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Twenty-five years of the Information Systems Journal: A bibliometric and ontological overview

Ariel La Paz[1] | José M. Merigó[1] | Philip Powell[2] |
Arkalgud Ramaprasad[3] | Thant Syn[4]

[1]Department of Management Control and Information Systems, School of Economics and Business, University of Chile, Av. Diagonal Paraguay 257, Santiago, 8330015, Chile

[2]School of Business, Economics and Informatics, Birkbeck—University of London, London, WC1E 7HX, UK

[3]Department of Information and Decision Sciences, University of Illinois at Chicago, 601 South Morgan Street, Chicago MC, 294, Illinois, USA

[4]Division of International Business and Technology Studies, Texas A&M International University, Laredo, Texas, USA

Correspondence
Philip Powell, School of Business, Economics and Informatics, Birkbeck—University of London, London WC1E 7HX, UK.
Email: beidean@bbk.ac.uk

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Abstract

The Information Systems Journal (ISJ) published its first issue in 1991, and in 2015, the journal celebrated its 25th anniversary. This study presents an overview of the leading research trends in the papers that the journal has published during its first quarter of a century via a bibliometric and ontological analysis. From a bibliometric perspective, the analysis considers the publication and citation structure of the journal. The study then develops a graphical analysis of the bibliographic material by using visualization of similarities software that employs bibliographic coupling and cocitation analysis. The work produces an ontological framework of impact and analyses the journal papers to assess qualitatively ISJ's impact. The results indicate that the journal has grown significantly over time and is now recognized as one of the leading journals in information systems. Yet challenges remain if the journal is to meet its aims in impacting and setting the agenda for the development of the Information Systems field.

KEYWORDS
bibliometrics, ontological analysis, VOS viewer, Web of Science

1 | INTRODUCTION

The Information Systems Journal (ISJ) is a leading international journal in the field of information systems (IS). The journal was created in 1991 by David Avison and Guy Fitzgerald as a British/European journal that aimed to challenge the existing American leadership in the field (Martinsons, 2016). Currently, ISJ is indexed in the Journal Citation

Reports (JCR) in the Social Science Edition, a database that only indexes those journals of the highest quality. In the latest editions of the JCR, ISJ is usually ranked in the top 25% of journals in its field. Additionally, ISJ is a constituent of the Association of Information Systems Senior Scholars' basket of eight top journals (Lowry et al., 2013). The journal produces six issues per year and is published by John Wiley & Sons.

Bibliometrics is a research field of information and library sciences that analyses bibliographic material quantitatively (Broadus, 1987). One of its main advantages is the ability to provide general overviews that identify the leading trends of the bibliographical material considered. Bibliometrics may be developed for many purposes including the analysis of research by countries (Bonilla, Merigó, & Torres-Abad, 2015), by authors (Podsakoff, MacKenzie, Podsakoff, & Bachrach, 2008) and by institutions (Cakir, Acarturk, Alasehir, & Cilingir, 2015). In IS research, several bibliometric studies analyse the state of the art (Culnan, 1987; Gallivan & Benbunan-Fich, 2007; Hirschheim & Klein, 2012) under a wide range of contexts including leading authors (Dean, Lowry, & Humpherys, 2011; Truex, Cuellar, Takeda, & Vidgen, 2011), institutions and countries (Clark, Au, Walz, & Warren, 2011), journals (Córdoba, Pilkington, & Bernroider, 2012; Lowry et al., 2013; Willcocks, Whitley, & Avgerou, 2008), and topics (Grover, Ayyagari, Gokhale, Lim, & Coffey, 2006).

Ontologies have a long history in philosophy and metaphysics but more recently have focused on defining a domain's concepts and categories and the relationships between them. Ontologies are used extensively in computer science, medicine, and philosophy. This paper develops an ontology of research impact that is less formal than computer scientists', more parsimonious than medical terminologists', and more pragmatic than philosophers'. It is designed to be actionable and practical, not abstract and metaphysical. The ontology provides a holistic vision of the journal impact domain and is used to systematically map, analyse, and synthesize a given corpus of knowledge, in this case, the publications of the journal. Its granularity matches that of the discourse in research and facilitates the mapping and translation of the domain-text to the framework and the framework to the domain-text. Using the ontology, this research systematically maps all the articles published in the first 25 years of ISJ in order to assess its impact.

In 2016, ISJ celebrated its 25th anniversary. Motivated by this event, this paper develops a bibliometric and ontological analysis of the publications of the journal between 1991 and 2015. The main advantage of this approach is the identification of the leading research trends in the journal under a wide range of contexts, including highly cited documents, leading authors, and key topics. The bibliometric results are studied by using the Web of Science (WoS) Core Collection, and a graphical analysis is carried out with bibliometric software: visualization of similarities (VOS) viewer (Van Eck & Waltman, 2010). The main benefit of developing a bibliometric analysis is that readers of the journal can easily get a snapshot of key issues that are apparent and are emerging in ISJ by investigating the publication and citation structure (Gaviria-Marín, Merigó, & Popa, 2018). Moreover, the development of an ontological analysis (Ramaprasad & Syn, 2015) visualizes the leading perspectives that affect the journal and its impact. ISJ has published retrospective evaluations of the journal, particularly regarding historical perspectives (Avison, Dwivedi, Fitzgerald, & Powell, 2008; Avison & Fitzgerald, 2012; Avison, Fitzgerald, & Powell, 2001) and of its leading themes (Evangelopoulos, 2016; Love & Hirschheim, 2016). However, it has not yet developed a deep bibliometric and ontological overview that integrates quantitative and qualitative perspectives of a systematic description, as presented here. Ontological analysis of bibliographic resources is gaining attention, prompted by discussions of what "journal impact" really is (La Paz, Merigó, Ramaprasad, & Syn, 2015), and by understanding that the impact of the knowledge published by journals permeates far beyond citation indicators.

The rest of the paper is organized as follows: First, the work reviews the bibliometric and ontological methods used here. Next, the study presents the results that consider the publication and citation structure of the journal, its leading authors and institutions, citing articles, and a keyword analysis. The paper then develops an ontological approach to the bibliographic results of ISJ. Finally, the work presents findings and conclusions.

2 | BIBLIOMETRIC AND ONTOLOGICAL METHODS

2.1 | Bibliometric methods

Bibliometrics is a res earch field of information and library sciences that studies bibliographic material in a quantitative way (Broadus, 1987; Pritchard, 1969). In order to assess the information, bibliometrics uses a wide range of indicators including the number of documents published, the number of citations, the citations per paper, and citation thresholds (Merigó, Gil-Lafuente, & Yager, 2015). Moreover, there are other, more complex indicators that combine the number of publications with the number of citations (Alonso, Cabrerizo, Herrera-Viedma, & Herrera, 2009; Ding, Rousseau, & Wolfram, 2014) such as the h-index (Hirsch, 2005). If the h-index of a set of documents is 20, it means that of all the documents in the set, there are 20 documents that have received 20 or more citations. The h-index has been used for many purposes including the measurement of a complete field generating what it is known in the literature as the h-classics (Martínez, Herrera, López-Gijón, & Herrera-Viedma, 2014). In some cases, studies consider other specific indicators for particular circumstances such as the Academic Ranking of World Universities (ARWU) and the Quacquarelli Symonds (QS) University Ranking. These indicators complement the information found from the bibliometric analysis of ISJ.

The study considers all the papers published in the ISJ between 1991 and 2015 but excludes early view. However, the bibliometric analysis focuses only on articles and reviews as they are usually representative of scientific contributions, while editorial material, notes, surveys, and book reviews are excluded. The study searches the bibliographic material through the WoS Core Collection database. WoS is a database that indexes only journals that have received a peer-review evaluation of high quality, with the aim of archiving all the leading scientific material that is published globally. This search was performed between September and November 2016. During the 25-year period, ISJ published 451 articles and/or reviews. In October 2016, the ISJ has received 8973 citations in WoS having a ratio of cites per paper of 19.90 and with an h-index of 49. That is, of the 451 publications, 49 have received 49 citations or more.

The analysis considers a wide range of issues including the publication and citation evolution of the journal, the most cited articles, the citing articles and the most frequent author keywords, and also a graphical analysis by using the VOS viewer software (Van Eck & Waltman, 2010). This software uses several concepts including bibliographic coupling, cocitation, and co-occurrence of keywords (Cancino, Merigó, Coronado, Dessouky, & Dessouky, 2017; Laengle et al., 2017). Bibliographic coupling appears when two documents cite the same third document (Kessler, 1963) while cocitation occurs when two documents receive a citation from the same third document (Small, 1973). Co-occurrence measures the number of times that each keyword appears in the author keyword list of the documents considered (Martínez-López, Merigó, Valenzuela, & Nicolás, 2018; Merigó, Pedrycz, Weber, & de la Sotta, 2018). A selection of rankings and visualizations is offered, with supporting tables and other material provided in the appendices.

2.2 | Ontological methods

2.2.1 | Ontology of research impact

An ontology represents a conceptualization of a domain (Gruber, 2008); it organizes the terminologies and taxonomies of the domain in a well-defined system. It is an "explicit specification of a conceptualization," (Gruber, 1995, p. 908) and can be used to systematize the description of a complex system (Cimino, 2006), creating simultaneously a number of specific hypotheses and theories related to the nature and structure of reality (Guarino, Oberle, & Staab, 2009; Wyssusek, 2004). As a complex concept, journal impact has not being captured in a narrative sentence but tends to be measured with the proxy of citations. An ontology may be parsimonious and effective in capturing its complexity while making it visible and comprehensible. The ontology is a combinatorial, visual, natural English

representation capable of encapsulating 500 potential pathways of research impact in a page, understandable to novices and experts. The number of pathways corresponds to all the combinatorial possibilities of the elements in each ontological framework dimension and is calculated as the multiplication of the number of elements in the taxonomies.

The ontology of research impact is presented in Table 1, and the following discusses the rationale for, and the logic underlying, construction of the ontology. A detailed description of ontological meta-analysis and synthesis is provided by Ramaprasad and Syn (2015), and the application of the method to analyse the literature in a domain by Cameron, Ramaprasad, and Syn (2017). It has been used to study a corpus of research on eCommerce (La Paz, Ramaprasad, Syn, & Vasquez, 2015), national health care policies (Ramaprasad, Win, Syn, Beydoun, & Dawson, 2016), and other domains.

Impact—the rightmost dimension in the ontology is a taxonomy of five ordinal categories. At the top is agenda-Setting research (words that refer to the dimensions of the ontology are capitalized, as are references to elements of a dimension.) Such research sets the agenda for future by introducing new paradigms, frameworks, methods, or breaking away from old ones. *Agenda-Setting* research papers are the ones that are likely to be "classics," perhaps revolutionary—to have the greatest impact upon the domain of research. The second category in the taxonomy is *agenda-Extending* research. Such research extends the existing paradigms, frameworks, and methods significantly but does not break away from them—radical perhaps, but not revolutionary. Papers in this category are likely to be semi-classics—to have significant impact on the domain of research. The third category is *agenda-Following* research. Such research works within the existing paradigms, frameworks, and methods confirming them, modifying them, and refining them. Papers in this category add incrementally to the body of knowledge. *Agenda-Neutral* research, as the name suggests, does not fit any paradigm, framework, or method. It is eclectic and perhaps interesting. It can reveal the boundaries and limits of the present paradigms, frameworks, and methods. It may catalyse agenda-Setting research by posing new questions and new problems. The last category is *agenda-Correcting* research. Such research is infrequent, but important. It corrects the errors in the other types of research described above. It may terminate a line of research, change its directions, or spawn an entirely new branch. A journal's impact will be based on the combination of impacts of the articles it publishes, and it would be expected that its mission statement and strategy to publicize and manage the submission and review process are aligned and articulated to achieve a given impact.

The *relevance* of an article may be *theoretical*, *empirical*, *applied*, *grounded*, and/or *integrative*, based on their contribution to knowledge in the domain. These are commonly accepted, broad categories of research. There are other categories too—for example, *basic* and *translational*. Basic research may be theoretical or empirical; translational research would be a combination of theoretical/empirical on one hand, and applied/grounded on the other, with feedback from each to the other. The five types capture the broad range of research in IS.

The categories are nominal. A research article may fit into one or more categories; and a journal may publish articles belonging to one or more categories. Theoretical articles are logically constructed, based on abstract constructs and concepts. They may articulate theoretical paradigms, frameworks, or models. Empirical articles, by contrast, are data driven. The data may be qualitative or quantitative; they may be collected using a variety of methods and

TABLE 1 Ontology of research impact

Relevance		Rigour		Temporality		Impact	
Theoretical		Definitive		A priori		Setting	
Empirical		Predictive		Ex ante		Extending	
Applied	+	Explanatory	+	In praesenti	Agenda-	Following	Research
Grounded		Descriptive		Ex post		Neutral	
Integrative				A posteriori		Correcting	
Total components = 5 * 4 * 5 * 5 = 500							

analysed using a range of techniques. Applied articles are based on the application to practice—in "real life." They entail the translation of theoretical and empirical research to practice to obtain feedback from practice to theoretical and empirical research. Grounded research is rooted in, and emerges from, the phenomenon that is the object of research. The phenomenon itself becomes the data. The data are documented qualitatively and quantitatively and organized and analysed to abstract conceptual and theoretical explanations of the phenomenon. Integrative research synthesizes an existing body of research—theoretical, empirical, applied, and grounded—and interprets it. It provides insights into the research's consistencies, inconsistencies, gaps, and potential advances. The genre of meta-analysis fits into this category and as do traditional reviews.

The *rigour* of a piece of research may be *definitive, predictive, explanatory,* or *descriptive*. The categories are ordinal. The ultimate, somewhat idealized, purpose of research is to obtain definitive knowledge—one that asserts a definitive causal relationship. Such knowledge is usually the product of well-controlled, double-blind, experimental studies. This standard is difficult to achieve in IS research but is an iconic goal. Predictive research asserts a temporal association sequence (for example—leads to) without asserting a causal relationship. The temporal association may arise from a known or unknown causal mechanism or combination of causal mechanisms. The temporality may be ordinal (simply A follows B), or interval/ratio (A follows B in X time units). Explanatory research simply asserts an association—neither temporal nor causal. The association may be intuited, validated statistically via correlation, or both. Correlation may be an indicator of predication or causation but is not synonymous with them. Descriptive research is simply an articulation of the entities constituting the phenomenon of interest, their structure, functions, and patterns. It does not assert association, prediction, or causation. It is simply the "basic standard." The rigour of research in any domain usually progresses from the descriptive to the definitive (hence the ordinality of the categories). The advances in a domain are based on feedforward and feedback between these categories of research.

The *temporality* of a research article is defined with reference to the phenomenon or the events constituting the phenomenon being studied. The categories are ordinal. A priori research is focused on phenomena which are unknown or unobserved. It seeks to conceptualize and observe them. The Higgs-Boson particle, for example, was conceptualized long before it was observed, before anyone imagined the existence of such an entity. Ex ante research is focused on the phenomenon prior to its occurrence. In praesenti research is focused on a phenomenon in real time, as it occurs. Ex post research focuses on a phenomenon after its occurrence. A posteriori research focuses on a phenomenon long after it has occurred. A priori research is the pinnacle of scientific research—to describe, explain, predict, and control the phenomena before it occurs. It would have been interesting to have had this type of research on the impact of social media such as Facebook and Twitter. There is not—although there is a profusion of a posteriori, ex post, and in praesenti research and now some ex ante research. A priori research is difficult in the social and behavioural sciences. For example, there is still time to theorize about the uses of money after the development of cryptocurrency, and ISJ could lead this research agenda. A research article may have singular or multiple temporality; a journal, by the same token, may publish articles spanning different Temporalities.

The four dimensions of the ontology are arranged left to right with adjacent signs and words such that reading left to right concatenating a category from each dimension forms 500 different sentences. Each such sentence is a potential component of a journal's impact. Four such components are illustrated below:

- Theoretical definitive, a priori agenda-Setting research. For example: a grand theory of technology acceptance.
- Applied descriptive *a posteriori* agenda-Neutral research. For example: case studies.
- Empirical predictive *ex ante,* agenda-Extending research. For example: replication of an empirical study in a different context.
- Empirical definitive *ex post,* agenda-Extending research. For example: review of a meta-analysis of research in a domain.

The above four components, and 496 others encapsulated in the ontology, are the potential components of research impact. The ontology deconstructs the construct and presents its combinatorial complexity concisely and, thus, helps take a systemic view of the problem of journal impact systematically.

Studying across papers, some components or its fragments may be instantiated frequently, some infrequently, and others not at all. Here, the frequently instantiated components/fragments are labelled the "bright" spots; the infrequent ones the "light" spots, and the overlooked ones the "blind/blank" spots. A "bright" component/fragment may be so because it is effective and important; it may also be a consequence of habit and of the herd effect, irrespective of whether it is effective or important. A "light" component/fragment may be so because it is ineffective and unimportant; it may also be a consequence of the difficulty of implementing it, irrespective of its potential effectiveness or importance. A "blind/blank" component/fragment may have been simply overlooked by design or by accident; or it may be infeasible. Knowing the luminosity of components/fragments and their antecedent reasons will help develop more systemic and systematic approaches to the challenge of understanding a journal's research impact. This paper maps the impact of all the articles published in ISJ in its first 25 years (1991-2015).

2.2.2 | Coding and analysis

This section explains how the ISJ articles were coded onto the ontology. The title, keywords, and abstract of all the 451 articles published in ISJ since its inception were downloaded into an Excel spreadsheet with the ontology arranged in the columns and the published article's information listed in rows to aid coding. Articles that do not have abstracts were not coded. Using the tool, a coder can map each article onto the elements of the ontology it addresses marking up with "1" the elements addressed and "0" the elements not addressed.

Three of the co-authors each coded two-thirds of the articles independently, overlapping the assignment in such a way that each article was coded by two researchers. After the first round of coding a sample of 25 articles, a comparison matrix of each pair of coders was generated. The coders discussed the differences between their coding based on the comparison matrix to obtain convergence of their coding. After the discussion, the coders revisited their respective coding and coded the rest of the articles. The comparison matrix after the second round showed increased, but not perfect, agreement reaching a total interrater reliability of 0.788, with partial reliabilities of 0.81, 0.70, and 0.85, respectively, on each 1/3 of data coded by pairs of co-authors (example in Table A1). The final coding was the union of the two coders on each article. The union is likely to decrease the errors of exclusion of an element and increase the errors of inclusion of an element. Thus, if an article was coded as empirical by one coder and applied by the other, it was coded as both empirical and applied in the final coding. On the other hand, the intersection of the two coders is likely to increase the errors of exclusion and decrease the errors of inclusion. In the above example, the article would be coded as neither empirical nor applied. In other words, with the union the coding will be broader than with the intersection.

There was no restriction on how many elements of the ontology could be encoded regarding an article, or a requirement that an article should be encoded on all the dimensions of the ontology. Thus, an article could be encoded to (a) an element from each dimension, (b) multiple elements from each dimension, (c) an element from some dimensions, or (d) multiple elements from some dimensions. Note that the coding is binary—whether the element (or its synonym) was present or not in the statement. The coding was not weighted; each encoding was assigned equal weight.

The data were analysed using the same Excel tool used for coding to generate ontological maps of research articles. The ontological maps show the frequency of occurrence of each element in the ontology in the corpus of research papers. The data are clustered using SPSS to extract the underlying themes.

3 | BIBLIOMETRIC RESULTS

This section presents the bibliometric results including the publication and citation structure of ISJ, the most cited papers, the citing articles, and the keyword analysis.

3.1 | Publication and citation structure of ISJ

ISJ published its first issue in 1991. Until 2007, the number of papers published annually in the journal varied between 15 and 20. Since 2008, the number of articles published annually increased and during the last 3 years is between 20 and 25. Note that this work only considers articles and reviews. ISJ is an influential journal, and its articles have received a significant number of citations, which is reflected in a dramatic increase in the journal's impact factor in the last 5 years from 1.381 in 2012 to 4.122 in 2016 and 4.267 in 2017. Note that this result is supported by the fact that ISJ has growing its number of citations but does not publish many papers annually. The denominator of the impact factor depends on the number of articles published during the last 2 years (Merigó, Mas-Tur, Roig-Tierno, & Ribeiro-Soriano, 2015).

Table A2 shows the 50 most cited papers of the journal in the first 25 years. Observe that since the journal has an h-index of 49 (that is, 49 documents with 49 citations or more), this list could be seen as the h-classic papers (Martínez et al., 2014). In the research published by ISJ, 13 papers have received over 100 citations. Above a 50 citation threshold, there are 46 papers—which represent around 10% of all the papers published in the journal.

The most cited paper was published by Carter and Belanger in 2005. This paper has almost 300 citations, and an annual citation rate of 30. No paper published after 2011 is in the top 50, though, naturally, these articles have had less time to receive a significant number of citations.

Table 2 presents the 25 most cited documents in the Journal. The aim is to identify the most relevant research that influence new contributions published in ISJ. There may be some limitations and deviations in this analysis as the most cited papers are not always most influential. But, essentially, Table 2 can be viewed as identifying research with significant impact in ISJ.

The citation network of the most cited papers indicates that most of the articles are published in journals with a similar profile to ISJ, including MIS Quarterly, Information Systems Research, and the European Journal of Information Systems. However, some key papers published in other journals are also identified, including Communications of the ACM, Journal of Marketing Research, and Organization Science. Additionally, some representative books are highly cited in the journal.

3.2 | Most productive and influential authors, institutions, and countries

Many authors from different countries have published in the journal. In order to identify the leading ones, Table A3 presents a list of the 30 most represented authors in terms of publications and citations. Table A3 ranks the authors by the number of citations, but with the requirement of having published at least three articles in ISJ in order to be included in the list.

North American and British authors dominate the list. Only four authors in the list are currently working in a non–English-speaking country. Four authors work at Georgia State University and three at the University of Manchester. Lyytinen is the most productive author and Keil the most cited. Note that the institutional affiliation shown in the table for each author is the most recent of a publication by the author in ISJ.

Authors from a wide range of institutions have published in ISJ. In order to identify the leading ones, Table A4 presents the 30 most productive and influential institutions. Note that they are ranked according to the number of citations, but with the requirement of having at least three articles published in the journal.

TABLE 2 Top 25 most cited documents in ISJ publications

R	Year	First Author	Source	V	P	Type	TC	Co
1	1999	Klein, H.K.	MIS Quarterly	V23	P67	A	42	41
2	1981	Checkland, P.B.	Systems Thinking, Systems Practice			B	40	38
3	1991	Orlikowski, W.J.	Information Systems	V2	P1	A	37	37
4	1994	Huberman, M.	Qualitative Data Analysis			B	35	32
5	1989	Eisenhardt, K.M.	Academy of Management Review	V14	P532	A	33	31
6	1995	Walsham, G.	European Journal of Information Systems	V4	P74	A	32	30
7	1981	Fornell, C.	Journal of Marketing Research	V18	P39	A	31	30
8	1989	Hirschheim, R.	Communications of the ACM	V32	P1199	A	29	29
9	1979	Burrell, G.	Sociological Paradigms			B	28	28
10	1990	Checkland, P.	Soft Systems Methodology			B	28	27
11	1994	Yin, R.	Case Study Research: Design and Methods			B	27	27
12	1967	Glaser, B.	Discovery of Grounded Theory			B	24	23
13	1983	Markus, M.L.	Communications of the ACM	V26	P430	A	24	23
14	1989	Davis, F.D.	MIS Quarterly	V13	P319	A	22	21
15	1989	Earl, M.J.	Management Strategies for Inform. Technology			B	22	16
16	1988	Curtis, B.	Communications of the ACM	V31	P1268	A	21	20
17	1992	Delone, W.	Information Systems	V3	P60	A	20	17
18	1984	Giddens, A.	The Constitution of Society			B	20	19
19	1992	Orlikowski, W.J.	Organization Science	V3	P398	A	20	20
20	1990	Avison, D.E.	Multiview: An Exploration of Information Systems			B	19	19
21	1995	Rogers, E.M.	Diffusion of Innovations			B	19	18
22	1986	Winograd, T.	Understanding Computers and Cognition			B	19	16
23	1993	Walsham, G.	Interpreting Information Systems in Organizations			B	18	16
24	2003	Chin, W.W.	Information Systems Research	V14	P189	A	17	17
25	2003	Venkatesh, V.	MIS Quarterly	V27	P425	A	17	17

Note. The abbreviations are available in previous table except for V = volume; P = page; A = articles; and B = books.

Georgia State University dominates the list, both in productivity and in influence. Three British universities are also well ranked with a significant number of publications and citations: London School of Economics and Political Science, University of Warwick, and University of Manchester. Most of the universities are located in English-speaking countries. Nine institutions are in other countries.

Looking more generally, it is interesting to note the country of origin of the institutions in order to identify the geographical regions that publish most in ISJ. Table A5 presents the most productive and influential countries.

The United States and the United Kingdom clearly dominate the list. It is worth noting that during the first years of the journal, the United Kingdom dominated the journal, although this hegemony reduced with the journal becoming a truly international one containing publications from North America, Europe, and Asia-Pacific (Avison & Fitzgerald, 2012). Additionally, when looking to the results per capita, the United States is not as dominant compared with small, developed countries including Finland, Denmark, Ireland, New Zealand, and Norway. Emerging countries have

not published much in ISJ, with the exception of Taiwan, Hong Kong, and China that together have 35 papers. These results coincide with the study of Martinsons (2016) and imply that the journal is very international but is still not global.

To summarize the country results, Table A6 presents the results divided into supranational regions. Note that Western Europe and North America are the most productive regions while developing regions have published few papers in the ISJ.

3.3 | Keyword analysis and citations of ISJ

ISJ receives citations from a wide range of sources. In order to identify the leading ones, this research analyses the citing articles of ISJ available in the WoS Core Collection. Table 3 presents the top 30 journals giving citations to ISJ documents, divided into 5-year periods.

As expected, the self-citations of ISJ are the most common. However, they represent a very small percentage of the total citations received by the journal. In general, ISJ mainly receives citations from IS journals including the European Journal of Information Systems, International Journal of Information Management, and MIS Quarterly. It is also worth noting the significant growth in the number of citations during the last few years, particularly in the latest 5-year period.

In order to identify the journals that are more cited by publications in ISJ, Table 4 presents a cocitation analysis of journals cited in ISJ. Recall that cocitation occurs when two documents receive a citation from the same third document (Small, 1973). The table considers the top 25 journals.

MIS Quarterly is the most cited journal in ISJ followed by Communications of the ACM and ISJ self-citations. Other journals cited in ISJ include leading IS journals and some general management journals such as Organization Science, Management Science, and the Academy of Management Review.

In order to understand better the citation structure of the journals cited in ISJ, it can be visualized through the VOS viewer software. Figure 1 shows the results considering a threshold of 20 citations and 100 connections. Note that the colours visualize cocitation clusters between the journals and the figure does not use capital letters.

The graph shows that general management journals tend to receive citations from the same papers while other articles tend to cite more information and computer science journals. However, ISJ seems to be more influenced by journals with a management profile.

ISJ publishes a wide range of topics in the IS discipline. In order to identify the leading topics published in the Journal, this research carries out a keyword analysis based on the keyword list provided by authors. In order to deal with this bibliographic material, the study uses the VOS viewer software to develop an author keyword analysis through co-occurrence of keywords.

"Information systems" is, unsurprisingly, the most common keyword. Additionally, some connected keywords are widely used, including IS development, information technology, information, and IS planning. The results, divided into periods of 5 years, indicate that now the term information systems is as well used, as perhaps it could be considered redundant. Due to this, other keywords are emerging as more common, including E-government and software development.

In order to visualize graphically how these keywords are connected, Figure 2 presents the co-occurrence of author keywords considering a threshold of three documents and the 100 most representative connections.

"Information systems" is at the core of the graph. Note that the network connections indicate the keywords that are frequently used in the same documents. In a deeper analysis of the content published by ISJ, Love and Hirschheim (2016) authors develop some general, thematic clusters of the ISJ articles and compare them with the thematic clusters of the eight journals of the Association for Information Systems (AIS) Senior Scholars' basket that also includes ISJ.

TABLE 3 Citations received by ISJ: Journals divided in periods of time

Rank	Journal	91-95	96-00	01-05	06-10	11-15	Total
1	Information Systems Journal	0	23	27	97	113	260
2	European Journal of Information Systems	1	9	24	83	81	198
3	International Journal of Information Management	0	2	17	30	63	112
4	MIS Quarterly	0	5	12	28	63	108
5	Journal of Information Technology	0	9	21	27	48	105
6	Information & Management	0	2	11	24	55	92
7	Journal of the Association for Information Systems	0	0	0	41	51	92
8	Journal of Strategic Information Systems	1	4	13	28	38	84
9	Computers in Human Behavior	0	0	0	12	69	81
10	Government Information Quarterly	0	0	0	23	49	72
11	Decision Support Systems	0	0	5	22	43	70
12	Information and Software Technology	0	4	7	23	32	66
13	Journal of Computer Information Systems	0	0	5	16	33	54
14	Journal of Management Information Systems	0	2	3	15	33	53
15	Information Systems Research	0	4	6	13	26	49
16	Industrial Management & Data Systems	0	0	3	14	30	47
17	Behaviour and Information Technology	0	0	0	11	34	45
18	Information Systems Frontiers	0	0	4	14	24	42
19	IEEE Transactions on Engineering Management	0	1	6	15	14	36
20	Information Systems Management	0	0	2	11	23	36
21	Information Technology & People	0	0	0	9	27	36
22	Journal of Systems and Software	0	0	3	10	23	36
23	Information and Organization	0	0	0	9	25	34
24	Journal of Global Information Management	0	0	3	12	18	33
25	Data Base for Advances in Information Systems	0	4	0	10	17	31
26	International Journal of Project Management	0	0	0	2	29	31
27	Journal of Database Management	0	0	4	14	10	28
28	International Journal of Mobile Communications	0	0	0	10	15	25
29	IEEE Transactions on Professional Communications	0	0	7	8	8	23
30	Systems Research and Behavioral Science	0	5	2	9	7	23

4 | ONTOLOGICAL RESULTS

To explore the research impact of ISJ from the ontological perspective and to contrast the achieved impact with ISJ's declared in its aims and scope on the journal's webpage, this research presents the ontological map of monads for all the 451 articles in Figure 3. It shows the frequency of occurrence of each element in the research articles. The length of bar below each element is scaled to the maximum count in the ontology (367).

The dominant relevance of the articles is theoretical (203), followed by empirical (181), and grounded (113). Applied (101) and integrative (84) articles are the least frequent. Given the multidisciplinary and integrative focus of ISJ, it appears to publish fewer of these articles. The emphasis on theoretical articles compared to empirical articles

TABLE 4 Cocitation of journals in ISJ publications

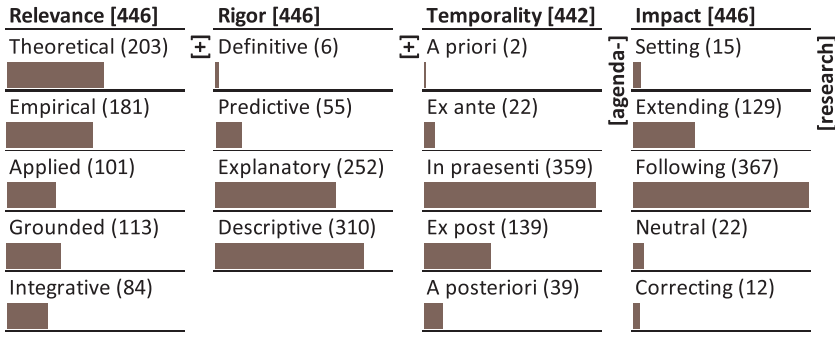| Rank	Journal	Citations	Cocitation Links
1	MIS Quarterly	1468	1263.09
2	Communications of the ACM	703	613.57
3	Information Systems Journal	621	563.13
4	Information Systems Research	495	462.72
5	Information Systems	471	299.47
6	Organization Science	455	407.47
7	Journal of Management Information Systems	373	358.38
8	Management Science	354	335.56
9	Academy of Management Review	330	311.36
10	European Journal of Information Systems	330	310.41
11	Information & Management	329	313.81
12	Harvard Business Review	211	199.00
13	Academy of Management Journal	209	199.02
14	Administrative Science Quarterly	201	191.73
15	Journal of Strategic Information Systems	147	139.73
16	Journal of Information Technology	131	124.45
17	Strategic Management Journal	125	118.08
18	Journal of Applied Psychology	122	113.88
19	Sloan Management Review	122	115.66
20	Decision Sciences	119	112.97
21	IEEE Software	110	99.62
22	Journal of the Association for Information Systems	103	100.11
23	Human Relations	101	89.72
24	Organization Studies	98	94.22
25	Decision Support Systems	92	89.34

in the context of growing emphasis on empiricism is interesting. Also noteworthy is the much greater emphasis on pure research (theoretical and empirical) than on applied research.

In terms of rigour, the papers are dominantly descriptive (310) and explanatory (252). By contrast, predictive (55) articles are rare, and definitive (6) articles are rarer. This is consistent with the types of publications that, according to its own overview, helped the journal build its reputation. However, the large gap between the descriptive and explanatory numbers on the one hand and the definitive and predictive on the other, may indicate limited movement towards greater rigour and potentially greater value of the research.

A clear majority of the articles are *in praesenti* (359), and many are ex post (139). There are very few a posteriori (39), ex ante (22), and *a priori* (2) articles. The overwhelming emphasis on the present and the past, as compared with the immediate and long-term future, corresponds to the focus on explanatory and predictive rigour, rather than predictive and definitive ones. It may reflect the dynamic nature of the field coupled with the emergent character of the IS discipline. Both these factors may make it difficult to investigate the future and easier to analyse the present and the past.

A clear majority of the articles are agenda-Following (367), and many are agenda-Extending (129). Very few are agenda-Neutral (22), agenda-Setting (15), and agenda-Correcting (12). To follow an agenda of research is easier than extending it, and to extend it is easier than setting one. The distribution may reflect the ease of doing research and

FIGURE 1 Cocitation of journals cited in ISJ

FIGURE 2 Co-occurrence of author keywords

publishing it. There is some emphasis on agenda-Neutral research, some of which could be agenda-Setting in the future. The focus on agenda-Correcting research, although relatively small, may be a sign of the self-reflection of the field. Agenda-Setting research is often future oriented. The limited emphasis on such research may be correlated

FIGURE 3 Ontological map of research articles

with the limited emphasis on ex ante/a priory research, and on definitive/predictive research. It is surprising to note, however, that although the dominant research is theoretical, it is not correspondingly agenda-Setting and is not particularly agenda-Extending. Theoretical research is a fertile ground for both.

The ontological map of monads highlights the individual elements emphasized in the articles. From the emphasis on the elements one may infer the dominant, less-dominant, and absent themes in the corpus. The first is likely to include the most frequent elements, the second the less frequent ones, and the last the infrequent elements. However, this may not always be the case. The dendrogram (Figure 4) is an exact visualization of these themes based on the association of elements in the data. It is based on cluster analysis using simple matching coefficient (SMC) and single-linkage, nearest-neighbour clustering. The clusters are formed based on the coding similarity between pairs of ontology elements in the corpus measured by the SMC (Sokal & Michener, 1958). SMC is a symmetric similarity measure that considers presence (coded as "1") and absence (coded as "0" or blank) of elements in the articles equally, in
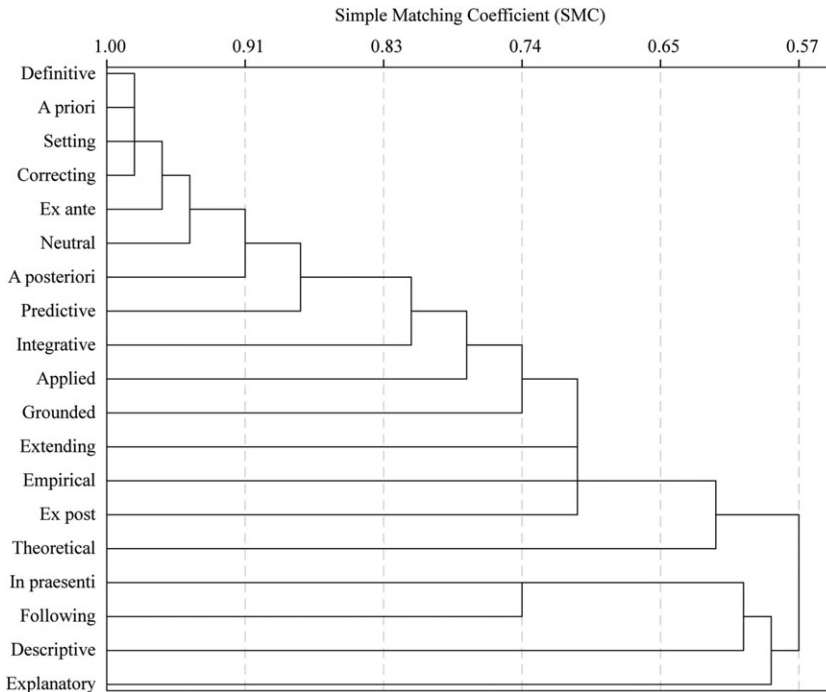
FIGURE 4 Dendrogram of research articles

contrast to other binary similarity/distance measures such as Jaccard (1912) and Sørensen-Dice (1945), which only consider presence of elements (Cheetham & Hazel, 1969; Gower, 1971).

The clusters in Figure 4 highlight groups of elements dominantly and lightly emphasized in the research corpus. Broadly, the bottom clusters contain the most frequent elements in the ontological map and the top clusters the elements that occur least frequently. While this pattern may be predicted from the ontological map, with some uncertainty, the clusters validate it.

By using the five equidistant divisions of SMC, the following five themes can be inferred in descending order of dominance in the research corpus. More divisions would result in finer-grained themes; fewer divisions will result in coarser-grained themes. Focusing on these clusters and summarizing them as themes by concatenating the elements within indicates the copresence and coabsence of ontology elements in the research corpus.

The bottom clusters of elements present the highest frequency from each dimension. It represents the primary themes—"bright" areas—of the research published by ISJ and can be summarized as follows:

Theoretical explanatory in praesenti agenda-Following research (68 articles)
Theoretical descriptive in praesenti agenda-Following research (93 articles)
Theoretical explanatory in ex post agenda-Following research (25 articles)
Theoretical descriptive in ex post agenda-Following research (28 articles)
Empirical agenda-Extending research (39 articles)
Grounded agenda-Extending research (36 articles).

The first four themes above highlight the present/past temporality of the theoretical articles, as opposed to their future (ex ante, a priori) temporality. They also highlight their agenda-Following impact, rather than being agenda-Setting or agenda-Extending. Their explanatory/descriptive focus also appears to be aligned with their present/past temporality and incremental agenda.

The second two themes interestingly highlight agenda-Extension via empirical and grounded research, not theoretical research the most dominant type by relevance. They are also atemporal and are rigour-neutral. They are a significant number and could provide the nucleus for agenda-Setting research in the future.

A cluster formed by "light" areas of research impact includes the following:

Applied research (31 articles)
Integrative predictive research (two articles)

Applied research stands alone without relationship to rigour, temporality, and impact. It is in a class by itself. Integrative predictive research without reference to temporality or impact has a weak presence and could perhaps be strengthened in the future.

The "blind/blank" themes of areas of impact where ISJ has been absent in publishing research are the following:

Definitive ex ante agenda-Setting research
Definitive a priori agenda-Setting research
Definitive a posteriori agenda-Setting research
Definitive ex ante agenda-Correcting research
Definitive a priori agenda-Correcting research
Definitive a posteriori agenda-Correcting research
Definitive ex ante agenda-Neutral research
Definitive a priori agenda-Neutral research
Definitive a posteriori agenda-Neutral research

TABLE 5 Agenda setting papers

Theme	Year	Author	Title	Cites in WoS
Theoretical explanatory ex ante agenda-Setting research	2002	Sharma, S.; Sugumaran, V.; and Rajagopalan, B.	A framework for creating hybrid-open source software communities	32
Theoretical/integrative descriptive ex ante/in praesenti agenda setting/following research	1994	Ngwenyama, O.K. and Klein, H.K.	An exploration of expertise of knowledge workers: towards a definition of the universe of discourse for knowledge acquisition	7
Applied explanatory in praesenti agenda-Setting research	2001	Dhillon, G. and Backhouse, J.	Current directions in IS security research: towards socio-organizational perspectives	130
Theoretical definitive ex post agenda setting/extending research	2005	McGrath, K.	Doing critical research in information systems: A case of theory and practice not informing each other	1
Theoretical/integrative descriptive ex ante/a priori agenda-Setting research	2014	Reimers, K.; Li, M.; Xie, B.; and Guo, X.	How do industry-wide information infrastructures emerge? A life cycle approach	1
Theoretical/integrative explanatory/descriptive a priori/in praesenti agenda-Setting research	1991	Avison, D.E. and Fitzgerald, G.	Information systems practice, education and research	0
Theoretical/integrative explanatory ex ante/in praesenti agenda setting/following research	1993	Wood J.R.G. and	Wood-Harper A.T.	
Information technology in support of individual decision-making	1			
Theoretical/grounded explanatory/descriptive in praesenti agenda setting/following research	2013	Davison, R.; Ou, C.X.J; and Martinsons, M.G.	Information technology to support informal knowledge sharing	17
Theoretical descriptive a priori/ex post agenda setting/neutral research	2015	Martinsons, M.G.	Research of information systems: From parochial to international, towards global or glocal?	1
Theoretical explanatory/descriptive ex ante/in praesenti agenda setting/extending research	1993	Espejo, R.	Strategy, structure and information management	0
Theoretical/applied explanatory in praesenti agenda setting/neutral research	2014	Pozzebon, M.	Structuration bridging diffusion of innovations and gender relations theories: A case of paradigmatic pluralism in IS research	1
Theoretical/integrative explanatory/descriptive ex ante/in praesenti agenda setting/following research	1993	O'Connor, A.D.	Successful strategic information systems planning	1

(Continues)

TABLE 5 (Continued)

Theme	Year	Author	Title	Cites in WoS
Theoretical/empirical explanatory ex ante/in praesenti agenda setting/following research	1993	King, W.R. and Kugler J.L.	The influence of rhetorical schemes on innovation decisions	0
Integrative explanatory/descriptive ex ante/ex post agenda setting/following research	1992	Livari, J.	The organizational fit of information systems	1
Empirical explanatory/descriptive ex ante/ex post agenda setting research	2011	Osei-Bryson, K. and Ngwenyama, O.	Using decision tree modelling to support Peircian abduction in IS research: A systematic approach for generating and evaluating hypotheses for systematic theory development	3
Theoretical explanatory/descriptive ex ante/ex post agenda setting research	2011	Furst, S.; Blackburn, R.; and Rosen, B.	Virtual team effectiveness: A proposed research agenda	66

Abbreviation: WoS, Web of Science.

There is an opportunity for many of these types of research to advance the IS domain. Consider, for example, "definitive a posteriori agenda-Setting research." Definitive historical research of major information system success/failure (for example, the US Affordable Care information system) could help set the agenda for future research in the domain.

In summary, the dominant impact of the research published in ISJ is incremental (agenda-Following/agenda-Extending) and not radical (agenda-Setting). There is little corrective or neutral research. "Blue sky" research would fall into the latter category.

The temporality of the research is short. Most of the research focuses on developments in the present or near future. There is little research in anticipation of events either in the short term (ex ante) or the long term (a priori). There is also little examination historically (a posteriori). In a sense, the temporality pattern fits the impact. With little historical examination, there is likely to be limited agenda-Correction. Similarly, with little anticipation, there is likely to be limited agenda-Setting research. However, ISJ has not published research that documents, analyses, or leads topics related to historical milestones in IS, such as the dot com boom in the 2000s, or the emergence of social networks.

The progression of the rigour of research beyond explanatory research is limited. It may be because of the difficulty of doing predictive and definitive research in the domain. This difficulty may be due to the volatility of the object of study, its complexity, and the combination of the two. There may be little value in definitive a posteriori research on a topic that may have metamorphosed by the time the research is completed. Similarly, the dynamism of the topic may make predictive a priori research difficult.

Among the four dimensions, the relevance dimension appears to be relatively better balanced, although skewed towards theoretical, empirical, and grounded research. Interestingly, given the topic, the quaternary importance of applied research is surprising. It may reflect the preference of the journal, the difficulty of doing such research, or a combination of the two.

A selection of 16 articles labelled as potentially agenda-Setting research is presented in Table 5, along with the number of citations and ontology theme. Interestingly, only two papers are in the h-classic list (Table A2), while most of the expected agenda-Setting articles do not receive as many citations as other agenda-Extending/Following/Neutral or Correcting articles.

5 | CONCLUSIONS

5.1 | Summary of findings

More than 25 years has passed since the creation of the ISJ in 1991. The journal has published a wide range of significant articles during this period of time. The ISJ is now recognized as one of the leading journals in the field of IS. This work studies the bibliographic material of ISJ, employing a bibliometric and an ontological approach.

From a bibliometric perspective, the results clearly identify the current strong position held by English-speaking countries, with few publications from the rest of the world.

First, the United States is prominent in the journal with the highest number of publications and citations. Many US institutions are among the leading ones publishing in the journal including Georgia State University, Virginia Polytechnic Institute, and University of Nevada—Las Vegas. And some leading authors work there, including Keil, Belanger, and Lyytinen.

Second, the Britain is also well represented. Moreover, it has more publications and citations per person than the United States. Some of the most relevant institutions are English including London School of Economics and Political Science, the University of Warwick, and the University of Manchester. Note that the journal has a British origin although the current editor-in-chief works at a university in Hong Kong.

Third, Canada, Australia, and New Zealand obtain significant results considering their population size. The three countries have two institutions placed among the top 30 institutions publishing in ISJ.

Fourth, Western Europe (excluding the United Kingdom) also publishes a significant number of papers. The Netherlands, Ireland, and the Scandinavian countries achieve the most significant results, especially considering their populations. With the exception of Germany that has published 14 papers in ISJ, the other European countries have published fewer than 10 and some have never published in the ISJ. Note that Slovenia is the only Eastern European country that has published in the journal.

Fifth, Asian countries have seldom published in the journal. China is the only country with a significant number of publications, but this number is small considering its huge population. Other emerging countries do not publish regularly in the journal. The expectation for Asia and developing countries is that they will increase their publication rates in the future.

5.2 | Recommendations

From the ontological perspective, there is an opportunity for the journal to have a definitive impact on the field by anticipating future developments in the field and setting the agenda based on its foresight. For example, it would have been groundbreaking for the journal to have anticipated the advent of Industry 4.0 (Ojra, 2019) instead of publishing research on it when it has become a reality. Its present trajectory is driven more by an explanatory and descriptive view of the past and present, than on a definitive and predictive view of the future. It also appears to emphasize continuity of agenda and not its disruption. The ISJ could increase its relevance by increasing the emphasis on applied, grounded, and integrative research. Thus, the journal could reset its trajectory. This would require shifting the temporal focus from the present and the past to the future. The journal might intentionally seek agenda-Setting research and increase its focus on agenda-Setting and agenda-Neutral research. Agenda-Neutral, which may not often fit the mould of the past, may be fertile ground for future agenda-Setting research. They may represent ideas that are "out of the box" or imported from other fields, as implied in Tables 2–4. The journal can also break new ground by increasing its emphasis on ex post and a posteriori research. Such research, by looking back at events, can foster deeper feedback and learning within the domain. The insights from such learning can aid, extend, and set the future research agenda in innovative ways. For example, the Editorial team could pose questions that may reorient or confirm the strategy for the selection and diffusion of research, such as (a) is the achieved impact factor based on a subset of publications in given themes?, (b) how can we identify the agenda-Setting submissions and

ensure that these ideas are published in ISJ?, (c) are our reviewers aligned with the search for high impact articles?, (d) should we publish a special issue on topics of interest for the future of the field?, or (e) how to attract authors with promising, eclectic, agenda-Setting, high impact research ideas? Taken together, these shifts in focus can help the journal not only keep a leading position in the rankings but to foment a revolutionary change in the IS domain. Yet any journal is dependent on authors producing such research and submitting it.

5.3 | Limitations and future research

This study presents an overview of the publications in the ISJ during its first 25 years. However, it is worth noting some limitations. First, the study considers the current picture of the publications in the journal. However, these results may change in the future. For example, future publications in the journal may come from authors and institutions that currently are not well placed in the rankings. Second, the number of citations of papers will change throughout time. Third, all the limitations of the WoS Core Collection database apply to this study. For example, WoS uses full counting giving one unit to each co-author of the paper. Thus, this approach underestimates the results of papers written by individual authors and overestimates the results of those with many co-authors. Note that in order to partially ameliorate this limitation, this research uses fractional counting in the analysis with the VOS viewer giving always one unit to each paper. And fourth, other related issues may influence the leading trends of the journal. Thus, this work is useful in identifying the leading trends in the journal up to 2016, though these results are dynamic and are influenceable by the editors.

ORCID

José M. Merigó https://orcid.org/0000-0002-4672-6961
Philip Powell https://orcid.org/0000-0002-2774-3862
Thant Syn https://orcid.org/0000-0001-5727-5927

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ORCID

José M. Merigó https://orcid.org/0000-0002-4672-6961
Philip Powell https://orcid.org/0000-0002-2774-3862
Thant Syn https://orcid.org/0000-0001-5727-5927

TABLE A1 Intercoder comparison

No.	Theoretical	Empirical	Applied	Grounded	Integrative	Definitive	Predictive	Explanatory	Descriptive	A priori	Ex ante	In praesenti	Ex post	A posteriori	Setting	Extending	Following	Neutral	Correcting
1	C1 C2	C2						C1 C2					C1 C2	C1 C2			C1 C2		
2	C1 C2	C1 C2					C1 C2					C1 C2	C1 C2			C1 C2			
3		C1 C2			C1 C2			C1 C2				C1 C2				C1	C2		
4		C2			C1		C1 C2	C1 C2	C1				C2	C1		C2	C2	C1	
5		C1 C2					C2		C1				C1 C2				C1 C2		
6	C1 C2	C1 C2						C1 C2							C1 C2				
7	C1 C2							C1 C2				C1 C2				C1 C2			
8	C2		C1 C2			C1			C2			C1 C2				C1 C2			
9			C2		C1 C2			C1 C2	C1 C2			C2	C2	C1 C2		C1 C2			
10	C2	C1 C2					C1 C2		C1 C2			C1 C2					C1 C2		
⋮																			
140				C1 C2				C1 C2	C1 C2			C1 C2					C2	C1	
141	C1 C2			C1 C2				C1 C2				C2				C1 C2			
142	C1 C2							C1	C2			C1 C2				C1 C2	C1 C2		
143	C1 C2							C1	C2			C1 C2					C1 C2		
144	C1 C2							C2	C1				C1 C2	C2			C1 C2		
145		C1 C2						C1 C2				C2				C1 C2			
146		C1 C2						C2				C2				C1 C2			
147	C1		C2						C1 C2			C2					C2	C1	
148		C2			C1			C1 C2				C2				C2		C1	
149		C1 C2					C1 C2					C2	C2				C1 C2		
150	C1 C2	C1 C2						C1 C2				C1 C2					C1 C2		

Note. Joint = 488; blank = 1825; coincide = 2313; only C1 = 98; only C2 = 169; total = 2850; intercoder = 0.81.

TABLE A2   Fifty most cited papers in ISJ

R	TC	Title	Author/s	Year	C/Y
1	296	The utilization of e-government services: citizen trust, innovation and acceptance factors	Carter, L. and Belanger, F.	2005	29.60
2	166	On the deep structure of information systems	Wand, Y. and Weber, R.	1995	8.74
3	162	Successfully completing case study research: combining rigour, relevance and pragmatism	Darke, P.; Shanks, G.; and Broadbent, M.	1998	10.13
4	143	Assessing and managing the benefits of enterprise systems: the business manager's perspective	Shang, S. and Seddon, P.B.	2002	11.92
5	135	Principles of canonical action research	Davison, R.; Martinsons, M.G.; and Kock, N.	2004	13.50
6	130	Current directions in IS security research: towards socio-organizational perspectives	Dhillon, G. and Backhouse, J.	2001	10.00
7	129	Case study research: a multi-faceted research approach for IS	Cavaye, A.L.M.	1996	7.17
8	127	The power of gifts: organizing social relationships in open source communities	Bergquist, M. and Ljungberg, J.	2001	9.77
9	115	Learning failure in information systems development	Lyytinen, K. and Robey, D.	1999	7.67
10	107	How virtual are we? Measuring virtuality and understanding its impact in a global organization	Chudoba, K.M.; Wynn, E.; and Lu, M.; and others	2005	11.89
11	103	Assessing e-commerce systems success: a respecification and validation of the DeLone and McLean model of IS success	Wang, Y.S.	2008	17.17
12	101	Predicting consumer intention to use mobile service	Wang, Y.S.; Lin, H.H.; Luarn, P.	2006	12.63
13	101	A paradigmatic and methodological examination of information systems research from 1991 to 2001	Chen, W.S. and Hirschheim, R.	2004	10.10
14	95	Understanding dynamics between initial trust and usage intentions of mobile banking	Kim, G.; Shin, B.S.; and Lee, H.G.	2009	19.00
15	92	Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams	Staples, D.S. and Webster, J.	2008	15.33
16	91	Does managerial orientation matter? The adoption of reinventing government and e-government at the municipal level	Moon, M.J. and Norris, D.F.	2005	10.11
17	87	The use of systems development methodologies in practice: a field study	Fitzgerald, B.	1997	5.12
18	82	A conceptual framework for understanding business processes and business process modelling	Melao, N.; Pidd, M.	2000	5.86
19	77	The story of socio-technical design: reflections on its successes, failures and potential	Mumford, E.	2006	9.63
20	76	Putting the 'theory' back into grounded theory: guidelines for grounded theory studies in information systems	Urquhart, C.; Lehmann, H.; Myers, M.D.	2010	19.00
21	76	Code quality analysis in open source software development	Stamelos, I.; Angelis, L.; Oikonomou, A; and others	2002	6.33
22	75	Power and resistance in the implementation of a medical management information system	Doolin, B.	2004	7.50

(Continues)

TABLE A2   (Continued)

R	TC	Title	Author/s	Year	C/Y
23	74	Striking a balance between trust anti control in a virtual organization: a content analysis of open source software case studies	Gallivan, M.J.	2001	5.69
24	74	The significance of context in information systems and organizational change	Avgerou, C.	2001	5.69
25	73	Formalized systems development methodologies: a critical perspective	Fitzgerald, B.	1996	4.06
26	72	The paucity of multimethod research: a review of the information systems literature	Mingers, J.	2003	6.55
27	72	Effort, co-operation and co-ordination in an open source software project: GNOME	Koch, S.; Schneider, G.	2002	6.00
28	72	Training to improve virtual team communication	Warkentin, M.; Beranek, P.M.	1999	4.80
29	67	A knowledge-focused perspective on the diffusion and adoption of complex information technologies: the BPR example	Newell, S.; Swan, J.A.; Galliers, R.D.	2000	4.79
30	66	Knowledge transfer in globally distributed teams: the role of transactive memory	Oshri, I.; van Fenema, P.; Kotlarsky, J.	2008	11.00
31	66	Evaluating e-government: learning from the experiences of two UK local authorities	Irani, Z.; Love, P.E.D.; Elliman, T; and others	2005	7.33
32	66	Virtual team effectiveness: a proposed research agenda	Furst, S.; Blackburn, R.; Rosen, B.	1999	4.40
33	66	The fetish of technique: methodology as a social defence	Wastell, D.G.	1996	3.67
34	64	Extending the two-stage information systems continuance model: incorporating UTAUT predictors and the role of context	Venkatesh, V.; Thong, J.Y.L.; Chan, F.K.Y; and others	2011	21.33
35	64	Reconciling user and project manager perceptions of IT project risk: a Delphi study	Keil, M.; Tiwana, A.; and Bush, A.	2002	5.33
36	62	Examining the integrated influence of fairness and quality on learners' satisfaction and Web-based learning continuance intention	Chiu, C.M.; Chiu, C.S.; and Chang, H.C.	2007	8.86
37	62	Intangible benefits valuation in ERP projects	Murphy, K.E.; Simon, S.J.	2002	5.17
38	60	Value-focused assessment of information system security in organizations	Dhillon, G.; Torkzadeh, G.	2006	7.50
39	59	The challenges of redressing the digital divide: a tale of two US cities	Kvasny, L.; Keil, M.	2006	7.38
40	58	The role of intermediaries in electronic marketplaces: developing a contingency model	Giaglis, G.M.; Klein, S.; O'Keefe, RM	2002	4.83
41	58	Analysing four types of IT sourcing decisions in the context of scale, client/supplier interdependency and risk mitigation	Currie, W.L.; Willcocks, L.P.	1998	3.63
42	56	Studying system development methodologies: an examination of research methods	Wynekoop, J.L.; Russo, N.L.	1997	3.29

(Continues)

TABLE A2 (Continued)

R	TC	Title	Author/s	Year	C/Y
43	55	Understanding the successful adoption and use of IS/IT in SMEs: an explanation from Portuguese manufacturing industries	Caldeira, M.M.; Ward, J.M.	2002	4.58
44	51	Cognitive biases and decision support systems development: a design science approach	Arnott, D.	2006	6.38
45	51	The user-developer communication process: a critical case study	Gallivan, M.J.; Keil, M.	2003	4.64
46	51	Too close for comfort? Distance and engagement in interpretive information systems research	Nandhakumar, J.; Jones, M.	1997	3.00
47	50	Information and meaning: Foundations for an intersubjective account	Mingers, J.C.	1995	2.63
48	49	Antecedents of flow in online shopping: a test of alternative models	Guo, Y.M.; Poole, M.S.	2009	9.80
49	49	Trust, control and the role of interorganizational systems in electronic partnerships	Gallivan, M.J.; Depledge, G.	2003	4.45
50	48	Towards a distinctive body of knowledge for Information Systems experts: coding ISD process knowledge in two IS journals	Iivari, J.; Hirschheim, R.; Klein, H.K.	2004	4.80

Abbreviations: R, rank; TC, total citations; C/Y, cites per year.

TABLE A3 Most productive authors in ISJ

R	Author	University	Country	TP	TC	H	C/P
1	Keil, M.	Georgia State Univ	USA	8	340	8	42.50
2	Belanger, F.	Virginia Polytech Inst & State U	USA	3	320	3	106.67
3	Weber, R.	Univ Queensland	Australia	3	238	3	79.33
4	Lyytinen, K.	Case Western Reserve Univ	USA	10	234	6	23.40
5	Martinsons, M.G.	City Univ Hong Kong	Hong Kong	4	206	3	51.50
6	Gallivan, M.J.	Georgia State Univ	USA	3	175	3	58.33
7	Fitzgerald, B.	Univ Limerick	UK	3	165	3	55.00
8	Kock, N.	Texas A&M Int Univ	USA	3	163	3	54.33
9	Hirschheim, R.	Louisiana State Univ	USA	4	149	2	37.25
10	Baskerville, R.	Georgia State Univ	USA	5	118	4	23.60
11	Myers, M.D.	Univ Auckland	N. Zealand	3	112	3	37.33
12	Mathiassen, L.	Georgia State Univ	USA	6	95	5	15.83
13	Mumford, E.	Univ Manchester	UK	4	94	2	23.50
14	Avgerou, C.	London Sch Econ	UK	3	92	3	30.67
15	Ngwenyama, O.	Ryerson Univ	Canada	5	82	4	16.40
16	Galliers, R.D.	Bentley Univ	USA	4	79	2	19.75
17	Henfridsson, O.	Chalmers Univ Tech	Sweden	5	73	5	14.60
18	Nandhakumar, J.	Univ Warwick	UK	3	60	3	20.00
19	Sarker, S.	Washington State Univ	USA	3	52	2	17.33

(Continues)

TABLE A3 (Continued)

R	Author	University	Country	TP	TC	H	C/P
20	Lowry, P.B.	City Univ Hong Kong	Hong Kong	4	51	3	12.75
21	Butler, T.	Univ Coll Cork	Ireland	3	51	2	17.00
22	Smithson, S.	London Sch Econ	UK	3	49	2	16.33
23	Newman, M.	Univ Manchester	UK	3	49	2	16.33
24	Powell, P.	Birkbeck—Univ London	UK	5	47	3	9.40
25	Fitzgerald, G.	Brunel Univ	UK	5	46	3	9.20
26	Howcroft, D.	Univ Manchester	UK	3	46	2	15.33
27	Heng, M.S.H.	Natl Univ Singapore	Singapore	3	46	3	15.33
28	Walsham, G.	Univ Cambridge	UK	5	43	2	8.60
29	Osei-Bryson, K.M.	Virginia Commonwealth Univ	USA	3	38	3	12.67
30	Rose, G.M.	Washington State Univ	USA	3	36	2	12.00

Note. Abbreviations available in the previous tables except for Ttotal publications; H = h-index; C/cites per paper.

TABLE A4 Most productive institutions in ISJ

R	University	Country	TP	TC	H	TC/TP	ARWU	QS
1	Georgia State U	USA	28	883	18	31.54	-	701+
2	London School Econ Pol Sci	UK	17	426	10	25.06	151-200	37
3	U Warwick	UK	15	401	9	26.73	151-200	51
4	U Manchester	UK	23	395	13	17.17	35	29
5	Virginia Polytech Inst State U	USA	3	326	3	108.67	301-400	361
6	City U Hong Kong	Hong Kong	11	310	8	28.18	201-300	55
7	Monash U	Australia	3	243	3	81.00	79	65
8	Brunel U	UK	9	241	7	26.78	401-500	345
9	U College Cork	Ireland	8	230	6	28.75	-	283
10	U Nevada Las Vegas	USA	5	221	4	44.20	-	-
11	U British Columbia	Canada	4	202	3	50.50	34	45
12	Louisiana State U	USA	4	193	3	48.25	301-400	651-700
13	Viktoria Inst	Sweden	4	173	4	43.25	-	-
14	U Jyvaskyla	Finland	6	164	4	27.33	-	338
15	U Houston	USA	6	151	4	25.17	201-300	601-650
16	Delft U Technology	The Netherlands	3	151	3	50.33	151-200	62
17	Lancaster U	UK	7	149	4	21.29	-	129
18	Erasmus U Rotterdam	The Netherlands	4	146	4	36.50	101-150	144
19	National Central U	Taiwan	3	144	3	48.00	-	411-420
20	Aalborg U	Denmark	9	130	6	14.44	201-300	374
21	Virginia Commonwealth U	USA	7	127	6	18.14	201-300	651-700
22	Washington State U	USA	8	126	6	15.75	401-500	395
23	Vienna U Economics Business	Austria	4	121	4	30.25	-	-

(Continues)

TABLE A4 (Continued)

R	University	Country	TP	TC	H	TC/TP	ARWU	QS
24	U Auckland	New Zealand	3	115	3	38.33	151-200	81
25	Penn State U	USA	5	113	4	22.60	77	95
26	Copenhagen Business School	Denmark	10	112	5	11.20	-	-
27	U Queensland	Australia	8	110	5	13.75	55	51
28	U Michigan	USA	4	110	4	27.50	23	23
29	Auckland U Technology	New Zealand	3	110	3	36.67	-	441-450
30	Temple U	USA	6	107	5	17.83	301-400	651-700

Note. Abbreviations are available in the previous tables except for ARWU and QS = ARWU and QS World University Rankings.

TABLE A5 Most productive countries in ISJ

R	Country	TP	TC	H	TC/TP	Population	TP/Pop	TC/Pop
1	USA	166	3725	34	22.44	324 924	5.11	114.64
2	UK	145	2369	26	16.34	65 110	22.27	363.85
3	Australia	38	835	15	21.97	24 273	15.66	344.00
4	Taiwan	14	578	9	41.29	23 519	5.95	245.76
5	Canada	32	554	11	17.31	36 155	8.85	153.23
6	Hong Kong	17	474	10	27.88	7374	23.05	642.80
7	The Netherlands	20	469	10	23.45	17 066	11.72	274.82
8	Finland	16	357	9	22.31	5501	29.09	648.97
9	Denmark	23	349	12	15.17	5724	40.18	609.71
10	Sweden	15	305	9	20.33	9954	15.07	306.41
11	Ireland	15	302	8	20.13	4757	31.53	634.85
12	New Zealand	11	269	7	24.45	4732	23.25	568.47
13	South Korea	5	239	5	47.80	51 069	0.98	46.80
14	Germany	14	159	7	11.36	82 175	1.70	19.35
15	Greece	4	156	3	39.00	11 533	3.47	135.26
16	Austria	6	153	5	25.50	8741	6.86	175.04
17	China	5	146	4	29.20	1 379 857	0.04	1.06
18	Norway	11	140	6	12.73	5236	21.01	267.38
19	France	7	73	4	10.43	64 695	1.08	11.28
20	Portugal	2	59	1	29.50	10 341	1.93	57.05
21	Israel	3	54	3	18.00	8587	3.49	62.89
22	Singapore	4	35	3	8.75	5607	7.13	62.42
23	Spain	3	30	2	10.00	46 438	0.65	6.46
24	South Africa	2	24	2	12.00	55 653	0.36	4.31
25	Chile	1	23	1	23.00	18 191	0.55	12.64
26	Slovenia	1	17	1	17.00	2064	4.84	82.36

(Continues)

TABLE A5 (Continued)

R	Country	TP	TC	H	TC/TP	Population	TP/Pop	TC/Pop
27	Iran	1	17	1	17.00	75 149	0.13	2.26
28	Switzerland	3	14	2	4.67	8364	3.59	16.74
29	Lebanon	1	11	1	11.00	4965	2.01	22.16
30	Kuwait	1	11	1	11.00	4330	2.31	25.40

Note. Abbreviations are available in the previous tables except for TP/Pop and TC/Pop = Number of publications and citations per ten million inhabitants.

TABLE A6 Publication structure in ISJ classified by supranational regions

R	Region	TP	TC	H	TC/TP	Population	TP/Pop	TC/Pop
1	Western Europe	250	4372	33	17.49	356 969	0.70	12.25
2	North America	189	4211	35	22.28	361 079	0.52	11.66
3	East Asia	40	1264	21	31.60	1 430 926	0.03	0.88
4	Oceania	48	1101	17	22.94	29 005	1.65	37.96
5	Middle East	7	99	6	14.14	101 531	0.07	0.98
6	Rest of Asia	4	35	3	8.75	5607	0.71	6.24
7	Africa	3	29	3	9.67	83 961	0.04	0.35
8	Latin America	1	23	1	23.00	18 191	0.05	1.26
9	Eastern Europe	1	17	1	17.00	2064	0.48	8.24

Note. Abbreviations are available in the previous tables.