

Research Directions in Information Systems Field, Current Status and Future Trends: A literature analysis of AIS Basket of Top Journals

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Abstract

Information system, as an emerging discipline which is dynamic and interdisciplinary, is constantly undergoing rapid changes; therefore, one of the most critical issues is to study the topics and methodological trends in this field. This study aimed to thoroughly investigate the topics and methodologies used in information system throughout a twelve-year period (2007-2018). In the present study, all the articles published in the top eight information system journals were investigated based on their topics and methodologies using a literature analysis approach, and the most common topics and methodologies in such studies were then detected. The main topics addressed in this field were electronic commerce/business, information system research, and IS usage/adoption, and the survey was the dominant research methodology in this regard. Furthermore, an increase in the use of the mathematical models indicates that more accurate quantitative research methods have made this field more mature. The research findings also show that the Internet of Things (IoT), big data, social media, bitcoin and block chain, digital transformation, sharing economy, digital platform, methodology of machine learning, data mining, and text mining are the main research topics and methods which should be further studied.

Keywords: Information Systems Research; Research Methodology; Literature analysis; Association for Information Systems; Senior Scholars' Basket of Journals; Academic Journals

1 Introduction

Compared to many disciplines in the field of social sciences and business, information system is a relatively new, emerging, and unique field undergoing constant changes for several reasons. On one hand, the changes in information technology, as one of the main areas of

information system research, are occurring so quickly that researchers can hardly address a particular phenomenon or topic in-depth before dealing with the other new issues since the speed of technological advances in software technology and the other information and communication technologies such as social media, smart devices, and new delivery mechanisms is extremely high. Another reason for the changes in this field is the emergence of new research paradigms, including interpretive and critical research, and new methodologies such as design science, action research and other methods, which have been extensively accepted. Furthermore, new researchers with different backgrounds and experiences have been involved in this field. In addition, these researchers deal with a variety of theories, theoretical foundations, frameworks, and reference disciplines (namely management, organization sciences, and computer sciences). Accordingly, the dynamic and interdisciplinary nature of the information system field and its diversity and rapid advances make it difficult for researchers to keep track of the modern-of-art topics and methodology trends; hence, having information about the current status of research in this field and being aware of its change processes would help the researchers in the field of information systems.

The present study investigated topics and methodology trends of research in the field of information systems throughout a 12-year period (2007-2018) using a literature analysis method. According to Stemler (2001), the literature analysis enables researchers to study and navigate large knowledge bases using relatively simple and systematic methods. In this study, the data was gathered based on the review of eight major journals in the field of information systems as such a large database including 3250 articles was created. The collected data encompassed the journal name, the year of publication of a concerned article, and the topic and methodology of the research paper.

An in-depth review of previous studies reveals that no comprehensive analysis has been carried out in recent years, and the most recent comprehensive research has been conducted during 2004-2013. Furthermore, some of the most recent studies have concentrated on only one journal (Palvia & Kakhki, 2016; Palvia et al., 2017). As a result, there are few comprehensive studies in this field. Considering the significance of this subject, the present study analysed the topics and methodologies used in the AIS Basket of the top journals throughout a twelve-year period (2007-2018). This review study would contribute to the improvement of the research on information systems. The main objectives of this study are as follows:

1. Determining the topics addressed by the researchers and analysing the research trends;
2. Detecting the most common research methodologies and their trends;
3. Identifying research gaps and predicting the future trends of information system research.

In the following, a review of the relevant literature is presented. In addition to the research methodology, the frameworks used to analyse the articles along with the journal selection procedures and the coding methods are also described. Furthermore, the analysis and coding results are also discussed. This paper also encompasses topic and methodological trends and is concluded with some discussions along with limitations and recommendations for future research.

2 Literature review

Since the early emergence of information systems, some researchers have published studies based on the analysis and review of the relevant literature. Three types of analyses are found out in the literature: research topics and themes (Avison, Dwivedi, Fitzgerald, & Powell, 2008; Claver, González, & Llopis, 2000; D'Aubeterre, Palvia, & Steevens, 2005; Dwivedi & Kuljis, 2008; Ji, Min, & Han, 2004; Palvia & Kakhki, 2016; Palvia, Kakhki, Ghoshal, Uppala, & Wang, 2015; Palvia et al., 2004; Palvia, Pinjani, & Sibley, 2007; Palvia et al., 2017; Sinclair, Simon, & Wilkes, 2004), methodologies and research paradigms (Avison et al., 2008; Chen & Hirschheim, 2004; Claver et al., 2000; Dwivedi & Kuljis, 2008; Ji et al., 2004; Liu & Myers, 2011; Myers & Liu, 2009; Palvia & Kakhki, 2016; Palvia et al., 2015; Palvia et al., 2004; Palvia, Mao, Salam, & Soliman, 2003; Palvia et al., 2007; Palvia et al., 2017), and authors and universities (Avison et al., 2008; Claver et al., 2000; Dwivedi & Kuljis, 2008; Palvia et al., 2007; Sinclair et al., 2004). Some studies have also adopted a combination of two or three approaches. In addition, some other studies have also examined research models and paradigmatic approaches. Table 1 presents the main research studies carried out on topics and methodologies.

As shown in Table 1, with the exception of a study by Palvia et al. (Palvia et al., 2015), which covered the period ranging from 2004 to 2013, no comprehensive and recent study has been published in the top journals in the concerned field. Two other recent studies in 2016 and 2017 have reviewed specific journals (namely *Information & Management* and *Global Information Technology Management*). Given the significance of this issue, the current study addressed this research gap as such this study analysed the topics and methodologies used in the top eight journals of information system and their trends over a 12-year period (2007-2018).

3 Research Methodology

Cumbie, Jourdan, Peachey, Dugo, and Craighead (2005) propose a three-stage process for literature analysis projects. In the first stage, the researcher collects a series of relevant articles. In the second stage, the researcher classified the articles into an appropriate framework. In the third stage, the researcher evaluates and combines the collected data. Accordingly, all the articles published in the top eight journals during 2007 to 2018 were first reviewed and coded. In the second stage, a two-dimensional framework encompassing topics and methodologies was created in order to classify the research papers, and each paper was then categorized with regard to the thematic and methodological dimensions. Finally, the analysis addressed practices such as comparing, connecting, and explaining the trends and results (Levy & Ellis, 2006). The last step was to identify the gaps in research literature and predict future trends (Webster & Watson, 2002). According to these three stages, the methodology framework of the present research is presented in Figure1.

Scholar	Period surveyed	Reviewed journals	First topic	Second topic	First methodology	Second methodology
Claver et al. 2000	1997-1981	<i>Information & Management MIS Quarterly</i>	IS development	DSS	Empirical studies	Field study
Palvia et al. 2003	1993-1997	Top Five Journals of Information Systems	-	-	survey	Frameworks and conceptual model
Palvia et al. 2004	1993-2003	Top Seven Journals of Information Systems	information systems resource management	IS development	survey	Mathematical modeling
Chen and Hirschheim 2004	1991-2001	Top Eight Journals of Information Systems	-	-	survey	Case Study
D'Aubeterre et al. 2005	1998-2003	Top Six Journals of Information Systems	Resource Management/IS Management Issues	Internet	-	-
Palvia et al. 2007	1998-2005	<i>Information & Management</i>	IS usage	Resource Management/IS Management Issues	survey	Case Study
Avison et al. 2008	1991-2007	<i>Information Systems Journal</i>	IS development	IS management	Library research literature Analysis frameworks conceptual modeling	Case Study
Dwivedi and Kuljis 2008	1997-2007	<i>European Journal of Information Systems</i>	IS management	IS development	Case Study	surveys and library research
Myers and Liu 2009	1998-2007	The Basket of Top Journals AIS (Six Journals)	-	-	survey	Case Study
Palvia et al. 2015	2004-2013	Top Seven Journals of Information Systems	Electronic Commerce	IS usage /adoption	survey	Laboratory experiment
Palvia et al. 2016	2006-2015	<i>Global Information Technology Management</i>	IS usage /adoption	Electronic commerce /business- IT and culture	survey	Case Study
Palvia et al. 2017	2004-2014	<i>Information & Management</i>	Electronic commerce/business	IS usage /adoption	survey	Field study

Table 1. Summary of previous studies based on the topics and methodologies used and their application priorities

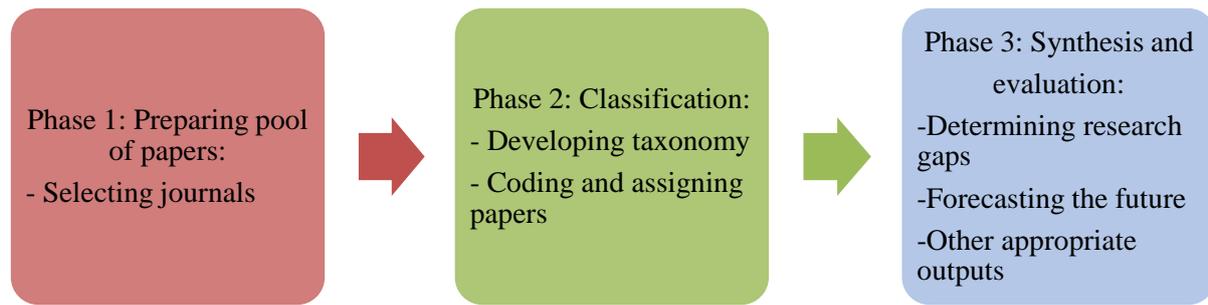


Figure 1. Research Methodology (adopted from [7] and [13])

3.1 Journal Selection

To create a pool of papers, the top and valid journals in the field of information systems were primarily selected; hence, the selected journals were a basket of top journals nominated introduced by the College of Senior Scholars. The College of Senior Scholars encourages colleagues, deans, and department chairs to consider a "basket" of top eight journals in the field of information system research. The College of Senior Scholars consists of professionals in the field of information systems, who have served as editors-in-chief of the concerned journals, current and former ICIS¹ chairs, program chairs, and current and former heads of AIS². This list covers the subject diversity as it contains a variety of methods and geographical information. In addition, the review processes of the concerned journals are accurate, their editorial staff are well-known and well-appreciated, and the journals have international audiences and contributors. In addition, the SJR index ("Scimago Journal & Country Rank"), reflecting the scientific quality of a journal, were also extracted, and all the selected journals had high SJR index. Therefore, the papers from these eight journals had been collected from 2007 to 2018. A total of 3252 articles were reviewed, as listed in Table 2 by journal.

3.2 Classification

The researchers developed a classification framework of information system research based on several criteria.

Journal	Number of issues	Number of papers	SJR Index
<i>European Journal of Information Systems</i>	66	438	2.04
<i>Information Systems Journal</i>	70	288	2.32
<i>Information Systems Research</i>	48	542	3.48
<i>Journal of AIS</i>	143	385	1.82
<i>Journal of Information Technology</i>	48	335	2.12
<i>Journal of MIS</i>	48	471	2.39
<i>Journal of Strategic Information Systems</i>	48	227	1.43
<i>MIS Quarterly</i>	48	566	4.21
Total	519	3252	

Table 2. List of Selected Journals, SJR index and Number of Papers (2007-2018)

¹ The International Conference on Information Systems

² Association for Information Systems

A majority of the studies using the literature analysis have focused on a combination of factors such as research topic, research model, research methodology, paradigmatic research approach, authors, and universities. In the previous section, some of the most important studies which have addressed these dimensions were mentioned. The present study focused on research topic and methodology, which are explained in the following sections.

3.2.1 Research Methodologies

Table 3 presents the research methodologies concerned to categorize the selected articles. The methodologies were adopted from Palvia et al. (Palvia et al., 2015). During the coding process, two titles "Social network analysis" and "Machine learning, Data mining, Text mining, and Web mining" were added. According to the previous researchers, these two methods have not fit in the previous categories and need to be considered as new methodologies. Further, it is necessary to provide a more detailed explanation about some of the concerned methodologies. First, it should be noted that the case study methodology is typically qualitative in nature; however, it can incorporate quantitative data as a part of the mixed-methods design. Accordingly, the case studies may involve both qualitative and quantitative research methods as such we distinguished it from the qualitative method.

Regarding the difference between content analysis and text mining, it can be mentioned that content analysis is "a technique for gathering and analysing the content of a text. The content refers to words, meanings, pictures, symbols, ideas, themes or any message that can be communicated" (Neuman, 2003). Content is coded into various categories or concepts depending on selected criteria (Weber, 1988), and coding can be manual or computer aided. Text mining is a computer-assisted technique to extract information and trends from large amounts of textual data (Feldman & Sanger, 2007; Fuller, Biros, & Delen, 2011; Tan, 1999). It is based on data mining, machine learning, and natural language processing techniques used for the texts under study. It mainly relies on computer programs and algorithms; thus, it is supposed to resolve the problems associated with the reliability of content analysis (Milne & Adler, 1999). Text mining is thus to analyse large amounts of texts using algorithms and computer programs. In contrast, content analysis is mostly done with or without computer software to examine the underlying meaning and constructs existing in the text being analysed. Text mining is a quantitative approach, while content analysis is a qualitative one.

In survey and mathematical modelling methods, survey data can be used for regression analysis and/or hierarchical linear modelling; however, in the present study, only articles that use structured questionnaires are included in this category, and the other papers adopting analytical (e.g., formulaic, econometric, or optimization model) or descriptive (e.g., simulation) models fall into the mathematical modelling category. Table 3 shows the final classification of the methodologies.

	Methodology	Definition
1	Speculation / commentary	Research that derives from thinly supported arguments or opinions with little or no empirical evidence
2	Frameworks and conceptual model	Research that intends to develop a framework or a conceptual model.
3	Literature review	Research that is based mainly on the review of existing literature.
4	Literature analysis	Research that critiques, analyzes, and extends existing literature and attempts to build new groundwork, e.g., it includes a meta-analysis.
5	Case study	Study of a single phenomenon (e.g., an application, a technology, a decision) in an organization over a logical time frame.
6	Survey	Research that uses predefined and structured questionnaires to capture data from individuals. Normally, the questionnaires are mailed (now, fax and electronic means are also used).
7	Field research	Study of single or multiple and related processes/ phenomena in single or multiple organizations.
8	Field experiment	Research in organizational setting that manipulates and controls the various experimental variables and subjects.
9	Laboratory experiment	Research in a simulated laboratory environment that manipulates and controls the various experimental variables and subjects
10	Mathematical modeling	An analytical (e.g., formulaic, econometric or optimization model) or a descriptive (e.g., simulation) model is developed for the phenomenon under study.
11	Qualitative research	Qualitative research methods are designed to help understand people and the social and cultural contexts within which they live. These methods include ethnography, action research, interpretive studies, and examination of documents and texts.
12	Design science	“Design science creates and evaluates IT artifacts intended to solve identified organizational problems”. It involves a rigorous process to design artifacts to solve observed problems, to make research contributions, to evaluate the designs, and to communicate the results to appropriate audiences. Such artifacts may include constructs, models, methods, and instantiations.
13	Secondary data	A study that utilizes existing organizational and business data, e.g., financial and accounting reports, archival data, published statistics, etc.
14	Content analysis	A method of analysis in which text (notes) are systematically examined by identifying and grouping themes and coding, classifying and developing categories.
15	Social Network Analysis	Study of the relationships of humans, organizations, groups, or any other set of related entities based on graph theory.
16	Machine learning, Data mining, Text mining and Web mining	Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and inference instead. It is seen as a subset of artificial intelligence. Data mining is the process of discovery of unknown relationships and patterns within the data. Text mining (text analysis) is the process of extracting high-quality information from the text. Web mining is a process of discovery of unknown and useful information from web data.

Table 3. Methodologies in the Information System Research (adopted from (Palvia et al., 2015))

3.2.2 Topics

Alavi and Carlson (1992) first detected the most frequent research topics in the literature on information systems, and Barki et al. (Barki, Rivard, & Talbot, 1993) developed a keyword classification scheme, which can be used as a basis for investigation IS research topics. Following the publication of these papers, the other researchers improved this topic-based classification. Some authors have adopted the construct classification proposed by AIS for

topic analysis (Levy & Ellis, 2006). In their paper, Palvia et al. (2004) used the top three-levels introduced by Barki et al. (Barki, Rivard, & Talbot, 1988) to develop their topics, and later in 2015, they added some topics to the list with regard to the research discussions and topics and new trends. The same category was used in the present study, and some changes were made during the coding process and some topics were added. For example, we added topics such as 'IoT', 'Bitcoin, Block chain, Fintech', 'Digital transformation' and 'Sharing economy, Digital platform' as new topics, and IT services/Digital Services as a topic not mentioned in the previous classification. Some changes were made in the title of the categories (e.g., crowdsourcing and outsourcing categories were merged), and one of the titles was also removed from the list. Table 4 shows the final classification of the most common research topics.

1	Big data
2	Artificial intelligence/Business intelligence/data analytics/expert system
3	Business process
4	Cloud computing
5	Customer relationship management (CRM)
6	Databases
7	Decision support system & executive IS
8	E-government
9	Electronic commerce/business
10	End user computing
11	Enterprise resource planning (ERP)
12	Environment of IT: internal or external
13	Global information technology (GIT)
14	Group support systems
15	Health information technology
16	Innovation/ Digital Innovation/ Digital Entrepreneurship
17	Internet of things
18	Internet/web
19	Inter-organizational systems
20	IS design and development
21	IS education
22	IS evaluation
23	IS functional applications
24	IS implementation
25	IS management and planning
26	IS research
27	IS staffing
28	IS usage/adoption
29	IT and culture/ethic
30	IT services/digital services
31	IT value/ Business Value of IT
32	Knowledge management
33	Media and communications
34	Mobile computing
35	Organizational design
36	Outsourcing and offshoring/ Crowdsourcing/ Crowd funding
37	Project management
38	Security and privacy
39	Social media and social computing
40	Social networks

41	Societal issues
42	Software and programming languages
43	Supply chain management
44	Sustainability
45	Team/Virtual teams/Collaboration
46	Telecommunications and networking
47	Bitcoin / Block chain / Fintech
48	Sharing economy/Digital platform
49	Digital transformation

Table 4. List of Topic Categories

3.3 Coding

While each article normally has a main topic and a dominant methodology, some papers deal with multiple topics and may use several methodologies. As a result, to include to such papers in the present study, in the coding file for each paper, three columns were designed for the topic(s) and two columns for methodology.

Accordingly, a total of 3252 papers published from 2007 to 2018, belonging to a basket of the top eight IS journals, were reviewed and codified using the proposed framework. To determine the research topics, each paper was analysed by title, keywords, and abstract. This approach has been adopted by several authors (Avison et al., 2008; Farhoomand & Drury, 1999; Palvia et al., 2015). To determine the research methodologies, the abstract and content of the papers were reviewed.

Three experts (including the researcher and two assistants) coded the articles individually. To achieve reliable results and increase reliability of this process, the following points were considered by the coders:

- In order to increase the coding uniformity and reduce the ambiguity, the coders had several meetings before coding and exchanged the necessary information. Finally, they, to some extent, came to an agreement on the encoding process.
- In the methodology section, standard definitions of the methodologies were provided for the coders to avoid coding mistakes.
- To remove the effect of the chance from the calculations, the inter-coder reliability was estimated.

Inter-coder reliability was calculated in a two-phase process. In the first phase, the coders encoded 50 papers independently and then compared their results. Table 5 shows the results of the first phase.

Coder	1	2	3
1			
2	75% (Topic) 63% (Methodology)		
3	78% (Topic) 71% (Methodology)	89% (Topic) 69% (Methodology)	

Table 5. Phase One of Inter-Coder Reliability (By topic and methodology)

As shown in Table 5, inter-coder reliability is not at 90%, a level of significance recommended in the relevant literature (Palvia et al., 2004); therefore, the authors discussed their findings in several sessions in the cases of inconsistency in order to reach a common understanding. In the second phase of the coding process, the coders coded 25 papers, and the results of inter-coder reliability are presented in Table 6.

Coder	1	2	3
1			
2	93% (Topic) 89% (Methodology)		
3	94% (Topic) 91% (Methodology)	98% (Topic) 93% (Methodology)	

Table 6. Phase Two Inter-Coder Reliability (By topic and methodology)

As it can be noticed, all coders achieved reliability at an acceptable level in this phase.

4 Results

In this section, the results are presented based on the topic and methodology of the concerned articles, for which the main thematic points and methodology as well as the major trends are discussed separately.

4.1 The process of using information systems methodologies

Table 7 lists the most frequently used research methodologies in the top eight journals during a twelve-year period. Since two methodologies were considered in coding for each paper (since a paper may use a combination of two methodologies, for example, survey and qualitative methods), two columns (namely primary and secondary methodologies) are devoted to methodology in the Table. For each methodology in Table 7, four values are presented: Number of times a methodology was used as the primary methodology, number of times a methodology was used as a secondary methodology, total number of times a methodology was used, and the percentage of using a methodology.

As it can be seen in Table 7, in the journals studied during a twelve-year period (2007-2018), the survey method was the most common methodology (19.3%). The other frequently used methodologies were mathematical modelling (17%), case study (13.8%), qualitative research (11%) and literature review (7%), respectively.

Table 8 shows the significant trends by year and the priority of methodologies per year during a 12-year period. Figure 2 also graphically illustrates the methodologies used during 2007 to 2018.

Methodology	Primary methodology count	Secondary methodology count	Total Papers	Total (%)	Rank by total
Survey	609	62	671	19.3%	1
Mathematical modeling	560	30	590	17%	2
Case study	464	14	478	13.8%	3
Qualitative research	354	29	383	11%	4
Literature review	243	0	243	7%	5
Laboratory experiment	197	15	212	6.1%	6
Speculation/commentary	194	1	195	5.6%	7
Frameworks and conceptual model	133	5	138	4%	8
Secondary data	104	26	130	3.7%	9
Field research	101	9	110	3.2%	10
Field experiment	99	4	103	3%	11
Design science	59	1	60	1/7%	12
Literature analysis	55	0	55	1/6%	13
Machine learning, Data mining, Text mining and Web mining	44	2	46	1/3%	14
Content analysis	21	14	35	1%	15
Social Network Analysis	15	6	21	0/6%	16
Total	3252	218	3470	100%	

Table 7. Rank of Research Methodology Based on Count and Percentage of Papers Using a particular methodology

Rank	Methodology	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
1	Survey	61	46	51	61	74	59	49	53	69	45	56	47	671
2	Mathematical modeling	31	26	30	44	42	77	55	55	47	50	61	72	590
3	Case study	54	50	42	33	45	40	46	47	31	33	25	32	478
4	Qualitative research	21	31	34	39	27	18	36	35	21	31	50	40	383
5	Literature review	33	22	22	19	27	30	21	12	19	16	13	9	243
6	Laboratory experiment	9	20	17	13	24	10	23	20	15	21	19	21	212
7	Speculation / commentary	12	17	6	36	25	31	8	18	17	17	4	4	195
8	Frameworks and conceptual model	15	11	15	10	10	17	13	9	7	8	8	15	138
9	Secondary data	4	9	10	17	10	17	12	7	20	13	6	5	130
10	Field research	7	6	5	12	9	18	10	13	5	5	12	8	110
11	Field experiment	3	5	10	8	6	6	12	8	12	15	13	5	103
12	Design science	1	9	3	2	1	7	4	6	8	8	9	2	60
13	Literature analysis	5	5	5	4	4	6	6	4	5	5	2	4	55
14	Machine learning, Data mining, Text mining and Web mining	1	1	0	2	0	1	2	3	0	5	10	21	46
15	Content analysis	4	1	4	4	0	3	2	3	5	5	2	2	35
16	Social Network Analysis	2	1	2	2	2	1	1	2	0	4	1	3	21
Total		263	260	256	306	306	341	300	295	281	281	291	290	3470

Table 8 - Methodology trends over the years 2007-2018

Survey method was the most-oft used research method in almost each year. The mathematical model also experienced a rising trend during this period and reached its peak in 2012. The other significant trend was a decline in the use of conceptual modelling and framework

methodology. Although the use of this methodology reached its peak in 2012, it was least used in 2015, 2016, and 2017. The use of this methodology, however, increased in 2018 once more.

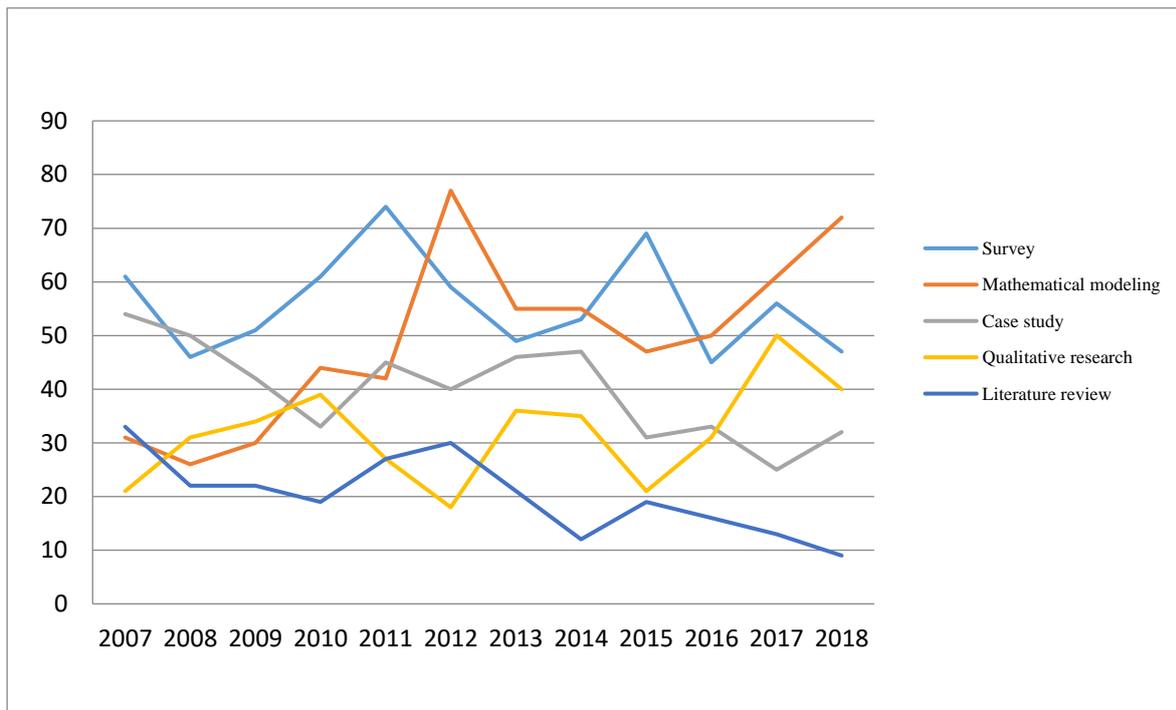


Figure 2 - The top 5 Methodologies in the Period (2007-2018)

4.2 Topic trends of information systems

Table 9 shows the frequency and percentage of the topics covered in all papers published from 2007 to 2018 in the top eight journals by year. Electronic commerce/business, information system research, and information system usage/adoption are the most frequently studied topics, with the “electronic commerce/business” being at the top of the list, having an 8.95% frequency. Information system research and information system usage/adoption are ranked next with the frequencies of 7.82 and 7.36 percent, respectively. In addition to these three topics, seven other common topics are information system management and planning (6.89%), security and privacy (6.31%), software and programming language (4.72%), outsourcing and offshoring/crowdsourcing (4.54%), social media and social computing (4.41%), knowledge management (3.81%), and IT value/ Business Value of IT (3.31%).

Regarding the topic trends, there is an increasing attention to social media, social network, and big data. Moreover, IoT was also discussed for the first time in 2016. Bitcoin / block chain / Fintech, sharing economy/digital platform and digital transformation were also first presented as research topics in 2017 and 2018. Figure 3 illustrates an analysis of these ten frequent topics.

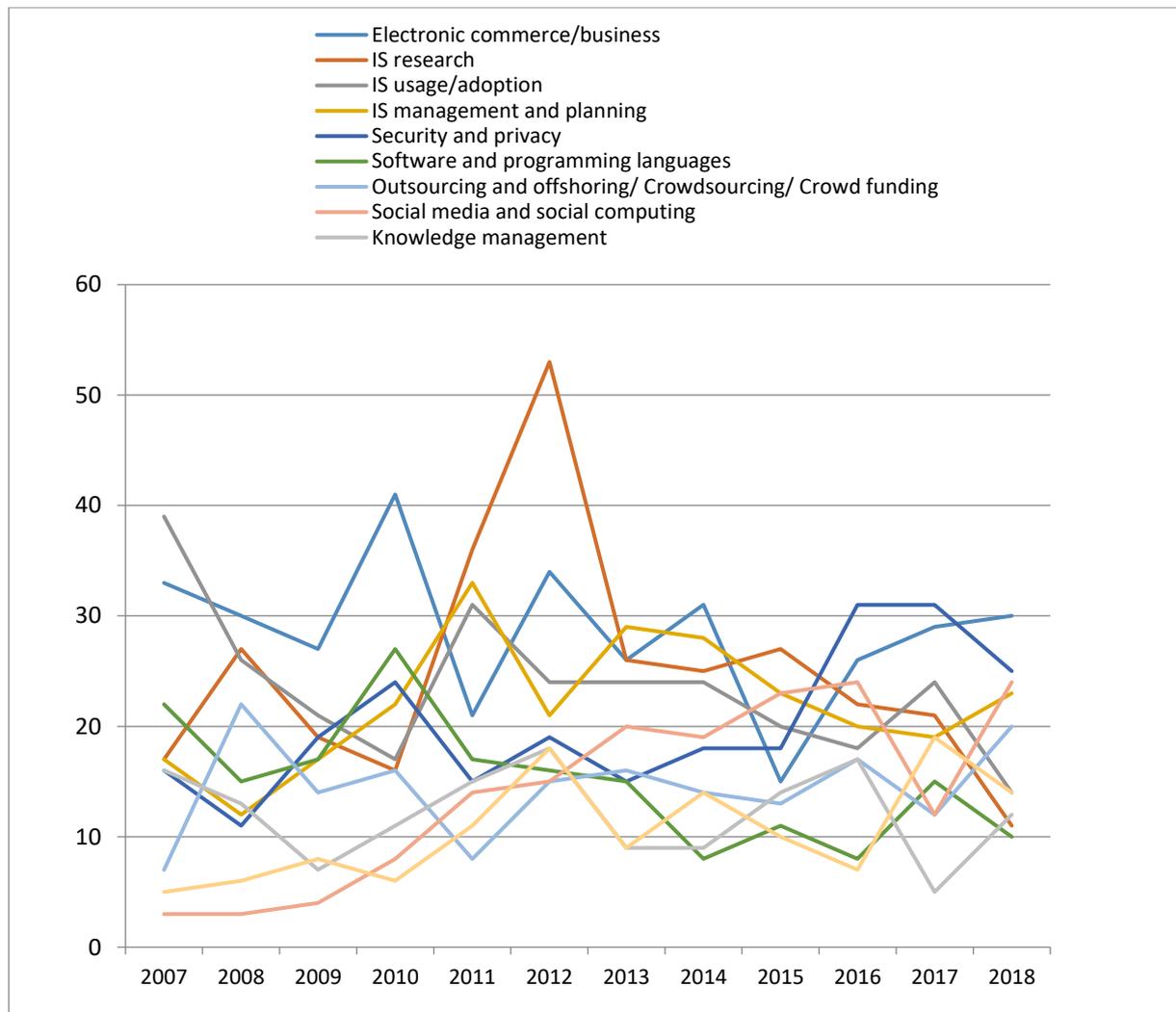


Figure 3. The top ten topics in the period (2007-2018)

Rank	Topic	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Percent
1	Electronic commerce / business	33	30	27	41	21	34	26	31	15	26	29	30	343	8.95%
2	IS research	17	27	19	16	36	53	26	25	27	22	21	11	300	7.82%
3	IS usage/adoption	39	26	21	17	31	24	24	24	20	18	24	14	282	7.36%
4	IS management and planning	17	12	17	22	33	21	29	28	23	20	19	23	264	6.89%
5	Security and privacy	16	11	19	24	15	19	15	18	18	31	31	25	242	6.31%
6	Software and programming languages	22	15	17	27	17	16	15	8	11	8	15	10	181	4.72%
7	Outsourcing and offshoring / Crowdsourcing / Crowd funding	7	22	14	16	8	15	16	14	13	17	12	20	174	4.54%
8	Social media and social computing	3	3	4	8	14	15	20	19	23	24	12	24	169	4.41%
9	Knowledge management	16	13	7	11	15	18	9	9	14	17	5	12	146	3.81%
10	IT value / Business Value of IT	5	6	8	6	11	18	9	14	10	7	19	14	127	3.31%
11	Social networks	2	6	0	14	5	6	10	10	17	12	19	13	114	2.97%
12	IS design and development	13	8	11	16	9	13	13	5	2	7	10	6	113	2.95%
13	Health information technology	20	3	5	3	17	5	5	8	9	11	18	9	113	2.95%
14	Innovation / Digital Innovation / Digital Entrepreneurship	8	7	5	9	5	7	8	7	9	7	16	9	97	2.53%
15	Internet / web	3	2	7	8	8	13	7	9	8	5	6	6	82	2.14%

Rank	Topic	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Percent
16	Team / Virtual teams / Collaboration	5	6	12	8	4	11	2	3	6	2	4	12	75	1.96%
17	Business intelligence / data analytics/expert system	2	2	3	2	3	13	3	8	4	10	12	9	71	1.85%
18	Project management	5	5	7	8	2	2	9	9	3	6	5	3	64	1.67%
19	Mobile computing	3	3	9	3	1	2	6	9	12	5	3	5	61	1.59%
20	IS implementation	3	5	6	4	7	6	11	4	2	3	1	3	55	1.43%
21	Media and communications	5	6	3	8	2	3	5	9	2	7	1	3	54	1.41%
22	Decision support system & executive IS	2	3	2	6	6	2	1	6	3	3	8	8	50	1.30%
23	IS staffing	8	3	2	1	5	6	3	3	4	5	2	7	49	1.28%
24	Telecommunications and networking	4	3	10	5	6	5	6	3	2	1	2	1	48	1.25%
25	E-government	13	7	1	5	7	3	3	2	1	3	0	2	47	1.23%
26	IT services / digital services	0	3	4	1	2	3	5	1	7	3	7	10	46	1.20%
27	IT and culture / ethic	7	3	3	3	4	3	3	5	8	1	0	5	45	1.17%
28	Inter-organizational systems	3	7	4	6	5	2	4	4	1	1	5	2	44	1.15%
29	Enterprise resource planning (ERP)	6	6	4	6	3	3	2	0	4	3	1	0	38	0.99%
30	Business process	4	5	2	6	2	4	2	3	4	3	2	0	37	0.97%
31	Sustainability	0	0	1	4	8	0	4	2	1	5	9	1	35	0.91%

Rank	Topic	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Percent
32	Societal issues	0	5	1	1	2	1	4	7	3	4	1	3	32	0.83%
33	Big data	0	0	0	0	0	1	0	0	9	11	3	7	31	0.81%
34	Cloud computing	0	0	2	0	1	1	3	2	4	6	2	8	29	0.76%
35	Supply chain management	2	2	7	3	7	1	2	0	1	1	1	1	28	0.73%
36	End user computing	2	4	0	4	2	2	0	3	4	0	2	0	23	0.60%
37	Bitcoin / Block chain / Fintech	0	0	0	0	0	0	0	0	0	0	6	11	17	0.44%
38	Databases	2	1	1	3	2	3	1	1	0	1	0	1	16	0.42%
39	Sharing economy / Digital Platform	0	0	0	0	0	0	0	0	0	0	3	13	16	0.42%
40	IS education	2	1	2	6	0	0	1	1	0	0	0	1	14	0.37%
41	Environment of IT: internal or external	0	0	0	3	3	2	1	1	0	1	0	0	11	0.29%
42	Group support systems	0	3	3	1	1	2	0	0	0	0	0	0	10	0.26%
43	Customer relationship management (CRM)	1	0	0	1	3	3	0	0	0	0	1	1	10	0.26%
44	Global information technology (GIT)	1	2	1	2	0	1	0	0	0	1	1	0	9	0.23%
45	IS functional applications	2	1	0	1	0	1	1	0	0	0	0	0	6	0.16%
46	Internet of things	0	0	0	0	0	0	0	0	0	1	3	1	5	0.13%
47	IS evaluation	1	0	1	1	0	0	0	1	0	0	0	0	4	0.10%

Rank	Topic	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total	Percent
48	Organizational design	0	0	1	1	0	1	1	0	0	0	0	0	4	0.10%
49	Digital transformation	0	0	0	0	0	0	0	0	0	0	0	3	3	0.08%
Total		304	277	273	341	333	364	315	316	304	321	341	347	3834	100%

Note: The total number of topics is more than the number of papers because of possible multiple topics per paper.

Table 9. Ranking of research topics over years 2007-2018 by year

4.3 Publication Patterns of Journals

Although most information system journals accept and publish articles on all aspects of the information system, the journals may have their own specific orientations based on their specific conditions, including history, editors, reviewers, and even authors. In this section, the topics and research methods of each journal are examined and compared.

Table 10 shows the publication patterns of the top ten topics in the eight journals, and Table 11 presents the research methods adopted in the studies published in the concerned journals.

Top topics (10)	EJIS	ISJ	ISR	JAIS	JIT	JMIS	JSIS	MISQ
Electronic commerce / business	26	14	106	20	16	78	17	66
IS research	58	26	17	53	69	9	7	61
IS usage / adoption	45	28	34	48	22	31	15	59
IS management and planning	50	23	40	25	32	26	33	35
Security and privacy	30	13	43	27	6	62	12	49
Software and programming languages	28	17	40	18	9	34	13	22
Outsourcing and offshoring / Crowdsourcing / Crowd funding	13	9	33	7	25	26	30	31
Social media and social computing	4	10	45	13	8	32	9	48
Knowledge management	14	27	16	10	16	23	20	20
IT value / Business Value of IT	11	3	34	11	8	24	11	25

Table 10. Number of papers representing the top 10 topics, by journal

As it can be seen in Table 10, some topics have been of a greater interest in some Journals. For example, the topic ‘electronic commerce’ is most frequently addressed in *Information Systems Research Journal*, and the topic ‘information system research’ is most frequently observed in *MISQ* and the *Journal of Information Technology*.

Methodology	EJIS	ISJ	ISR	JAIS	JIT	JMIS	JSIS	MISQ
Survey	123	67	90	71	41	118	60	101
Case study	101	87	22	46	87	28	60	47
Frameworks and conceptual model	21	13	6	38	14	7	10	29
Qualitative research	78	75	26	44	40	31	36	53
Speculation/ commentary	29	4	27	23	73	0	8	31
Literature review	18	23	5	70	46	16	27	38
Literature analysis	18	5	1	4	12	1	5	9
Field research	10	8	24	11	7	16	3	31
Field experiment	6	2	34	6	3	23	1	28
Laboratory experiment	13	11	48	36	3	56	2	43
Mathematical modeling	22	4	237	24	8	139	14	142
Design science	8	3	3	16	0	14	2	14
Secondary data	8	3	44	6	7	31	10	21
Content analysis	9	5	4	6	2	5	0	4
Social Network Analysis	2	2	8	2	3	3	1	0
Machine learning, Data mining, Text mining and Web mining	3	0	8	1	3	19	0	12

Table 11. Number of papers representing each methodology by journal

Regarding the research methods, the *European Journal of Information Systems* and the *Journal of MIS* have published the largest number of papers with survey method; however, *Information Systems Research Journal* contains the largest number of papers using mathematical modelling.

5 Discussion and Conclusion

Information system is an emerging and unique discipline, which is constantly experiencing rapid changes as such understanding the topics and research methods used in this field and the trend of the changes in this regard can be useful for researchers in the field of information systems. Accordingly, this study detected the trends in the field of information system research over a twelve-year period (2007-2018) using a comprehensive literature analysis approach.

5.1 Topics and their trends during 2007-2018

The first objective of this study was to investigate the topics used by researchers and their trends during a 12-year period. To this end, 3252 articles from the top eight information system journals were reviewed and analysed by three coders. Accordingly, several findings were achieved. First, the analyses showed that electronic commerce/business received higher attention among the other topics. This field of research dramatically caught the attention of many researchers with the advent of the Internet. With revolutionary advances in Internet technology and relevant software and applications to facilitate e-commerce, the research in this area continues to grow. This finding is in line with the findings of previous studies (e.g., Palvia et al., 2015).

Information system research is another area which has been addressed frequently. In some other review studies (Avison et al., 2008; Palvia et al., 2015), this field was also ranked third. The present study refers to research papers on information system dimensions such as models, methods, paradigms and theories. Considering the emerging and interdisciplinary nature of information system and the need to address paradigms, models, new methodologies and theories in this field, this topic seems to be of interest in future studies.

The third area of research is the usage and acceptance of information systems. In a large number of previous studies, this area has been among the top three issues (Palvia et al., 2015; Palvia et al., 2004; Palvia et al., 2007; Sinclair et al., 2004). The turning point of research on the usage and acceptance of information systems was emerged following Davis' (Davis, 1989) study on technology acceptance model. Afterwards, many researchers have increasingly addressed this issue in various Journals so that the research on this topic has remarkably grown.

5.2 Methodologies and their trends during 2007-2018

As the second objective of the study, the researchers were to detect the most common research methodologies and their trends. The findings showed that most of the published papers are empirical studies and have used a survey method for data collection. This finding is consistent with the findings of some other studies (Chen & Hirschheim, 2004; Myers & Liu, 2009; Palvia et al., 2015; Palvia et al., 2004; Palvia et al., 2003; Palvia et al., 2007). Information system researchers generally prefer to use survey method so that more than a quarter of the reviewed papers adopted this method to collect data. However, the results also revealed that that some recent researchers have also adopted qualitative and case study methods since these methods provide a deep, precise, and clear understanding of a phenomenon under study. The second

most popular methodology was the mathematical model. In this study, a wide range of methods such as analytical models, formula-dependent models, optimization models, algorithms, multi-criteria decision-making, Bayesian Networks, hierarchical linear modelling, regression analysis, panel co-integration analysis, Multiple Indicators-Multiple Causes were also in this category. Such an increased attention indicates that the authors are seeking to increase the accuracy of the research through adopting mathematical, quantitative, and complex methods.

5.3 Research Gaps and Future Trends

The third objective of this paper was to identify research gaps and predict the future trends in the field of information system research. In this regard, a few points should be noted. First, the topics 'IoT', 'bitcoin / block chain / Fintech', 'sharing economy/digital platform' and digital transformation have been recently raised in the field of information systems as such they have not been included in previous classifications; hence, the future researchers are more likely to focus on these issues.

Researchers have identified these issues based on the analysis of papers published during the research period. In other words, in recent years due to rapid innovation in information technology, new subject areas and issues emerging from these resulted in publications that did not fit previously identified subject areas and issues. Researchers identified these issues by reviewing papers during the coding process. These categories were confirmed by attending conferences, typically, the first places where new research comes to light. Evidence to supporting the identification of new topics was obtained by examining conference topic lists. For example, in the International Conference on Information Systems (2020), in Track Descriptions Section, the following topics were introduced as new research topics: 'block chain, DLT, and Fintech', 'sharing economy, platforms, and crowds', 'digital innovation, entrepreneurship, and new business models', and 'IoT and the smart connected world'. In Pacific Asia Conference on Information Systems (2020), in Track Descriptions Section, the following topics were considered as new research topics: 'block chain, Fintech, and emerging technologies', 'sharing economy', 'digital transformation and social impact in the MENA Region'.

Second, the topic 'Big Data' was first posed in 2012 in the concerned journals and experienced a relatively large growth in 2015 and 2016. Today, with the advent of technologies, various devices and equipment such as mobile phones, environmental sensors, various software logos, cameras, microphones, RFID detection devices, wireless sensor networks, social networks, and data production are increasing at a dazzling speed. Accordingly, the large volume of information available to organizations, on the one hand, and the complexity of societies and organizations and the increasing need for decisive decisions based on this comprehensive information, on the other hand, require an established alignment between business needs and information system research in this field. This topic, thus, seems to be one of the would-be research areas.

The other interesting trend is social media, which has also been of great interest over the past twelve years. Given its high popularity among users and its widespread use, this topic is likely to be the focus of attention in the future.

Regarding the research methodology, a significant trend is to decrease the use of framework methods and conceptual models. Although it was greatly used in 2012, it was less addressed

in 2015, 2016, and 2017. Once more, this topic became the hotbed of debate in 2018. These results suggest that the journals are more inclined to publish the real research more than the frameworks guiding the research studies.

The other notable trend is the increasing use of machine learning and data mining over the last two years. According to the descriptions on big data and given the enormous amount of information available, these methods are suggested for the analyses as such they would be more widely used in the future.

Finally, the present study contributes to the existing literature by providing a detailed and relatively comprehensive overview of the information system studies in authentic journals and comparing the results. Moreover, the novelty of this research lies in its being up-to-date and including a larger number of top journals.

One of the limitations of the present research was that only eight journals were investigated. Although a large number of the leading experts and authors in the field of information system have published their papers in these journals, there are some other specialized journals such as *Decision Support Systems*, *Journal of Global Information Technology Management*, *IEEE*, *Information and Management*, which were not included in this study. These journals have their own rules and themes in selecting topics and methodologies; hence, the results of this study could be generalized to all the research information management systems with little caution.

Another limitation is concerned with the classification scheme for the research topics. Despite the fact that a highly comprehensive list of topics was developed based on the previous research, the topic list turned out not to be completely comprehensive, and the topics of some papers were not included in these categories. Accordingly, some of the issues were inevitably added during the coding process. The same limitation was noticed regarding the research methodology. One more limitation was the level of details for the topics. In order to preserve meaningfulness, topic categories should not be too broad or too limited. In this regard, we were to have an appropriate level of topic classification, to the best knowledge of the research team. However, the findings were at the same time affected by the type of thematic categories to some extent. In other words, the categories were affected by the topics grouped together or separated from each other. For example, a team, a virtual team, and collaboration were grouped together in one category; however, social networks and social media were classified separately. This came true for the level of methodological details.

Finally, since coding a large number of papers requires the division of tasks, and coding was carried out by three coders, there may be differences in codes. We spared our efforts to minimize such concerns through evaluating the coders using two sets of papers and reaching a common understanding. Moreover, the inter-coder reliability was higher than the recommended values, indicating that there was a considerable degree of common understanding and agreement among the coders.

Considering the scope of the research, future researchers are recommended to consider other journals and compare them with the findings of the present research. Furthermore, more comprehensive frameworks are suggested to be considered for future work. In other words, in addition to topics and methodologies, the future studies should include models and approaches, paradigms, writers, and universities. Further, the future researchers can examine the adopted research methodologies to determine which methodology and topic are more consistent.

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