the realization that education is an asset and that a sound educational system is vital, which is capable of producing better human resources and could help in recognition of better economic and social goals.

In the process of development, education is, therefore, an investment. This investment has to be made well in time to get full benefits from the overall development efforts. Free flow of information is obviously an essential requirement for achieving educational goals and objectives. Educational administrators require various types of information and data for efficiently carrying out their official assignments. They can only do this in a context which allows them to access, use, validate and communicate required information. In this context, a number of factors are influencing building up of a sound and reliable educational structure but the key factor is the user centered/user friendly information system for educational administrators which is a neglected connection in Pakistan's national scheme of things. On the other hand, yet no comprehensive study at the national or provincial level is conducted to find out the information needs and seeking behavior of educational administrators which can assist in designing an effective, efficient and user centered information system for educational administrators at national level. Keeping this wide gap in view, this study aimed at finding the information needs and seeking behavior of educational administrators and proposing a comprehensive and well integrated user centered/friendly national information system for educational administrators for desired transformation in the education of Pakistan. Following are the objectives of the study:

1. To review the existing information system of education in some developed and developing countries.
2. To review the existing educational system and information system of education in Pakistan.
3. To study the information needs and seeking behavior of educational administrators.
4. To propose a model for the national information system for educational administrators in Pakistan.

- To validate the proposed model.

Flow chart presented in figure 1 shows the research methodology of the study.

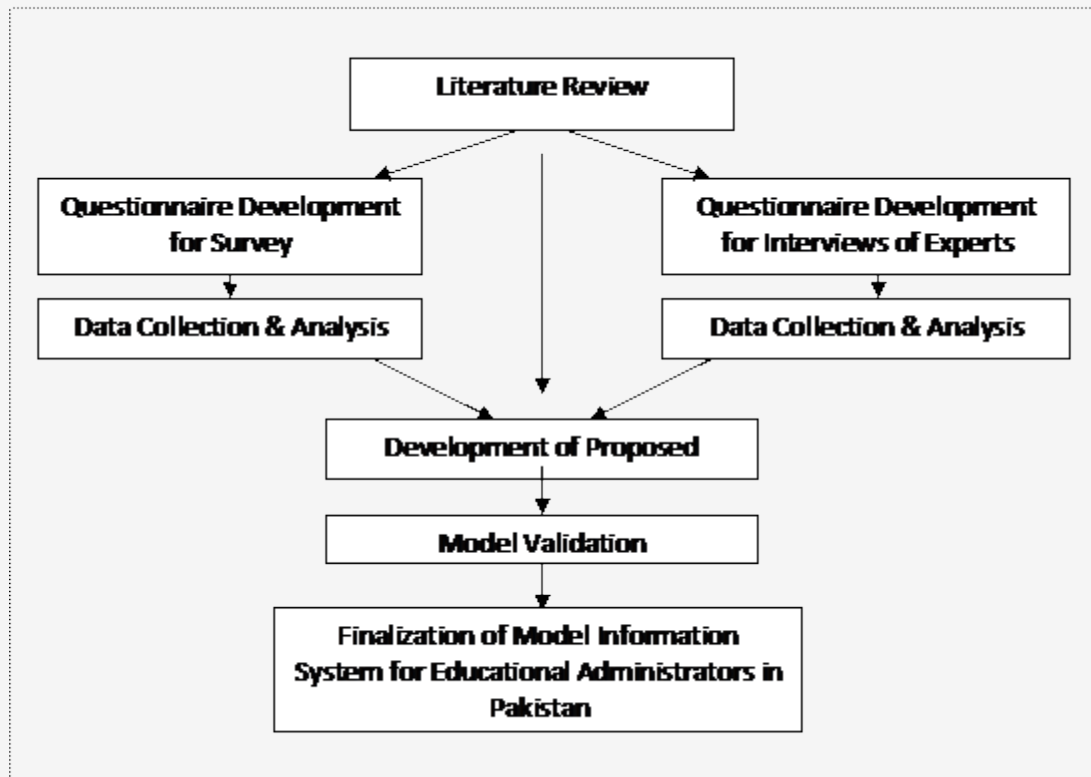


Figure 1. Flow Chart of the Research Methodology

## Model Development Process

This section explains the process of model development including procedures used for literature search, instrument development, data collection, and analysis.

### Literature Review

To understand different theoretical and practical aspects of the study, a thorough search of the relevant literature was conducted. For this purpose, different aspects of information system were reviewed in detail. Literature related to education system of Pakistan; information systems especially in education at international and national level; user studies conducted for finding the information needs and seeking behavior of intended users especially educational administrators; role of such studies in the development of effective information systems and their implementation were collected and reviewed thoroughly. For literature search standard sources were used e.g., Library literature, theses, online resources.

### Survey

Keeping in view the objectives of the study, a selected group of experts from the public sector institutes, who, in their discharge of day to day administrative work, had to depend upon the information system in education, were identified with the help of reviewed literature and discussion with experts. The



educational administrators i.e., Registrars/ deans/ heads of departments in universities and principals of schools and colleges were identified as the target population for the questionnaire survey. The respondents were from the Punjab province and Islamabad Capital Territory (ICT). The choice of the Punjab for the questionnaire survey and interviews is based on three main grounds: (1) The researcher is based in Punjab and logistic support for the PhD fieldwork was most conveniently available in this region; (2) Circumstances in Balochistan and NWFP provinces are not in favor of field survey; (3) The province is home to over half the population of Pakistan. About 50% educational institutes are situated within Punjab province and Islamabad Capital Territory (ICT).

For sampling purpose the Punjab province was divided into clusters and sub clusters and each district was designated as a primary cluster. It was tried to get response from each district. Then each district was divided in sub clusters i.e. tehsils. Sub clusters (tehsils) were randomly selected. Elements (i.e. schools, colleges and universities) were selected according to a defined criterion. To get the reasonable response, 300 (in total) responses were targeted from three groups of respondents i.e. schools, colleges and universities. Three separate questionnaires for school, college and university administrators along with cover letter were distributed through mail, email and personal visits. Many follow up letters, emails, telephone calls and personal visits made the achievement of 97.6 percent response possible. The quantitative data were analyzed with the help of SPSS version 15. Descriptive statistics such as Mean, Mode, Median, Standard Deviation etc. were used. Further inferential statistics such as Paired Sample T-test, ANOVA and MANOVA were used to reach at conclusions.

## **Interviews**

Semi structured interviews were also conducted. Sample for interviews was chosen through purposive sampling. Interview of three different categories of experts were conducted i.e., educational administrators (i.e., ex Vice Chancellors, EDOs, DEOs, Deputy Chiefs of Education in Planning Commission of Govt. of Pakistan etc.); Information and library professionals (working on executive positions of well known institutes); and Information system experts. In total 55 interviews were audio recorded. The data acquired through open ended questions and interviews; were analyzed qualitatively. These interviews and review of the related literature helped in the overall understanding and designing of the system. A pilot study was conducted to assess the reliability and validity of the instruments developed for the study.

## **Important Features of the Proposed Model**

*Centralization:* Due to its characteristics of reduced duplication, utilization of resources, more centralized control and better standardization, the proposed model is centralized. Interview with information system, and library and information science experts made it very clear that the proposed model should be centralized.

*Pooling the Existing Information Systems/Services:* Keeping in view, the interview findings and existing practices of the world information systems, the proposed information system will pool the existing information systems and services.

*Access and Services based on Knowledge Environment Model:* Keeping the survey and interview findings in view, the proposed products, services and access will be based on the knowledge environment model. Keeping in view the diversity of information needs of different level of educational administrators, the proposed system seeks to offer both a sophisticated technological environment and also a more traditional set of services.

*Development in Phases: The use of Spiral Model Approach:* All three categories of interview respondents mentioned that as the proposed model will cover all three levels of education i.e. school, college and university education, thus the model should emerge in phases and with the successful

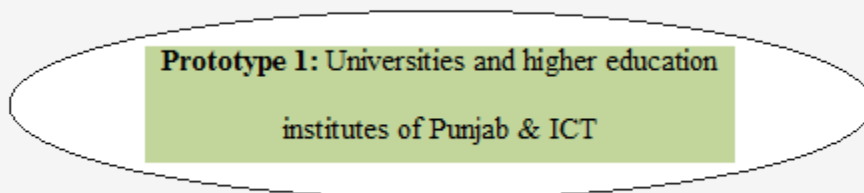


completion of one phase, the other should be started. The approach for this purpose used is “Spiral Model” in which the objectives, alternatives and constraints are determined, mechanism is developed for risk analysis, and then prototypes (sample models) are developed and implemented. If successful, the next level plan is developed and executed.

*Clearly Defined Objectives and Activities of PAK-NISEA:* The new system requirements are defined in the coming section, after a comprehensive system study of the various education enterprise processes in Pakistan, in as much detail as possible. It involved survey and interviewing internal and external users, preparation of detailed flow diagrams showing the process or processes for which the IS is to be developed, the inputs and outputs in terms of how the data is to be recorded/ entered and the form in which the results are to be presented. Following are the objectives of the proposed model:

- To provide information with easy access
- To provide update and current information in the field of education
- Training of Educational Administrators
- To ensure availability of valid, reliable and needed information
- Training of other staff members i.e., Information providers/librarians etc.
- To have linkage within educational institutes of the country
- To provide information according to the administrators’ specific needs
- To develop and maintain an online full text database of educational documents related to administrators’ information needs
- To generate and maintain adequate media of information
- To have linkage within educational information systems of the world.

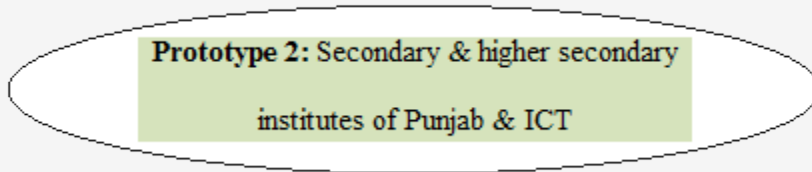
*Risk analysis: Ongoing monitoring, maintenance and evaluation:* It is important part of the system development from initial stage to complete implementation of each step. It includes addressing any factors which may risk the successful completion of entire project of PAK-NISEA development including alternative strategies and constraints. *Prototyping:* Based upon the finalized strategy and the preliminary design, the first prototype (sample model at a small scale) of the new system will be developed.



*Prototype 1: PAK-NISEA Phase I*

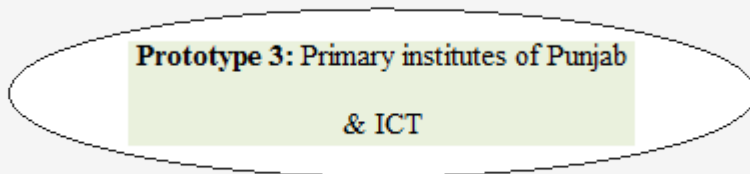
The system will be developed in phases. As a first prototype only the system will prepare a module for higher education sector of the Punjab province and Federal Area of Pakistan. As the results of the survey and reviewed literature reveals that universities are fewer in number and enjoying better ICT facilities so the first prototype would cover higher education sector only.

*Development and verification of next-level product:* The prototype prepared will be tested against benchmarks based on end users’ expectations and evaluated risks to verify the various aspects of the development. Refinements and rectifications of the prototype will be undertaken until target users’ satisfaction is achieved before development of the next level of the system.



*Prototype 2: PAK-NISEA Phase II*

The second prototype will cover a module for secondary & higher secondary education sector of the Punjab province and Federal Area of Pakistan. The prototype 2 will be tested and verified.



*Prototype 3: PAK-NISEA Phase III*

The third prototype will cover a module for primary education sector of the Punjab province and Federal Area of Pakistan. The prototype 3 will be tested and verified.

*Plan of next phase for other provinces:* The preceding steps are iterated until the end user is satisfied that the refined IS represents the final product desired. The final IS will be constructed based on the refined prototypes. The final system (An information system for Punjab Province and Federal Area of Pakistan, covering school, college and university sectors) will be thoroughly evaluated and tested. Routine maintenance will be carried out on a continuing basis to prevent large-scale failures. In the next phase of the plan applying above three prototyping approaches the NISEA will be developed in NWFP & AJK, Sindh, and Baluchistan provinces as well. A final product will be a National Information System for Educational Administrators in Pakistan.

### **Components of PAK-NISEA**

The components of the proposed information system include: a) geographic acquisition and distribution coverage and type of information acquired, b) primary users, c) media classification, d) information acquisition, e) information selection, f) information processing, g) information storage, h) products and services, and i) management structure and funding.

### **Validation of the Model**

The draft model is sent to the experts of education, information system and library and information science for validation. For this purpose some national and international experts/professionals, who are well known in their respective fields were contacted through mail/e-mail and were requested to give their comments on the draft of proposed model. Observations received will be qualitatively analyzed and ideographically summarized (Till the writing of this paper, the model is in validation phase). In the light of experts' opinion, necessary amendments will be made to the model before final presentation in the dissertation.

### **Conclusion**

The model development is an effective research method which provides a logical guideline to the researchers in proposing any new system or services etc. This tool helped, in this study, to propose a user centered/friendly information system for educational administrators in Pakistan. Following recommendation are made on the basis of this study:

As research provides theoretical foundations for any discipline and helps in its development, the LIS professionals should engage themselves in research for the development of their profession.

- Model development has proved to be an effective research tool. It should be used more frequently in LIS research as well. LIS researchers in Pakistan should pay special attention on it.
- The example of PAK-NISEA explains the logical steps of model development. Other researchers should take help from this experience.

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