State of the Art Review

Account of methodologies and methods applied in LIS research: A systematic review

Ahsan Ullah[a,*], Kanwal Ameen[b]

[a] Government Degree College, Pindi Bhattian, Hafizabad, Pakistan
[b] Department of Information Management, University of the Punjab, New Campus, Lahore, Pakistan

A B S T R A C T

The use of appropriate methodology is a necessary component of reliable and valid research. A comprehensive account of methods used in library and information science (LIS) research was conducted using quantitative systematic review. Exhaustive searching techniques were employed to gather relevant literature. Of this body of work, more than half did not develop or apply a taxonomy of methods. By contrast, this review used three taxonomies to categorize methods. The findings reveal that empirical, descriptive, and quantitative research methodologies were used in that majority of LIS research. Survey was the most widely research method and descriptive statistics were used by majority of LIS authors for data analysis. This review contributes a comprehensive list of methodologies and methods used in LIS research and can help to identify strengths and gaps in the use of methodology. Documentation of methods used in LIS research can help the research community make decisions about future practice in the areas of methods, measures, and reporting.

1. Introduction

The application of methodologies and methods in library and information science (LIS), as with other disciplines, has changed a great deal during the last four decades. The development of LIS as a discipline "was strictly connected to descriptive methodologies, aimed at meeting the challenges posed by professional practice through empirical strategies of a professional nature" (Risso, 2016, p. 74). With the passage of time, LIS authors have started to use more sophisticated methodologies.

Studies which explore the use of methodologies typically take two approaches. Firstly, individual studies are selected and examined for their use of methods by using content analysis, systematic review, or bibliometrics. In the second approach, the findings from the literature are reviewed and synthesized. In studies in LIS, the majority of authors have examined individual pieces of published research (first approach) when exploring the use of methods. Only a few authors have reviewed and synthesized the results, but these largely report the state of methodological trends in sequential narrative sections (Powell, 1999; Risso, 2016; Rochester & Vakkari, 1998).

Powell (1999) reviewed LIS research literature by dividing it into comprehensive works and specific sub-fields, and arranged the results in chronological order. He analyzed only research methods and did not discuss data analysis techniques. Risso (2016) considered only the broad LIS field, ignoring specific sub-fields. He acknowledged the existence of large lists of such studies but restricted the analysis to avoid overwhelming the audience. To illustrate progress and development in the use of research methods, he analyzed LIS articles in chronological order without making thematic categories. Rochester and Vakkari (2008) reviewed and compared the results of methods applied in selected countries, including Nordic countries, Spain, Turkey, Australia, China and UK.

The narrative review approach adopted in these three studies makes it difficult to integrate the findings and extrapolate from them. By contrast, the present study synthesizes similar data across studies and also contributes a useful categorization of results to shed light on the use of methodology in LIS research.

1.1. Problem statement

Knowledge of methods used in a particular discipline is invaluable for researchers who want to choose among appropriate methods in the conduct of reliable and valid research. Existing reviews of LIS methodology do not lend themselves to being examined in the aggregate. Some are presented in chronological order and some do not present replicable search criteria for the collection of literature and lack pre-set inclusion and exclusion criteria. The scope of some reviews is limited to a comparison of a few nations or synthesis of findings of only comprehensive or specific area studies. There is also a need to explore the

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* Corresponding author.
E-mail address: ahsanullah_libr@yahoo.com (A. Ullah).

popularity of various research methodologies and methods used over time (Rochester & Vakkari, 1998). The present research synthesizes exhaustive evidence about the use of methods and presents results in an integrated manner. Replicable search strategy and pre-set inclusion and exclusion criteria are also applied to synthesize similar results. The purpose is to present more comprehensive set of results, but in a manner which will not overwhelm readers.

This study is significant in several ways. The presentation in one comprehensive set of results helps in exploring the practice of methodology use across the LIS discipline over time. The results may serve as a comprehensive account of methods and can be used to identify strengths and existing gaps in the use of methodology in LIS (McKibbon, 2006). Also, an accumulated account about the use of methodology can serve as groundwork for researchers as they look at new questions (Matteson, Salamon, & Brewster, 2011).

The following research questions drive the study:

1. What types of LIS literature are explored in studies of methodologies and methods?
2. What time span has been explored?
3. What research methodologies are applied in LIS research?
4. What methods are used for collection and analysis of data?
5. What kinds of statistical analyses are adopted?

2. Literature review

2.1. Methodology and method

Methodology is "the collection of methods or rules" applied to conduct research about a particular problem and the aggregation of "principles, theories and values" that govern the entire path to research (Somekh & Lewin, 2005, p. 346). Research methodology, research strategy, research design and research approach are different terms used interchangeably for methodology. Research design or methodology "serves as the architectural blueprint of a research project, linking data collection and analysis activities to the research questions and ensuring that the complete research agenda will be addressed" (Bickman & Rog, 2008, p. 11). Research methods are "specific strategies and procedures for implementing research designs including samplings, data collection, data analysis and interpretation of findings" (Teddlie & Tashakkori, 2009, p. 21). Blaxter, Hughes, and Tight (2006) make a key distinction between method and methodology. According to them, method mainly relates to the tools and techniques related to collection and analysis of data (such as questionnaires or interviews) but methodology takes a philosophical view of the problem and is an "approach or paradigm that underpins the research" (p. 58).

2.2. Reviews of use of methodologies and methods

Rochester and Vakkari (1998) compared national trends in the use of research methods in LIS literature and further compared these with the methods used in the international literature explored by Järvelin and Vakkari (1993). Of the seven studies compared by Rochester and Vakkari, five reported on the use of methods in Spain, Turkey, Australia, China, and the UK, one looked at Nordic countries, and one was not restricted to any specific region. They found that "survey method was popular internationally and nationally, as was the historical method and the conceptual" (Rochester & Vakkari, 1998, p. 172). Experimental or qualitative methods, which are frequently used in other disciplines, were found to be less frequently used in LIS.

Powell (1999) categorized a selected group of studies into two sets: comprehensive and area specific reviews. Four studies (Blake, 1994; Feehan, Gragg II, Havener, & Kester, 1987; Peritz, 1980; Schlachter & Thomison, 1982) were considered to be comprehensive reviews; two explored methodologies in dissertations and other two considered journal articles. Examples of specific area reviews included Callison

(1997, school library media), Goodall (1996), public library research), and Julien (1996, information needs and uses literature).

There are few large-scale systematic reviews or meta-analyses in LIS, largely due to "the difficulty in accumulating results involving variables related to the same research problem across studies and the lack of appropriately measured variables related to the same research problem across studies so that the results can be combined meaningfully" (Ankem, 2005, p. 165). Ankem (2008) evaluated seven systematic reviews and five meta-analyses published in LIS journals from 1996 to 2006. She considered methods used for identification of studies, inclusion and exclusion criteria, quality assessment, data extraction, and synthesis. All the reviews investigated topics in the area of medical librarianship or medical information. Data sets used by review authors included both qualitative and quantitative studies but Ankem advised that quantitative and qualitative data sets should not be synthesized in the same set of results. Multiple quality assurance criteria were used to ensure quality standards but rigor was not always apparent. Authors of systematic reviews and meta-analyses were found to be concerned about the lack of availability and the dispersion of existing results. Ankem recommended the use of inferential statistics to find correlation in the data sets.

Risso (2016) compiled an annotated bibliography of seminal works produced from different countries and social contexts and demarcated the studies into different decades starting from the 1970s. There was not a great variety in methods. Survey and content analysis were universally popular, while historical method was not. Countries were at different stages of development in LIS research. Social contexts, such us cultural and economic conditions, were found to influence the use of method and theory in research. The emergence of strong theoretical and methodological frameworks during the 1990s suggested a trend for future decades. Risso recommended that type and use of methods should be strictly defined.

3. Research design

3.1. Methodology and methods

A quantitative research approach was used, and a secondary data analysis method was adopted to synthesize findings across different studies. Secondary data analysis allows researchers to focus on analysis rather than data. Secondary data about the use of methodologies and methods was extracted from published literature reviews. Different kinds of reviews analyze and report secondary data in different ways. Narrative reviews lack summaries of whole bodies of knowledge. Systematic reviews compare secondary data numerically (McKibbon, 2006) while meta-analyses use statistical tests to synthesize secondary results across multiple studies (Saxton, 2006). Systematic reviews and meta-analyses synthesize and present results in a more integrated way as compared to narrative reviews (Cook, Mulrow, & Haynes, 1997).

Most of the selected publications present results about the use of methodologies and methods in terms of frequencies and percentages. Only a few studies applied statistical tests to explore relationships between methodology and other variables. In the present study, systematic review was used in order to promote an objective review of the numerical data related to use of methods. Defining the specific research questions, adoption of a replicable search strategy for collection of material, and stating pre-set inclusion and exclusion criteria for selection of the data set are important features of systematic review (Cook et al., 1997; Matteson et al., 2011) and are applied in the current study to reduce personal bias and enhance consistency and objectivity in findings.

3.2. Literature search

Multiple strategies, including searching multiple databases, tracking citations from relevant studies, seeking recommendations from experts,

and citation pearl growing (Matteson et al., 2011) were applied in gathering a comprehensive collection of relevant literature on the application of research methods in LIS research. Interactive scanning of the retrieved articles indicated that majority of the articles have investigated both the nature of LIS research topics and the use of methodology simultaneously. Authors of such articles did not tend to use the terms *methodology* or *method* in the title of the article. By contrast, articles which exclusively investigated methodology tended to have these terms in their titles. Many studies were conducted using content analysis and bibliometrics. Interactive scanning of search results revealed that the three terms *research, content analysis,* and *bibliometrics* were used more frequently in the titles of articles rather than *methodology* or *methods.*

Using the advanced search option available in Google Scholar (GS), four combinations of these terms (*research, library* and *content analysis; research, LIS* and *content analysis; research, library* and *bibliometric;* and *research, LIS* and *bibliometric*) were used to retrieve articles. These combinations retrieved 45, 5, 84 and 10 articles respectively. The combination of the three terms *research, method,* and *library* was also searched in titles in GS, yielding 149, of which the majority were related to discussions about methods. After the perusal of all of the results, 35 relevant articles were identified.

Forward citation chaining was conducted through GS for the retrieved 35 articles for identification of further studies. This citation chaining added only three more articles. Manual bibliographic searches were conducted on the 38 articles to find additional publications that fit the set criteria. Manual searching techniques expanded the results to 58.

Despite adopting comprehensive searching techniques, it is still possible that some studies may be missing from final sample. A complete list of articles selected for the current study appears in Appendix A.

3.3. Inclusion and exclusion criteria

When building a data set for examination, appropriate inclusion and exclusion criteria must be established to answer the question being asked (Matteson et al., 2011). The following inclusion criteria were applied for selection:

- journal articles which reported the use of methodologies and methods in LIS or a sub-domain;
- empirical research articles which used quantitative design for eliciting evidence about methodology and methods;
- in the English language; and
- published in scholarly journals, or as pre-print versions shared by authors on social media platforms or in repositories.

The following items were excluded:

- conference papers, dissertations and theses;
- articles which investigated the use of specific research methods or group of research methods such as ethnographic, theory use, cohort studies, etc.; and
- articles in which frequency or percentage was not presented. For example, frequencies about the use of methodologies and methods cannot be calculated from Zhang, Zhao, and Wang (2016), Yontar and Yalvac (2000) and Buttlar (1991), and so these were excluded.

3.4. Categorization and coding of results

Various taxonomies and taxonomy subcategories have been applied to explore the use of methodologies and methods. Most authors categorized results directly by method, such as content analysis, interview, and bibliometrics. Some authors used more elaborate taxonomies, including sub-categories. Categories and codes are interesting in

themselves in that they show the evolution and change in nomenclature of methodologies and methods. Categorization and coding in the present study were based largely on the taxonomies and codes used by authors in the articles, with modifications made so as to present results in an integrated manner. For example, interviews are categorized under one heading whether structured or un-structured, but focus groups are categorized separately.

3.5. Quantification

Authors presented their results typically as percentages, frequencies, or both. In cases of percentage only, percentages were converted into frequencies for the purpose of the present study. The data were entered into a spreadsheet. The overall frequency for each category of methodology and method was entered into one column. Frequencies were cumulated to illustrate the overall use of any methodology or method. The percentage for each category of methodology and method was also calculated to compare results in terms of percentages.

4. Results

4.1. Types of literature

Of the 58 reviews, more than 75% focused exclusively on journal articles (Table 1). Half of the remaining studies also included conference papers, books, and book chapters. Conference papers and dissertations were rarely selected alone to explore methodology use.

4.2. Time span during which methods are used

The time period covered by the selected reviews ranges from 1980 to 2016 (Table 2), with most studies looking at the use of methodologies and methods between 1991 and 2016.

4.3. Research methodologies: Quantitative, qualitative, mixed

Only 14 of the 58 reviews categorized the literature into the broad categories of quantitative, qualitative, or mixed, with a majority of articles falling into the quantitative category (Table 3).

4.4. Research methodologies: Descriptive, comparative, exploratory, etc.

Only 5 of the 58 reviews classified the methodologies on the basis of the aim or purpose of the studies (Table 4). Most studies (50%) were descriptive, followed by comparative (11%), exploratory (8%), evaluative (7%), explanatory (5%), and a small handful of other categories, with 5% of articles reporting the use of multiple approaches. A sizable proportion (12%) of research methodologies are placed in the category called *other*, unidentified by authors.

4.5. Research methodologies: Empirical, etc.

A taxonomy which categorized methodology as empirical or non-empirical was used by nearly one third of the reviews (Table 5).

Table 1
Types of literature.

Type of material	Frequency	%
Articles only	44	76
Articles, conference papers, books, etc.	8	14
Conference proceedings	3	5
Dissertations and theses	2	3
Article abstracts	1	2
Total	58	100

Table 2
Time span.

Period covered	Frequency	%
1980–1990	4	7
1991–2000	22	38
2001–016	32	55
Total	58	100

Table 3
Research methodologies: Qualitative, quantitative, etc.

Methodology	Review articles that reported	Frequency of usage	% of usage
Quantitative	14	2999	49
Qualitative	14	2005	33
Mixed or multi methods	13	707	12
Other	4	383	06
Total	14	6094	100

Table 4
Research methodologies: Exploratory, etc.

Methodology	Review articles that reported	Frequency of usage	% of usage
Descriptive	5	688	50
Comparative	2	158	11
Exploratory	4	111	08
Evaluative	3	87	07
Explanatory	2	71	05
Model building	1	8	0.6
Prescriptive	1	2	0.1
Predictive	1	2	0.1
Multiple	2	81	06
Other	3	168	12
Total	5	1380	100

Table 5
Research methodologies: Empirical, etc.

Methodology	Review articles that reported	Frequency of usage	% of usage
Empirical	19	2414	48
Description, descriptive, opinion, opinionated	9	999	20
Conceptual, verbal argumentation, criticism, concept analysis	9	541	11
System and design analysis	8	236	4.7
Literature review	10	125	2.5
Discussion	3	117	2.3
Case study	6	89	1.7
Historical analysis	6	84	1.6
Mathematical	5	79	1.5
Theoretical	3	41	0.8
Bibliographic	3	46	0.9
Methodological	3	25	0.5
Multiple, other	12	221	4.2
Total	19	5017	100

Empirical research strategies were used predominantly, followed by the category identified as *description, descriptive, opinion, opinionated*. Variations in approaches used by authors to categorize methods into empirical or other categories affected the counts in Table 5. Chu (2015) treated conceptual analysis, model building and theory development as theoretical approach. Cano (1999) adopted the methodology scheme used by Järvelin and Vakkari (1990) and classified articles into a new category named *descriptive* and placed it in the *other method* category. These research approaches are counted in the *descriptive, description,*

opinion, opinionated category for the current study. Some studies have reported case study and historical analysis as a separate research approach from empirical research while the majority of articles placed them under empirical research. The frequency of case study and historical approach are given separately in these cases. Bibliographic and methodological research approaches are also used in this taxonomy by some authors. Gunasekera (2008) classified empirical strategy, survey method, content analysis, historical analysis, and case or action research and so on separately, but for the current analysis all these are included as empirical. Multiple methods, mixed methods, and other are placed together. For articles in which research methodologies were compared for two or more countries (Hua, 1999), the total methods used in different countries are counted.

4.6. Dominant research methods

Thirty-eight of the 58 reviews categorized results by method (Table 6). Survey was the most dominant method used (33%), followed by theoretical analysis and content analysis (7% each). Other frequently used methods include historical analysis, bibliometric, information system analysis and design, and experiment.

4.7. Rarely used methods

Many research methods were identified in only one or two review articles (Table 7) and for a small number of articles. The results, combined with Table 6, show a wide variation in the use of methods. It has to be noted that variations in categorization and aggregation have some affect on the counting reported in Tables 6 and 7. Survey and questionnaire are treated separately by some authors. Interviews were categorized separately by some authors while others merged interview and questionnaire into survey, and some included focus group. For example, Chu (2015) categorized questionnaire, interview and focus group separately while Aytac and Slutsky (2012) categorized survey, interview and focus group into survey. Peritz (1980) divided survey into survey of public and survey of libraries. Similarly, some authors have separated citation analysis from bibliometrics while others included citation in bibliometrics (e. g., Blake, 1994). In another example, Peritz (1980) categorized survey or experiments in the same category, and these were included only in survey in Table 6—obviously this has an effect on the number reported for experiment. Similarly, Blake (1994) merged the results of biographical, historical and bibliographic into one category—these results were counted under historical.

4.8. Statistical methods

Only 10 of the 58 reviews reported the statistics used to analyze results (Table 8). Most articles used descriptive statistics (73%) while inferential statistics (24%) were used in 24% of the analyzed research. Multiple analytical techniques were identified as having been applied in a few articles. Frequencies of different types of descriptive statistics were given in only one study while frequencies of different categories of inferential statistics were given in four. Types of inferential statistics identified include correlation such as Pearson, Spearman, Kendall's Tau-b, etc.; *t*-tests; ANOVA and ANCOVA; chi square, Mann-Whitney-Wilcoxon; multiple regression; Shapiro-Wilk; factor analysis; Cramer's V; Kruskal-Wallis; and Kruder-Richardson estimates.

5. Discussion

The vast majority of reviews considered journal articles only (76%). Methodologies used for different kinds of scholarship may be different; this may be worth further investigation. Looking at the time span, it appears that the exploration of methodology gained momentum after 1990, though it is also possible that research published before 1990 was not retrieved through searching.

Table 6
Dominant research methods.

Methods (sub-types and variants)	Review articles that reported	Frequency of usage	% of usage
Survey (survey-2665, questionnaire-2141, Iinterview-696, consultation with experts-2, focus group-113)	38	5623	33.0
Theoretical analysis (theory, theoretical approach, analytical, model development and validation)	7	1230	7.2
Content or protocol analysis	29	1209	7.0
Historical analysis (historic, biographic)	17	1038	6.0
Bibliometric (webometric, informetric)	21	852	5.0
Information system analysis and design	7	664	4.0
Experiments (experiment, investigations)	27	658	3.8
Conceptual approach (verbal arguments, criticism, concept analysis, discussion)	7	588	3.4
Description	1	497	3.0
Descriptive	3	489	2.8
Case study (case study single)	14	424	2.5
Observation (observation and description)	15	298	1.7
Transactional log analysis (computer log analysis)	11	260	1.5
Comparative study	6	226	1.3
Citation analysis	12	222	1.2
Case or action research	10	208	1.2
Evaluation	8	192	1.1
Qualitative	5	145	0.8
Descriptive example	1	143	0.8
Secondary analysis	11	138	0.8
Literature review	8	127	0.7
Operation research	4	81	0.5
Mathematical and logical method	3	72	0.4
Ethnography	6	45	0.3
Think aloud or verbal protocol	2	34	0.2
Delphi	6	17	0.1
Other, multiple	15	1290	8.0
Total	38	16,728	98

Table 7
Rarely used research methods.

Methods (sub-types and variants)	Frequency of usage	% of usage
Cross sectional	1	50
Descriptive bibliography	1	38
Need assessment	1	25
Metadata analysis	1	22
Case series	1	19
Class room research	1	16
Diary research	1	13
Usage study	1	12
Task analysis	1	10
Literature analysis	1	9
Cohort	1	8
Grounded theory	1	7
Patron requests (ILL and reference)	2	6
Statistical analysis	1	6
Research summaries	1	5
Desk research, statistical analysis	1	5
Meta-analysis	2	5
Bibliographic	1	4
Longitudinal	1	4
Key tracking	1	3
Research portfolio	1	3
Student journal or papers	1	3
Consensus seeking technique	1	2
Control trials	1	2
Discourse analysis	1	2
Grey relational analysis	1	2
Phenomenology	1	2
Student journal or paper	1	2
Research summaries	1	2
Card sorting	1	1
Contextual inquiry	1	1
Critical incident technique	1	1
Cluster analysis	1	1
Field simulation	1	1
Naturalistic inquiry	1	1
Participatory action research	1	1
Testing, unobtrusive	1	1
Workshop	1	1
Total	38	347 (2%)

Table 8
Statistical methods.

Type of statistics	Review articles that reported	Frequency of usage	% of usage
Descriptive statistics	10	1779	72
Inferential statistics	10	604	24
Multiple statistics	4	100	04
Total	10	2483	100

Considering Table 3, either qualitative or quantitative methods are used in more than 80% of articles, as compared with mixed methods. Some unusual categories in this taxonomy were also discovered. For example, Vakkari (2008) placed seven articles in a category identified as *analytical*, which in the present study was included in *other*. Among all the authors, only Ngulube (2010) defined mixed methods studies specifically as those which include both qualitative and quantitative methods. Multi-method qualitative and multi-method quantitative categories as described by Creswell (2009) have not been identified by any review author and it is likely that these were placed in *other* or *mixed or multi methods*. This points to the need for better definitions of terms.

Most LIS research is still descriptive in nature. The use of comparative and explanatory approaches is increasing but the rate of increase is not impressive. It is very encouraging that LIS authors are using empirical strategies to find and propose solutions to problems confronting the profession. Oddly, despite the prevalence of automated systems in libraries, the system design and analysis research approach is infrequent. Also surprisingly, the use of inferential statistics, which exposes relationships among different variables, is reported in only one fourth of the research conducted in LIS.

A limitation to this study, and one that underscores a theme that has appeared several times above, is that operational definitions of identified methods are not standardized. The present study performed categorization and coding using authors' taxonomies. As a result, there is inconsistency, overlap, and ambiguity in the terms used in Tables 5 through 8, and these may have affected the findings. It was beyond the

scope of this study to develop a new taxonomy and provide better definitions but this reinforces the need for that kind of initiative or activity. This variation also made comparison in the use of methods impossible. Powell (1999) observed 20 years ago that there was no agreed upon classification scheme for categorizing research methods; unfortunately this has not changed.

6. Conclusion

The findings of the study represent a comprehensive review of methodologies and methods, and demonstrate that there appears to be a wide range and variety in methods used in LIS. Having a complete list such as this is useful, as it can serve as the toolkit from which LIS researchers and the library community can select when making decisions about method, measures, and reporting practices (Kelly & Sugimoto, 2013). This study has also revealed that there is a core of approaches that predominate in almost every aspect studied. While it could be the case that these predominant methodologies and methods are just the most appropriate in LIS, it is also possible that researchers do not give enough thought to other possibilities, or are not aware of them. A comprehensive list such as the one provided here could inspire researchers to consider new approaches, especially when exploring new kinds of research questions. Finally, this research highlights the need for the research community and higher education community (in which researchers learn their craft) to come to agreement on how terms and taxonomies are used when describing the various aspects of the research process, in any discipline.

Appendix A

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Ahsan Ullah is a librarian at Government Degree College, Pindi Bhattian Hafizabad, Pakistan. He is currently a doctoral candidate in the Department of Information Management, University of the Punjab, Lahore, Pakistan. His dissertation relates to the use of research methodology in library and information science, especially in Pakistan. His research interests are library management, research methods, repositories, and training of library professionals in Pakistan.

Kanwal Ameen is chair of the Department of Information Management, University of the Punjab, Lahore, Pakistan. She has authored more than 120 publications, including journal articles, conference proceedings, books, and book chapters, and is the Editor-in-chief of *Pakistan Journal of Information Management* & *Libraries*. She also serves on the editorial advisory boards of several international journals. Her work has been recognized with the receipt of awards such as a Fulbright for postdoctoral research at the University of Missouri, Columbia; the Higher Education Commission of Pakistan's Best Teacher Award; the Pakistan Library Association's Life Time Achievements Award; and the Asian Library Leaders Award for Professional Excellence—India.