

## **Evolution of Information Systems Business Value Research: Topic Modeling Analysis**

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### **Abstract**

Information Systems Business Value (ISBV) has been a key research topic within the information systems discipline through time. Over the last three decades, ISBV research has dealt with various aspects such as the type of relationships, research methods, theoretical foundations, influencing factors, and measurement issues. This research applies topic modeling on the abstracts of 2824 articles published between 1990 and 2020. Results show that topics such as IS management, IS implementation, and IS public services had endured over time; topics such as IS strategy and IS design had initially gained and then lost traction; and topics such as IS social practices, IS emerging services, and IS sustainability have gained momentum in recent years. Further, ISBV research tends to examine specific and emerging IS tools, technologies, and applications such as Blockchain, Internet of Things (IoT), and business analytics, and seems poised for greater focus on IS sustainability in the near future.

**Keywords:** Business Value, Information systems, Information Systems Business Value, Review, Topic Modeling.

## 1 Introduction

Information Systems<sup>1</sup> Business Value (ISBV) discipline has been and is expected to remain one of the major research topics for information systems (IS) researchers [1]. Given the changing role of IS during different digital eras, the way it creates business value has also evolved [2]. SAP Corporation provides the evolution of digital eras from 1960 to 2020 [3]. The first era, “mainframe and Personal Computers (PCs)”, lasts from the 1960s to the 1980s. The primary value of IS in this era stands for “industrial automation” with the emergence of PCs and the large-scale adoption of mainframes aimed at plant floor automation. During 1990-2000, the era of “client-server and internet” appeared with the widespread adoption of PCs, broadband internet connection, and the large-scale adoption of enterprise information systems, especially Enterprise Resource Planning Systems (ERPs), aimed at “business process automation”, inter and intra-organizational integration, and also as a solution to Y2K problem. The emergence of modern concepts and technologies such as smart phones, cloud computing, social networking and Big Data shaped the third era of “cloud, mobile and Big Data” during 2000-2010 triggered the “digital transformation” of business models. Finally, the last era; “intelligent technologies” appears, enabled with advanced technologies such as Artificial Intelligence (AI), Internet of Things (IoT), distributed computing, and Blockchain, shaping more “intelligent enterprises”.

Not surprisingly, the ISBV body of knowledge has also evolved in line with IS evolution to assist businesses in gaining the most advantage of IS initiatives. Early studies focusing on the financial impacts of IS doubted the economic value of IS [e.g., 4–6]. Later, direct positive

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<sup>1</sup> IS research has used the term ‘Information System (IS)’ interchangeably with ‘Information Technology (IT)’, and ‘Information and Communication Technology (ICT)’ [1]. In this research, a ‘holistic’ view on IS has been adopted, as suggested in the ATIS Telecom Glossary: “The entire infrastructure, organization, personnel, and components for the collection, processing, storage, transmission, display, dissemination, and disposition of information”. In line with this definition, and for consistency, we label IT and ICT as IS throughout the text.

associations between IS investments and business value were observed, and IS intangible effects were also considered [e.g., 7–9]. Finally, studies attempted to “unlock the gray box”, focusing on ISBV creation mechanisms or indirect effects, such as the effect of IS on business processes [e.g., 10, 11], absorptive capacity [e.g., 12], or strategic alignment [e.g., 13]. The emergence of advanced technologies has also influenced the ISBV trend, as more and more research took examining the ISBV of specific IS applications and technologies such as Big Data, IoT, AI, and Blockchain, rather than studying general IS initiatives [2].

The evolution of the ISBV domain has been of research interest not only from the lenses of the causality and type of relationships (i.e., positive/negative, or direct/indirect effects) and adopted technologies, but also from other perspectives such as research methods, theoretical foundations, contextual factors, and measurement issues [see 14]. Some prior research has attempted to synthesize empirical findings of the literature to reveal ISBV. This is one of the essential tasks for advancing a field of research and integrating the fragmented areas, particularly when characterized by exponential growth involving various research themes and topics, such as ISBV research. Drawing a coherent map of literature in any domain enabled by subjective and qualitative literature reviews is essential to reveal conceptualizations and theory development [15], yet insufficient [16]. Several common qualitative approaches such as literature reviews [1, 17, 18], archival research [19], and meta-review analysis [14] have been leveraged to synthesize the ISBV literature, present the state-of-the-art, and draw the deficiencies and research gaps in the ISBV literature (see ZareRavasan and Krčál [2] for a full review). However, the extensive body of the ISBV literature makes such approaches time and cost-consuming with a lack of replication possibility.

Automated quantitative approaches such as topic modeling [e.g., 20–22], computational literature review [e.g., 23], and bibliometric analysis [e.g., 24–27] have been recently adopted in the context of different IS domains. With the exception of Big Data and analytics business value in Batistič and der Laken [28], quantitative approaches to synthesizing the ISBV literature are scarce. Considering the unfilled gap in the literature, we investigate dominant ISBV research topics to provide a clear view of the extant knowledge base. Understanding ISBV key themes is crucial since the topics have been evolving or getting integrated into other topics over time due to the emergence of new technologies and changes in the role of IS. Mapping the evolution of ISBV over time also adds significant value and knowledge to the ISBV literature.

We apply the topic modeling approach to discover the dominant topics and analyze the trend of topics over time using slope analysis. Specifically, our study examines the evolution of ISBV research over 30 years (1990–2020) based on journal articles indexed in Scopus. We adopt one main analysis (for the whole period) and three subgroup analyses (for each decade). The main analysis discovers the dominant topics overall, whereas the subgroup analysis identifies the prevalent topics in different periods, the emergence of new topics, and the evolution of topics over time. Our study complements earlier qualitative reviews but employs a broader scope and includes a larger corpus of documents, which provides a more robust, structured, comprehensive, and objective presentation of the evolution of the ISBV research as well as the trends of various ISBV topics.

## **2 Theoretical Background**

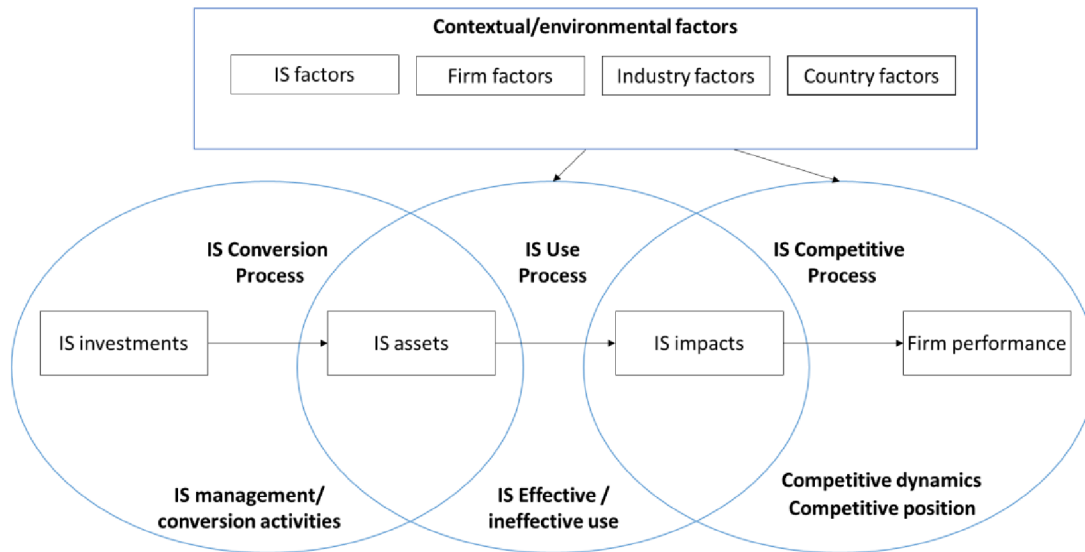
### **2.1 Information Systems Business Value**

ISBV is “the impact of investments, particularly IS assets, on the multidimensional performance and capabilities of economic entities at various levels, complemented by the ultimate meaning of



performance in the economic environment” [1]. Early studies primarily defined ISBV as the contribution of IS to firm performance and used firm-level output or end-product-based measures of ISBV [e.g., 29]. Since the singular focus on firm-level output variables provides a limited understanding of how ISBV was created, later studies adopted a process perspective and included the impact of IS on intermediate business processes [e.g., 30]. This shift to a process-oriented approach offers greater potential for meaningful measures of ISBV and provide better insights into how ISBV can be created [31].

Soh and Markus [30] describes how the effects of IS over a chain of interrelated yet uncertain outcomes from ‘IS investment’ to ‘firm performance’. Increases in ‘firm performance’ require an essential degree of ‘IS impacts’, which in turn require ‘IS assets’, which require ‘IS investments’. The link from ‘IS investments’ to ‘IS assets’ involves the process of IS management/conversion and investment in complementary (non-IS) investments (‘IS conversion process’); the link from ‘IS assets’ to ‘IS impacts’ relies on the effective US use (‘IS use process’); and the link from ‘IS impacts’ to ‘firm performance’ depends on the ‘IS competitive process’ [30]. While [30] continues to serve as a theoretical foundation for ISBV [32, 33], the model has improved and evolved. In particular, the effect of contextual factors and time lag has been embedded in the model later on [see 1, 2]. For a comprehensive view of the ISBV processes, this research adopts an integrated ISBV framework based on Soh and Markus [30] and Schryen [1], as shown in Figure 1.



**Figure 1.** ISBV process model

## 2.2 Prior reviews and syntheses on ISBV literature

Prior literature on ISBV has been based on a diverse body of research, including conceptual, theoretical, analytic, and empirical studies [17]. ISBV can be investigated at different analysis levels, such as individual, firm, industry, and economy (also known as country or macro) [34]. ISBV research can be of ex-ante and ex-post nature in which ex-ante evaluation addresses which available IS investment options will best benefit the firm while ex-post research investigates the extent to which IS has created value [35]. ISBV has also been examined taking IS investment, IS capabilities, IS resources, IS staff, IS adoption, and IS use into consideration [2]. Due to such diversity in the ISBV discipline, some aspects of ISBV have been over-researched while others might remain partially unaddressed. This imbalance in the focus on ISBV research spurred detailed investigations to synthesize the ISBV literature over time, as explained next.

Among the first literature review studies, Kauffman and Weill [36] review 13 ISBV studies published from 1975 to 1988 and summarize their motivation, focus, and caveats. Brynjolfsson [29], based on an ISBV review, argues that the shortfall in IS productivity is due to deficiencies

in measurement and methodology. Brynjolfsson and Yang [37] update Brynjolfsson's [29] review by classifying IS productivity studies into economy-wide, industry-level, firm-level, consumer surplus, and economic growth. Chan [38] classifies ISBV studies according to research methods, measures, and levels of analysis. Dehning and Richardson [39] propose a framework to classify ISBV studies regarding the influence of IS spending, IS strategy, and IS capability on performance. Dedrick et al. [40] review empirical studies examining the economic value of IS on firm, industry, and country levels. Kohli and Devaraj [41] meta-analyze 66 ISBV papers and examine IS payoff determinants. Melville et al. [17] review 202 ISBV papers and develop an ISBV model incorporating the firm, industry, and country environment. Piccoli and Ives [42] synthesize ISBV literature that examines IS role in sustaining competitive advantage. Chau et al. [34] propose a taxonomy on ISBV dimensions and issues in measuring ISBV. Wan et al. [43] analyze 96 papers from 1996 to 2006 that cite Brynjolfsson and Hitt's [44] paper. They categorize empirical research by their results, level of analysis, research methods, and variables included in the model. Kohli and Grover [35] review ISBV literature at the firm level. Paré et al. [18] classify empirical research papers according to their method and goal.

Liang et al. [45] conduct a meta-analysis of 42 ISBV studies to discover how different Resource-Based View (RBV) factors impact firm performance. Lim et al. [46] use meta-analysis to examine ISBV research focusing on IS investment's return. Masli et al. [19] synthesize recent empirical ISBV research with a focus on measurement issues. Schryen [1] proposes a new ISBV model. Sabherwal and Jeyaraj [31] extend Kohli and Devaraj's [41] work by meta-analyzing 303 ISBV studies published from 1990 to 2013. They investigate (1) IS investment measurement approaches, (2) study's methodological attributes, (3) value generation, (4) value measures, (5) value enablers, (6) moderating effects, and (7) theoretical approaches.

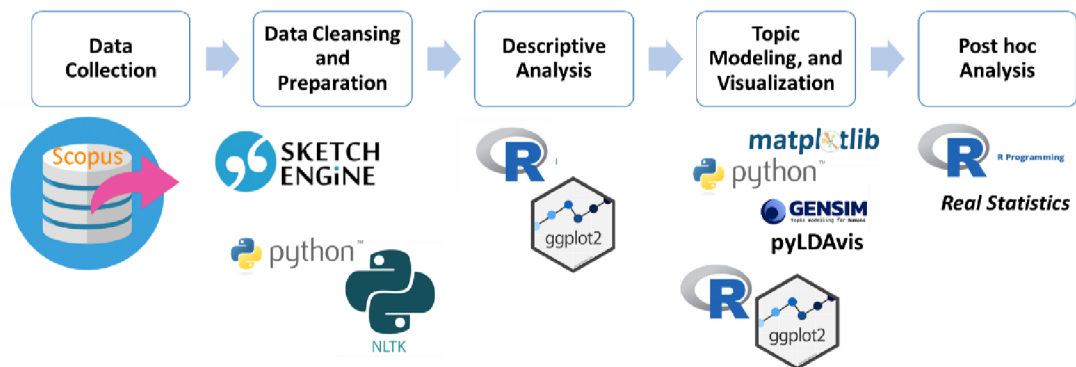
More details regarding the ISBV literature reviews can be found in ZareRavasan and Krčál [2]. A summary of the review period and sample size of prior ISBV literature reviews are illustrated in Table 1. According to the table, prior ISBV reviews primarily used the full text of articles, as they needed to qualitatively code variables and relations manually. Besides, there is no ISBV study aiming to objectively cluster ISBV literature and analyze the stability of topics over time, which is the focus of this research.

Table 1. Summary of prior ISBV reviews

Citation	Review period (sample size)	Method
Kauffman and Weill [36]	1975-1988 (13 empirical studies)	Literature review
Brynjolfsson [29]	1986-1991 (17 empirical studies)	Literature review
Brynjolfsson and Yang [37]	1982-1995 (46 empirical studies)	Literature review
Chan [38]	1993-1998 (38 empirical studies)	Meta-analysis
Dehning and Richardson [39]	1996-2001 (31 empirical studies)	Meta-analysis
Dedrick et al. [40]	1985-2002 (34 empirical studies)	Meta-analysis
Kohli and Devaraj [41]	1990-2000 (66 empirical papers)	Meta-analysis
Melville et al. [17]	Up to 2002 (202 papers)	Literature review
Piccoli and Ives [42]	1981-2003 (117 papers)	Literature review
Chau et al. [34]	1993–2005 (41 papers), and 2000–2005 (49 papers)	Literature review
Wan et al. [43]	1996-2006 (96 papers that referenced Brynjolfsson and Hitt [44])	Literature review
Kohli and Grover [35]	-not reported	Literature review
Pare et al. [18]	1991-2005 (124 empirical papers published in MISQ and ISR)	Literature review
Liang et al. [45]	1990-2009 (42 empirical papers adopted RBV)	Meta-analysis
Lim et al. [46]	1990-2010 (44 empirical papers)	Meta-analysis
Masli et al. [19]	2000-2011 (>50 empirical papers)	Literature review
Schryen [1]	1989-2012 (>200 empirical papers)	Literature review
Sabherwal and Jeyaraj [31]	1990-2013 (265 empirical papers)	Meta-analysis
ZareRavasan and Krčál [2]	1990-2020 (235 papers)	Literature review
This research	1990-2020 (2824 papers)	Topic modeling

### 3 Method

The main research steps are illustrated in Figure 2. A combination of manual and automated methods was applied for data collection, data cleansing and preparation, topic modeling and visualization, and finally, post hoc analysis. Different tools, programming languages, and libraries are utilized to achieve the intended outcomes.



**Figure 2.** Research steps, employed applications, and libraries

### 3.1 Data collection

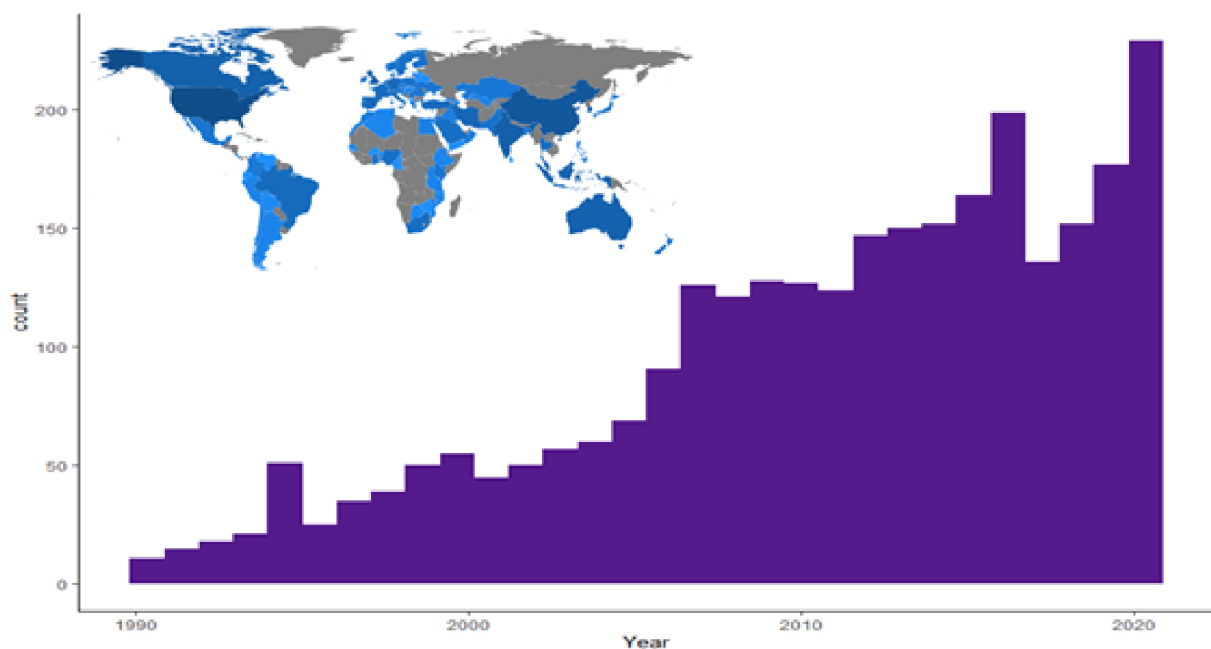
We employed the Scopus search engine to discover the ISBV literature because of its broad coverage and high data quality. To ensure that all the relevant articles to the research topic were included in our final dataset, the Title, Abstract, and Keywords of the published papers in Scopus were queried using Wildcard (\*), a Boolean operator (OR), and proximity operator W/n (within the n words) as shown below.

TITLE-ABS-KEY ( “Information \* technolog\*” OR “Information \* system\*” OR “enterprise \* system” ) W/1 TITLE-ABS-KEY ( investing OR investment\* OR expenditure OR capab\* OR competen\* OR use OR usage OR asset OR resource\* OR implement\* OR adopt\* ) AND TITLE-ABS-KEY ( performance OR profitability OR productivity OR value OR benefit OR impact OR effect ) AND ( LIMIT-TO ( SRCTYPE , “j” ) ) AND ( LIMIT-TO ( LANGUAGE , “English” ) ) AND ( LIMIT-TO ( DOCTYPE , “ar” ) )

The search query is based on the underlying concepts of the ISBV framework in Figure 1. To cover the chain from ‘IS investments’ to ‘firm performance,’ our search query includes ‘information technology,’ ‘information system,’ and ‘enterprise system’ to refer to the IS. It also includes ‘investment’ and ‘expenditure,’ value generation concepts such as ‘assets,’ ‘capability,’ ‘adoption,’ and ‘use’ [e.g., 31], and related variants such as ‘resources,’ ‘competencies,’ and ‘implement’. To capture only those studies that examined ISBV measures, we included ‘performance,’ ‘profitability,’ and ‘productivity’ [e.g., 31], ‘value,’ ‘benefit,’ ‘impact’ and

‘effect’ [e.g., 1]. We searched for journal articles published in English from 1990 to 2020. Conference papers, textbooks, chapter books, and working papers were excluded as scholars use indexed journals to disseminate quality findings [47]. We also excluded review papers and editorials. The search was conducted in June 2021 and returned 2,839 journal articles. Using the Scopus feature, we downloaded and merged all the metadata (such as journal name, publication year, title, abstract, and keywords) into a single CSV file. After an initial check, 15 papers were removed since the abstract text was unavailable.

The remaining 2,824 articles build our corpus, which is considerably large and poses difficulties for manual analysis and interpretation. These articles were published in 1160 journals and authored by more than 6600 authors. 470 papers were single-authored. In Figure 3, we show the distribution of articles over time and by the geographic locations of the authors. Researchers from the USA, China, UK, India, and Canada contributed the most articles to the ISBV literature.



**Figure 3.** Distribution of published articles

### 3.2 Data cleansing and preparation

The abstracts of the articles were used for analysis, a common approach adopted in prior IS research [e.g., 48] since well-constructed abstracts contain the essential information of research papers and facilitate quick and accurate identification of the research topics [23].

The following steps are conducted for data cleansing. First, the terms<sup>2</sup> were standardized to remove duplicate references to the same term. For instance, “HIS,” “HIT,” “hospital information system,” “health information technology,” “healthcare information technology,” and “healthcare information system”; “GIS” and “geographic information system”; “ERP” and “enterprise resource planning”; “MIS” and “management information system”; “DSS” and “decision support system”; “PLS” and “partial least squares”; “TAM” and “Technology Acceptance Model,” and “RBV” and “resource-based view” were coded as similar words.

Second, multi-word phrases such as “business analytics,” “social network”, “dynamic capability”, and “business model” were preserved by replacing spaces with underscore characters. Through this, we tried to keep the meaning behind multi-word terms (n-grams) of our corpus. To objectively discover n-grams, we employed the “terminology extraction, multi-word terms” functionality of Sketchengine<sup>3</sup>. This tool provides a CSV file of the frequency of multi-word terms of the given corpus. Visually checking the CSV file, we discovered a list of multi-word terms relevant to our study and worth preserving in the corpus, which we did by replacing spaces with underscore characters.

Third, using the “terminology extraction, single words” functionality of Sketchengine, we extracted the frequent single words. Again, visually checking the output, we defined the list of

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<sup>2</sup> “Terms” refers to the frequent single word (e.g., firm, business) or multi-word (e.g., social network, management information system) keywords of the corpus.

<sup>3</sup> See <https://app.sketchengine.eu>

our stop words (e.g., research, paper, purpose, aim, and objective). Fourth, “information technology,” “Information system,” and “enterprise system” phrases were removed as we expect to have them in almost all papers, and they do not add any specific value for topic modeling. Finally, actions such as converting words to their singular forms, tokenization, lemmatization, and synonyms were performed (using NLTK library of Python) to prepare the data set for analysis.

### **3.3 Process of topic modeling**

Topic modeling is a quantitative method for assessing textual data and uses statistical methods to extract semantic information from a text corpus. Hofmann [49] proposed the first topic model, probabilistic Latent Semantic Indexing (pLSI). Further developments have been presented and implemented to optimize the topic modeling algorithms [50]. There are various open-source programming and commercial software packages available for these models, such as Gensim and Scikit-learn packages in Python, tidytext in R, SAS Text Miner, and Leximancer [51].

Gensim, presented by Rehurek and Sojka [52], is an open-source topic modeling toolkit in Python that aims to extract the semantic topics from the corpus using data streaming and incremental algorithms. It includes multiple algorithms such as LDA, RP, LSA, TF-IDF, hierarchical Dirichlet processes (HDPs), LSI, and singular value decomposition (SVD) [53]. We employed the LdaModel in Gensim for topic modeling and then created visualizations using the “ggplot2”, “matplotlib” and “pyLDAvis” libraries. The optimum number of topics is also estimated based on perplexity and log-likelihood.



#### 4 Topic modeling and visualization

The topic modeling strategy is illustrated in Figure 4. The main analysis was based on the analysis of abstracts for all papers published in all years. Additional analyses were also conducted based on the publication year to better understand the evolution of ISBV topics over time. Accordingly, all articles were divided into three subgroups based on the publication year: 1990-2000 (#320), 2001-2010 (#874), and 2011-2020 (#1630).

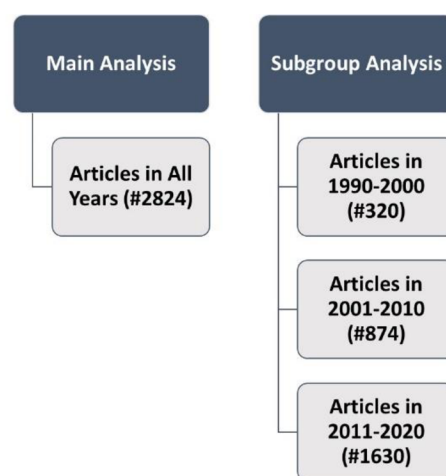


Figure 4. Topic modeling strategy

##### 4.1 Main Analysis

Ten topics were uncovered in the main analysis. Some emergent topics seem to be consistent with the dominant themes of IS research and not specific to ISBV, such as ‘IS adoption,’ ‘IS implementation,’ ‘IS management,’ ‘IS usage,’ ‘IS capability,’ and ‘IS strategy’. Some others, such as ‘e-health,’ ‘e-learning,’ and ‘IS public services,’ refer to specific IS applications in different domains. The top 10 keywords for each topic are provided in Table 2, along with the distribution of papers by publication year.

Table 2. Topics in all years, with distribution in years.

Topics (% of corpus)	Top ten contributing terms to the topic	Publication year*			
		1990	2000	2010	2020
<b>e-health (12.0)</b>	healthcare, patient, health_information_system, health, hospital, practice, nurse, medical, clinical, electronic				
<b>IS capability (11.8)</b>	performance, capability, firm, resource, integration, competitive_advantage, competency, collaboration, dynamic, resource_based_view				
<b>IS adoption &amp; use (10.3)</b>	user, adopt, usage, perceive, behavior, intention, satisfaction, perception, acceptance, attitude				
<b>IS strategy (9.7)</b>	investment, strategy, firm, market, financial, asset, decision, return, alignment, governance				
<b>IS implementation (8.3)</b>	implement, process, project, success, management, enterprise_resource_planning, plan, team, stakeholder, failure				
<b>IS productivity (7.8)</b>	productivity, knowledge, human_resource, innovation, technological, efficiency, regression, analysis, capital, economy				
<b>e-learning (6.7)</b>	learn, university, student, experience, science, academic, education, train, content, skill				
<b>IS Social practices (6.4)</b>	organization, change, work, practice, structure, culture, leadership, commitment, transformation, conflict				
<b>IS public services (6.3)</b>	resource, geographic_information_system, environmental, city, local, water, state, land, region, spatial				
<b>IS design (5.8)</b>	service, application, process, network, design, integrate, infrastructure, task, requirement, solution				
<b>IS management (5.4)</b>	management, risk, analysis, small_and_medium_size_enterprise, function, operation, communication, assessment, audit, institutional				
<b>IS evaluation (5.1)</b>	benefit, evaluation, tool, analysis, evaluate, decision_support, decision, problem, solution, sustainability				
<b>IS project management (4.5)</b>	cost, time, control, product, policy, social, communication, efficiency, human, worker				

note : \* the range of the Y-axis for this column is fixed at 0-40.

According to Table 2, ‘e-health,’ ‘IS capability,’ and ‘IS use’ are the three top topics encompassing over one-third of the whole corpus. The popularity of topics such as ‘IS project management,’ ‘IS evaluation,’ and ‘IS Social practices’ has stagnated throughout the period. In comparison, topics such as ‘IS adoption,’ ‘e-health,’ ‘e-learning,’ ‘IS capability,’ and ‘IS use’ gained momentum in recent years. Further visualization was done using the pyLDAvis library, which allows the user to look at individual topics while keeping the big picture in view and is thus helpful in interpreting and labeling topics. Figure 5 shows the result for topic#3: e-health.

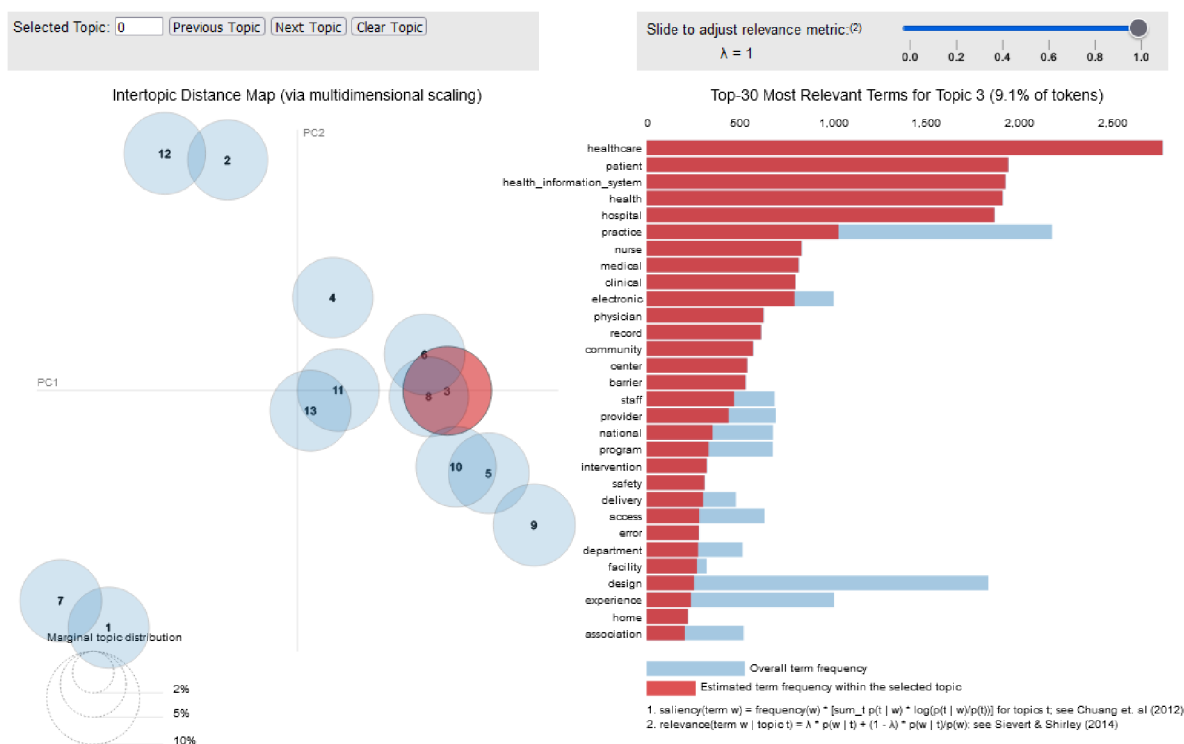


Figure 5. Interactive LDAvis presentation of topics (topic#3, e-health)

## **4.2 Subgroup Analysis**

### **4.2.1 Analysis of articles published in 1990-2000**

The analysis includes 320 articles accounting for 11.3 percent of the main corpus. The revealed nine topics are shown in Table 3. Topics of ‘IS strategy,’ ‘IS productivity,’ ‘IS design,’ ‘IS management,’ ‘IS implementation,’ ‘IS evaluation,’ and ‘IS public services’ are similar to the topics in the main analysis. ‘IS adoption’ and ‘IS use’ emerged as distinct topics in the subgroup analysis, but are integrated into a single ‘IS adoption & use’ topic in the main analysis. ‘IS public services’ had relatively more articles compared to the main analysis as it incorporates ‘e-health’ and ‘e-learning’ related terms that emerged as distinct topics in subsequent years (described later). It makes sense as both ‘e-health’ and ‘e-learning’ topics have been immature during this period. Similarly, ‘IS implementation’ entails terms relate to ‘IS project management’ topic of the main analysis. Finally, we miss ‘IS capability’ topic here, as the concept developed later and made popular inspired by the works of Bharadwaj [54], and Santhanam and Hartono [55].

Studies in this period heavily focused on ‘IS evaluation’ and ‘IS productivity’ topics as a response to “IS productivity paradox”, accounting for nearly one-third of the total articles. There have been contradicting recommendations during this period in terms of ISBV. While some doubted ISBV [e.g., 4, 6], others suggested a direct positive relationship between IS and firm performance [e.g., 7–9]. This paradox led scholars in later years to look for potential sources of such contradicting results [e.g., 17, 41].

Table 3. Topics in 1990-2000, with distribution in years

Topics (% of corpus)	Top ten contributing terms to the topic	Publication year*	
		1990	2000
<b>IS evaluation (15.9)</b>	benefit, cost, process, project, decision, issue, evaluation, problem, investment, decision_support		
<b>IS productivity (14.4)</b>	investment, performance, firm, organization, productivity, strategy, return, economic, competitive_advantage, financial		
<b>IS strategy (12.2)</b>	strategy, industry, software, market, product, function, customer, competitive, global, demand		
<b>IS implementation (11.9)</b>	implement, organization, change, work, process, management, technical, structure, environment, communication		
<b>IS adoption (11.6)</b>	adopt, organization, innovation, knowledge, characteristic, practice, individual, diffusion, attitude, behavior		
<b>IS public services (10.9)</b>	healthcare, health, education, service, hospital, alignment, health_information_system, patient, learn, clinical		
<b>IS use (9.7)</b>	user, computer, application, success, usage, perception, experience, perceive, task, acceptance		
<b>IS management (6.9)</b>	management, resource, service, access, tool, environmental, agency, requirement, database, library		
<b>IS design (6.6)</b>	analysis, time, integration, electronic, capability, integrate, analyze, profit, price, produce		

note : \* the range of the Y-axis for this column is fixed at 0-15.

#### 4.2.2 Analysis of articles published in 2001-2010

The analysis includes 874 articles accounting for 31 percent of the main corpus. The revealed ten topics for articles published during the period are shown in Table 4. Compared to the main analysis, we have exact topics here; however, comparing topics for 1990-2000 and 2001-2010 reveals some similarities and differences. Excluding ‘IS evaluation’ of 1990-2000 period that is missed here and ‘IS adoption,’ and ‘IS use’ that integrated into ‘IS adoption & use’ in 2001-2010 period, we have all similar topics from the previous period. Nevertheless, three additions are ‘e-health,’ ‘IS social practices,’ and ‘IS capability,’ as a result of advancements in e-health discipline, the increasing importance of social and human factors in IS implementation, and the capabilities required to gain the most business value of IS initiatives. The emerging ‘IS capability’ topic has gained the most attention during this period with 13.5 percent of the total

published articles, followed by ‘IS productivity’ with 12.2 percent. Taking into account the IS capabilities of IS adopters and also context-related factors (here partially revealed as ‘IS social practices’), most studies in this period reported positive impacts of IS initiatives on business performance [e.g., 10, 55, 56].

Table 4. Topics in 2001-2010, with distribution in years

Topics (% of corpus)	Top ten contributing terms to the topic	Publication year*	
		2001	2010
<b>IS capability (13.5)</b>	performance, firm, capability, market, innovation, product, infrastructure, competitive_advantage, resource, flexibility		
<b>IS productivity (12.2)</b>	investment, cost, productivity, capital, evaluation, financial, efficiency, time, return, benefit		
<b>IS adoption &amp; use (11.8)</b>	user, usage, adopt, perceive, individual, behavior, intention, social, perception, acceptance		
<b>e-health (10.4)</b>	healthcare, hospital, patient, health, practice, health_information_system, service, clinical, nurse, medical		
<b>IS implementation (10.3)</b>	implement, knowledge, success, plan, practitioner, challenge, issue, failure, team, executive		
<b>IS strategy (10.2)</b>	organization, change, benefit, strategy, network, supply_chain, initiative, supplier, source, collaboration		
<b>IS design (9.6)</b>	process, management, project, risk, problem, issue, decision_support, control, solution, requirement		
<b>IS public services (8.1)</b>	adopt, human_resource, government, electronic, application, public, policy, state, digital, environment		
<b>IS management (7.0)</b>	resource, analysis, application, decision, tool, structure, outsource, uncertainty, operation, environmental		
<b>IS social practices (6.9)</b>	work, design, culture, communication, global, learn, train, cultural, human, power		

note : \* the range of the Y-axis for this column is fixed at 0-25.

### **4.2.3 Analysis of articles published in 2011-2020**

The analysis includes 1,630 articles that account for 58 percent of the main corpus. The revealed 12 topics are presented in Table 5. Certain topics were similar to the main analysis; however, a comparison of topics that emerged here and in other periods and the main analysis reveals some similarities and differences. Firstly, this period is the only period that ‘IS strategy’ has not appeared as a distinct topic. A closer look shows that related terms to ‘IS strategy,’ such as strategy and alignment, are already incorporated into the ‘IS capability’ topic. Second, the ‘e-learning’ topic emerges during this period thanks to the growing interest in IS value for the education and academic community. This finding is in line with the results of the main analysis that shows only a few ‘e-learning’ related publications during the early years. Third, two new topics appeared here that did not show up in other analyses as ‘IS emerging services’ and ‘IS sustainability’. This is quite interesting to see that recent ISBV studies examined the role of specific emerging technologies such as cloud computing, business intelligence, RFID, and IoT (top terms according to Table 5) in creating business value. Another interesting emerging topic is ‘IS sustainability’. Surprisingly, a significant part of ISBV literature focuses on sustainability issues due to ever-increasing environmental issues and the supporting role of green IT and sustainable business models. Overall, ‘IS capability’ still stands in the first rank in terms of the frequency of publications, followed by ‘e-health’ and ‘IS adoption & use’. ‘IS productivity’ is ranked fourth, indicating that “the gray box” of ISBV is not completely unlocked yet, an issue that is highlighted in some of the recent ISBV reviews [e.g., 1].

Table 5. Topics in 2011-2020, with distribution in years

Topics (% of corpus)	Top ten contributing terms to the topic	Publication year*	
		2011	2020
<b>IS capability (13.3)</b>	capability, strategy, innovation, dynamic, competitive_advantage, governance, competency, alignment, agility, resource_based_view		
<b>e-health (12.6)</b>	healthcare, health_information_system, patient, health, hospital, electronic, nurse, medical, clinical, record		
<b>IS adoption &amp; use (11.8)</b>	adopt, user, usage, behavior, perceive, intention, individual, satisfaction, acceptance, attitude		
<b>IS productivity (9.4)</b>	investment, firm, financial, productivity, market, capital, economic, growth, return, accounting		
<b>IS social practices (8.2)</b>	organization, management, human_resource, employee, change, culture, practice, structure, human, leadership		
<b>IS sustainability (7.9)</b>	industry, green, sustainability, power, collaboration, sustainable, product, environmental, operational, flexibility		
<b>IS evaluation (6.8)</b>	analysis, application, tool, risk, evaluation, management, assessment, decision_support, evaluate, solution		
<b>IS management (6.8)</b>	cost, time, efficiency, control, security, asset, standard, operation, monitor, compliance		
<b>e-learning (6.6)</b>	learn, university, student, institution, education, academic, content, library, train, science		
<b>IS implementation (6.1)</b>	implement, process, project, design, software, successful, problem, stakeholder, technical, structure		
<b>IS emerging services (5.4)</b>	service, resource, internet, interaction, online, cloud, emerge, device, rfid, intelligence		
<b>IS public services (5.3)</b>	country, network, plan, policy, government, state, audit, national, public, city		

note : \* the range of the Y-axis for this column is fixed at 0-35.



## 5 Post hoc analysis

### 5.1 Trend Analysis

The main analysis and three subgroup analyses revealed the dominant topics and their distribution through the periods. We conducted a post hoc analysis of the total number of documents within each topic and the relative weight within the given period. In general, the number of publications increased for most topics over time; however, only a few topics grew in relative popularity based on the slopes<sup>4</sup> analyzed. The slope showed whether a topic had an upward (i.e., positive slope) or downward (i.e., negative slope) trend. Table 6 depicts the status of the 17 unique topics in the main and subgroup analyses, in which  $\nearrow$  and  $\searrow$  denote the upward and downward trends, respectively. Significance levels reported in the table indicate if the observed positive or negative trend is statistically significant or not. Blank cells in the table refer to the topics that did not emerge in the relevant time period. As ‘IS adoption’ and ‘IS use’ are integrated into ‘IS adoption & use’ topic in 1990-2000 period, we grouped them in the table for better visualization. Topics of the subgroups analyses are all observed in the main analysis, excluding ‘IS emerging services’ and ‘IS sustainability’ topics of the 2011-2020 period.

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<sup>4</sup> Simple slope analysis of the linear model is conducted in R (see “lm” function)

Table 6. The overall trend of topics across different analyses

Topic	All Years	1990-2000	2001-2010	2011-2020
IS strategy	∖***	—	—	
IS productivity	—	—	—	—
e-health	↗*		—	↗*
IS project management	∖***			
IS design	—	—	—	
e-learning	—			↗*
IS capability	↗***		—	—
IS management	—	—	—	—
IS implementation	∖***	—	—	—
IS evaluation	∖***	—		—
IS public services	∖***	—	—	—
IS adoption & use	↗***		↗***	—
IS adoption		—		
IS use		—		
IS Social practices	∖***		—	—
IS emerging services				—
IS sustainability				—

0.001 '\*\*\*'; 0.01 '\*\*'; 0.05 '\*'; — 'non-significant'; blank cells mean that the topic is not applicable for the associated year.

For the main analysis, different trends have been observed. Uptrends are revealed only for three topics of 'e-health,' 'IS capability,' and 'IS adoption & use'. On the contrary, 'IS strategy,' 'IS project management,' 'IS implementation,' 'IS evaluation,' 'IS public services,' and 'IS Social practices' showed a negative slope. The remaining four topics of 'IS productivity,' 'IS design,' 'e-learning,' and 'IS management' demonstrate no statistically significant positive or negative trends. Nevertheless, the slope analysis results for the topics are more consistent across the subgroups. In the analysis for "Articles in 1990-2000" we observe no statistically significant trend. The same is valid for the analysis of "Articles in 2001-2010" excluding 'IS adoption & use' which shows a strong positive trend. For the analysis of "Articles in 2011-2020", only 'e-health' and 'e-learning,' show upward trends while the others are not significant.

## 5.2 Topics intra-period analysis

We also examined the dominance of topics within the three periods to determine if there are significant differences in terms of the frequency of papers assigned to each topic. This analysis helps determine if the frequency/percentage of each topic in Tables 2-5 indicates a difference in the dominance of topics. We first conducted a one-way ANOVA test to gauge if there is a statistically significant difference between the means of three or more independent topics. We then used the Tukey HSD/Kramer test<sup>5</sup>, which compares the means between each pairwise combination of groups, to find which groups are different. We ran this procedure for the main analysis and three sub-group analyses separately using 'Real Statistics'<sup>6</sup>.

These results are reported in the supplementary materials for the paper. For the main analysis, the derived p-value of the ANOVA test is significant at the 0.01 level, indicating significant differences in the means for at least one of the topics. The Tukey HSD/Kramer test shows that the difference is significant for 'e-health' with 'IS evaluation' and 'IS for Public'. The same holds for the 2011-2020 period analysis, in which the p-value is significant at the 0.01 level and the Tukey HSD/Kramer test shows the difference in a handful number of topics. For the other two subgroup analyses (1990-2000 and 2001-2010), given the achieved p-value greater than 0.05, we concluded no significant differences in the means for the topics, which was also confirmed by the Tukey HSD/Kramer tests.

Overall, for the main analysis, the top three topics (i.e., 'e-health,' 'IS capability,' and 'IS adoption & use') have higher means than one or more topics with the lower frequencies in Table 2. Such differences were significant for 'e-health' with 'IS public services,' 'IS design,' 'IS

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<sup>5</sup> See <https://www.real-statistics.com/one-way-analysis-of-variance-anova/unplanned-comparisons/tukey-hsd/>

<sup>6</sup> <https://www.real-statistics.com> provides capabilities not found in Excel and easier to use than SPSS.

management,’ ‘IS evaluation,’ and ‘IS project management’; ‘IS capability’ with ‘IS design,’ ‘IS management,’ ‘IS evaluation,’ and ‘IS project management’; and for ‘IS adoption & use’ with ‘IS project management’. For the subgroup analysis for 2011-2020, all top three topics (i.e., ‘IS capability,’ ‘e-health,’ and ‘IS adoption & use’) show higher means than those for the last six topics (i.e., ‘IS evaluation,’ ‘IS management,’ ‘e-learning,’ ‘IS implementation,’ ‘IS emerging services,’ and ‘IS public services’).

## **6 Discussion**

### **6.1 Findings**

Figure 6 is derived by consolidating the results of all subgroup analyses for three periods. The three digital eras of SAP are also embedded in the figure as client, server, and internet era; cloud, mobile, and Big Data era; and intelligent technologies era. The technologies in each era pose different opportunities for business value creation, including business process automation, digital transformation, and intelligent enterprise. The topics from our analysis are shown for each period. Colored boxes indicate topics with upward trends in Table 6. Arrows indicate the evolution of each topic or how a topic is integrated into another topic (based on the similarity of the terms within topics). For instance, the connection from ‘IS public services’ in the first era to ‘e-health’ in the second era shows that the latter topic is emerged or evolved from the first topic. As another example, the arrow from ‘IS strategy’ in the second era to ‘IS capability’ in the third era shows that the first topic is integrated into the second one during the period.

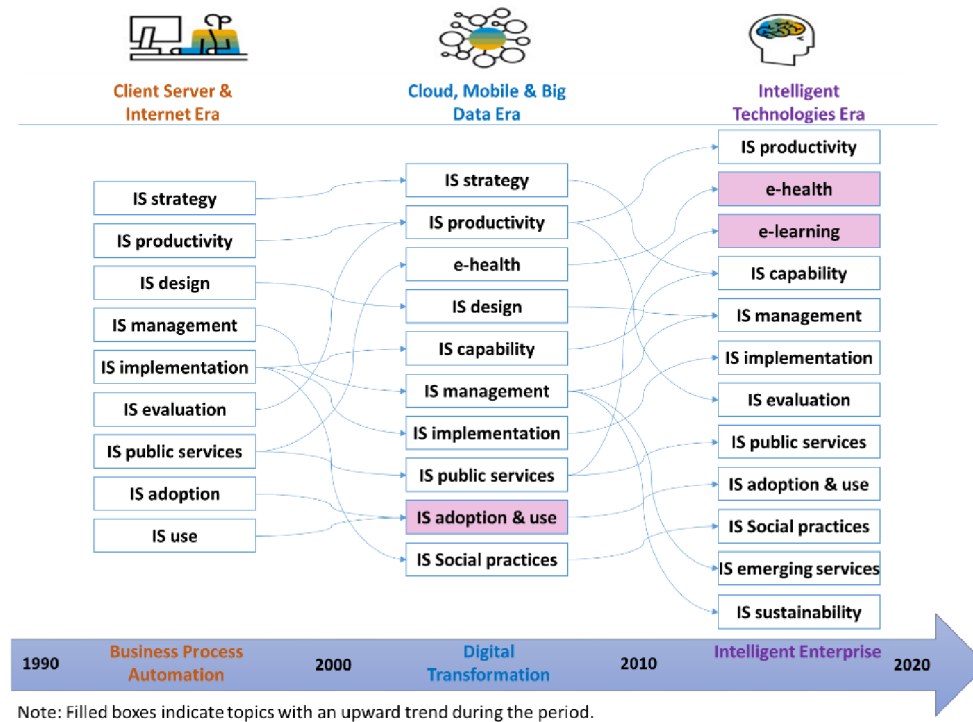
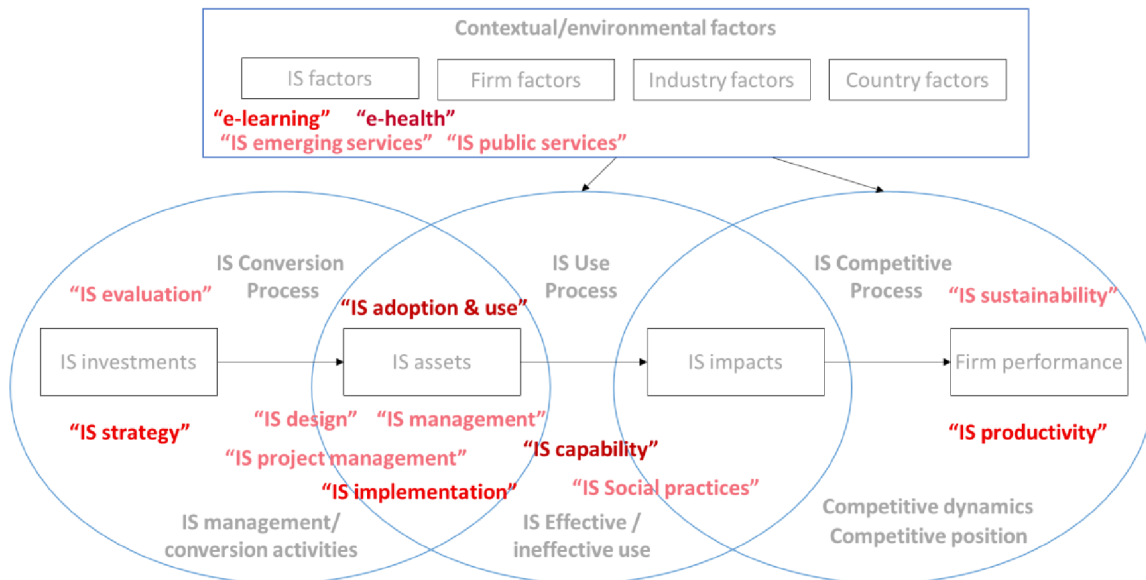


Figure 6. The evolution of ISBV topics

Figure 6 could be a useful tool for ISBV academicians. First, the evolution of topics can easily be traced using the connections between boxes. Second, dominant topics and trending topics in each period can be observed. Finally, the ISBV literature lags behind in emerging technologies. Although cloud, mobile, and Big Data concepts emerge in the second era, the ‘IS emerging topic’ appears only in the third period.

Further, all emergent topics can be mapped to the ISBV framework, as shown in Figure 7. To map the topics to processes, the underlying definitions of each process in Soh and Markus [30] are utilized. For instance, according to their model, IS conversion process includes ‘IS strategy,’ ‘IS project management,’ ‘IS implementation,’ and ‘IS evaluation’ activities. Topics such as ‘IS evaluation,’ ‘IS productivity,’ and ‘IS sustainability’ are related to a single process while ‘IS management,’ ‘IS implementation,’ and ‘IS project management,’ are related to two processes.

Four topics of ‘e-health,’ ‘e-learning,’ ‘IS emerging services,’ and ‘IS public services’ are mapped to “IS factors” in contextual factors as they refer to specific IS tools and applications.



Note: The intensity in the font color for topic names indicates the dominance of the topic (the higher the intensity, the stronger is the dominance)

Figure 7. Mapping topics to ISBV processes

Overall, the mapping shows how ISBV literature addresses model's processes. According to the model, organizations invest in IS. For that, they need to evaluate different options based on different parameters such as benefits and risks (‘IS evaluation’), and the investment must be aligned with business and IS strategies (‘IS strategy’). Then, subject to the varying degrees of effectiveness throughout the IS management process, they obtain IS assets. The quality of IS assets largely depends on how an IS solution is designed (‘IS design’), how it is implemented (‘IS implementation’), and how the project management treated that (‘IS project management’). IS assets then need to be adopted/used (‘IS adoption & use’) and managed (‘IS management’) appropriately. Quality IS assets, if used effectively, yield desired IS impacts. Effective use calls

for some organizational capabilities ('IS capability') and proper social and cultural adaptations ('IS social practices'). Finally, IS impacts can yield firm performance that needs to be assessed based on different tangible, intangible ('IS productivity'), or recently stressed out sustainability issues ('IS sustainability'). We expect future research to focus more on the social, economic, and environmental aspects of IS sustainability.

Figure 7 also highlights the role of IS-specific tools and applications in ISBV literature. The topic modeling revealed four IS-specific tools and applications that emerged throughout time, from 'IS public services' in the early years to 'e-health,' 'e-learning,' and finally 'IS emerging services'. This is in line with "IS artifacts" topic of recent IS research topic modeling [i.e., 20] that categorizes different IS tools and applications under this broad topic. ZareRavasan and Krčál [2], in a recent ISBV literature review, observed that only a handful number of empirical ISBV studies analyze the business value of specific IS applications. Then, the question is whether this high-level approach is suitable for understanding ISBV. Aral and Weill [57] argued that due to this issue, "we know little about the relative performance contributions of different types of IS investments and whether different IS investments impact different aspects of firm performance." Bharadwaj et al. [58] concluded that "firms benefit unequally from their different IS investments." Schryen [1] proposed that "empirical results of different studies are hard to compare (danger of comparing apples with pears)." For example, investments of equal amounts in the networking infrastructure and business analytics tools that enable firms to discover the hidden market and customer patterns and incorporate that data-driven insight into the decision-making process are likely to yield a different business value. Then, it is expected that future research will examine the business value of specific IS applications (especially emerging

technologies such as Blockchain, virtual reality (VR)/augmented reality (AR), and Big Data Analytics) rather than following a general IS approach.

## **6.2 Limitations**

Our findings should be interpreted in light of the limitations of this study. First, we restricted the scope of our research to IS, as reflected by our search terms, such as IS. This simplification might bias our sample as we might not capture all ISBV papers published on IS variants such as ERP, CRM, DSS, or recent technological concepts such as social media, IoT, Big Data, or Blockchain unless one of the search terms was available on the abstract. Second, our analysis was solely based on the abstracts of the papers. While abstracts contain more data than the title or author-specified keywords, we did not use other alternatives (e.g., full text) for topic modeling, which might lead to other topics. Third, our analysis was based on the Gensim library implemented in Python and has not been heavily compared against other topic modeling algorithms. A brief comparison with Scikit (implemented in Python) showed that Gensim was superior. Although we confirmed the accuracy and relevance of topics with two ISBV experts, we have not delved into comparisons between algorithms. The topics might differ when other topic modeling algorithms are employed. Further, due to the inherent limitations in the algorithm, there may be slightly different outcomes with different runs using Gensim. Setting the random state at one and the iterations at 300, we could freeze the optimum number of topics in different runs. However, the distribution of top terms in topics shows slight changes in each algorithm run.

## **6.3 Future Research Directions**

First, future research could establish best practices and guidelines for standardizing the algorithm parameters and validation procedures of the emergent topics, which may yield more objective



results for topic modeling. Second, future research could also apply and tune different topic modeling algorithms that may enable a comparison of emergent topics. Such an analysis also enables robustness tests of the topics. Although our subgroup analysis offers a reasonable level of verification based on similar and related topics, it may be possible to employ additional tests to extend our confidence in the topics. Third, an expanded corpus that includes the title or author-supplied keywords in addition to the abstracts could be used for topic modeling of ISBV literature. Fourth, future research might follow a more robust search query to identify the corpus of studies for analysis. Using IS taxonomies might be helpful to have an objective list of terms that could be included in the search terms as IS variations (e.g., ERP, CRM, Big Data). For instance, the WAND IT taxonomy<sup>7</sup> may be used for this purpose in future research to determine how the sample and topics change due to the inclusion of more IS-related terms in the search query. Finally, future research might focus more on identifying dominant theories and theoretical lenses in ISBV research. Even though in some areas such as ‘IS adoption & use’ or ‘IS capability’, we observe dominant theories such as Technology Acceptance Model (TAM), Resource-based-View, and Dynamic Capabilities view, widely applied theories in other topics such as ‘IS evaluation’ and ‘IS management’ are scarce. The Appendix summarizes the description of topics, some example articles from the associated corpus, and future research directions.

## **7 Conclusion**

This research maps the evolution of ISBV research over time. Using articles published in Scopus-indexed journals from 1990 to 2020, topic modeling was applied to the abstracts of 2824 unique papers. Results based on the main and subgroups analyses revealed various topics and

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<sup>7</sup> <https://www.wandinc.com>

their evolution over time. The emergent topics were also mapped to ISBV processes using an integrated ISBV framework. Using Scopus-indexed journal papers and a broad time period allowed us to be unbiased in terms of sample adequacy. Based on the results, it can be argued that ISBV research is not restricted to a fixed and static range of topics but keeps evolving in interaction with other disciplines in terms of problems, concepts, and theories. Since each topic has its unique focus within the ISBV domain, topics such as ‘IS design,’ ‘IS social practices,’ and ‘IS management’ may seem unrelated at first sight; however, the process view of ISBV shows that all topics fit the big picture to form a more cohesive knowledge structure.

From a research viewpoint, our results can assist scholars within various research streams in understanding the overall knowledge structure of ISBV discipline since it shows how particular topics have emerged, evolved, and connected with each other based on the ISBV process-view framework. From a practice viewpoint, our results suggest that CIOs and business executives should not merely focus on IS investments but pay close attention to the ways in which IS investments may be converted into business value through the various stages of the ISBV process. Executives having a process view of ISBV should not only consider complementary IS and non-IS resources and assets but also intermediate steps such as strategic fit, design, capability, implementation, management, adoption, and use to realize ISBV. Further, business executives should focus on IS intangible benefits and capabilities rather than economic measures in evaluating IS productivity.

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## Appendix

Description of topics and future research directions.

Topic					Description (main focus of the topic)	Future research directions
	All Years	1990-2000	2001-2010	2011-2020		
<b>IS strategy</b>	✓	✓	✓		How strategic fit between specific business strategies and specific business models play a role in ISBV creation. The focus is on the strategic and competitive environment.	<ul style="list-style-type: none"> <li>- How to design proper strategies and incentive policies to carry out effective IS projects.</li> <li>- How to align all organizational resources to create and sustain valuable and difficult-to-imitate competitive advantage.</li> <li>- How (competitive) ISBV might be eroded over time, which factors affect it, and how to cope with that.</li> </ul>
<b>IS productivity</b>	✓	✓	✓	✓	The business value of IS such as efficiency, economic value, accounting and market measures of ISBV, cost and benefit analysis.	<ul style="list-style-type: none"> <li>- What are effective methods or frameworks to evaluate IS productivity from 'as-is' challenges to 'to-be' opportunities?</li> <li>- Developing methodologies aimed to measure value items, especially at the business process level.</li> <li>- What are the proper objective and subjective productivity measures (beyond merely economic view, at the business and process levels), such as gaining rare core competencies, organizational cultural and structural transformation, and enterprise image in the market?</li> <li>- How ISBV (IS productivity) influences subsequent IS investments (closing the IS investment-IS productivity loop, based on historical empirical firm-level data)?</li> <li>- How to trace and evaluate investments' productivity of particular IS assets (e.g., by conducting enterprise case studies).</li> </ul>
<b>e-health</b>	✓		✓	✓	How the specific setting for ISBV in the healthcare sector is.	<ul style="list-style-type: none"> <li>- Develop a taxonomy for tangible and intangible performance measures in the healthcare sector.</li> <li>- Examine the application of emerging technologies in the context of e-health (especially Blockchain, IoT, and business analytics applications in the healthcare value chain).</li> </ul>
<b>IS project management</b>	✓				How to manage IS projects (such as project critical success factors, time, cost, and quality control)	<ul style="list-style-type: none"> <li>- Develop critical success factors for emerging IS and explore how they are different from conventional IS.</li> <li>- Examine the interdependencies in projects' cost, time, and quality and how to trade-off among them to get the desired ISBV.</li> <li>- Develop project management best practices for different IS projects.</li> </ul>
<b>IS design</b>	✓	✓	✓		How design features of IS (such as functionality, architecture) affect the business value.	<ul style="list-style-type: none"> <li>- How to capture and predict uncertain IS users' dynamic requirements and design acceptable IS that can deliver desired ISBV.</li> <li>- How IS design features impacts users' IS acceptance, adoption, and continuous use.</li> <li>- How to effectively create necessary technological and managerial standards in IS design.</li> </ul>
<b>e-learning</b>	✓			✓	How the specific setting for ISBV in the education sector is, not only for academic institutions, but also for firms using e-learning platforms.	<ul style="list-style-type: none"> <li>- How to mass-customize educational needs of employees to get the best from their IS use (e.g., AI techniques on emotion and behavior patterns recognition of users could help).</li> <li>- How to simulate organizational learning and engage employees in IS training programs (especially with gamification of learning).</li> </ul>
<b>IS capability</b>	✓		✓	✓	How IS capabilities (such as IS assets and resources,	<ul style="list-style-type: none"> <li>- Interdependencies and dynamics between specific IS (and non-IS) capabilities, skills,</li> </ul>

Topic	All Years				Description (main focus of the topic)	Future research directions
	All Years	1990-2000	2001-2010	2011-2020		
					IS and non-IS human skills) influence ISBV.	<p>competencies and practices.</p> <ul style="list-style-type: none"> <li>- How to build, maintain, develop and sustain IS capabilities over time.</li> <li>- How IS capabilities differ for different IS and technologies (such as Blockchain, Big Data Analytics).</li> <li>- How IS capabilities complement internal and external factors to create ISBV.</li> </ul>
<b>IS management</b>	✓	✓	✓	✓	How to manage IS operations (such as asset management, security, assessing, auditing, and outsourcing) to get the most ISBV.	<ul style="list-style-type: none"> <li>- Developing IS asset classification schemes according to the enterprise or industry goals.</li> <li>- How IS could create or decrease business risks, especially at the economic level (e.g., creating risks of IS and business failure, security, and privacy issues, decreasing the risks of a wrong decision based on inaccurate data).</li> <li>- How IS resource allocation and resource orchestration improve IS effective use.</li> <li>- How reconfigurations of organizational routines impact ISBV.</li> <li>- How outsourcing (and related variants such as Software-as-a-Service (SaaS), knowledge process outsourcing, and offshoring) could help or harm business value creation in the short, mid, and long term.</li> </ul>
<b>IS implementation</b>	✓	✓	✓	✓	How to implement IS (implementation methods from organizational and technical perspectives) to get the most ISBV.	<ul style="list-style-type: none"> <li>- How the implementation approach (change management process, Business Process Reengineering (BPR), customization, cloud or in-house software implementation, technical and structural issues) influences ISBV.</li> <li>- Develop best practices and guidelines for carrying out IS projects to ensure successful implementation.</li> <li>- Empirically examine the efficiency and effectiveness of currently available best practices (such as SAP's ASAP or Oracle AIM methodology for ERP implementation).</li> </ul>
<b>IS evaluation</b>	✓	✓		✓	How to evaluate IS and select the most appropriate one that fits the desired business value.	<ul style="list-style-type: none"> <li>- Developing publicly available models, frameworks, and taxonomies for IS evaluation (focusing on simplicity and applicability, other than complicated and hard-to-use mathematical models).</li> <li>- How to incorporate intangible value in objective IS evaluation models.</li> <li>- How IS investments affect each other and jointly create ISBV.</li> </ul>
<b>IS public services</b>	✓	✓	✓	✓	The business value of IS in the public domain such as smart city, agriculture, water, land, and waste management.	<ul style="list-style-type: none"> <li>- How to assess digital readiness and ensure a better match of the public IS to the target user group.</li> <li>- How to leverage Industry 4.0 concept and infrastructure to create more ISBV for the enterprise and the user.</li> <li>- Examine the effect of environmental characteristics and how they may interact with one another in delivering public IS and services and capturing ISBV, using case studies or empirical data. The examination of similar IS in a single industry across multiple countries might enable the isolation of environmental factors that are the source of different ISBV levels.</li> </ul>
<b>IS adoption &amp; use</b> <b>IS adoption</b> <b>IS use</b>	✓		✓	✓	How users' perception, attitude, and behavior toward IS can change, and how it could affect acceptance, adoption, use, and success of IS.	<ul style="list-style-type: none"> <li>- How to properly and objectively measure IS use, other than solely relying on subjective and perceptual measures of the use frequency.</li> <li>- How to relate IS usage patterns (user behavior) to ISBV creation.</li> <li>- What is the effect of alternative theoretical models or lenses (such as TAM, TRM, and TPB for IS adoption) for ISBV research.</li> <li>- How adoption theories (such as TAM, TRM, and TPB) differ in organizational and individual IS</li> </ul>



Topic					Description (main focus of the topic)	Future research directions
	All Years	1990-2000	2001-2010	2011-2020		
						<p>adoption (mandatory use against the free will) and which biases it could cause in case of improper theory application.</p> <ul style="list-style-type: none"> <li>- How non-IS investments influence effective IS use.</li> <li>- How IS effective use contributes to sustaining firm's competitive position.</li> <li>- How latency effects (time lag) influence effective IS use and firm performance.</li> </ul>
<b>IS Social practices</b>	✓	✓	✓		How human aspects (such as culture, leadership, training, change management, team working, social ties, and communication) play a role in ISBV creation.	<ul style="list-style-type: none"> <li>- How social practices differ in different IS projects (for instance, digital transformation at the business model or business process level).</li> <li>- How changes in organization structure influence the ability of IS impacts to generate ISBV.</li> <li>- How social practices influence effective IS use.</li> </ul>
<b>IS emerging services</b>				✓	How emerging IS could lead to a new business value and how it could be different from conventional technologies.	<ul style="list-style-type: none"> <li>- What enablers, infrastructure, organizational structure, skills, and capabilities are required to adopt emerging IS? Are they any different technology by technology or context by context?</li> <li>- What are the specific business value of emerging IS such as Blockchain, social platforms, VR/AR, and how it is different from conventional IS.</li> <li>- How to use emerging IS and other possible change dynamics to achieve sustained competitive advantage?</li> <li>- How integrating different state-of-the-art technologies (such as cloud computing, Blockchain, IoT, Big Data Analytics) could lead to a disruptive value or business model transformation.</li> <li>- Current readiness and barriers for the broad application of emerging IS at the organizational and individual levels.</li> </ul>
<b>IS sustainability</b>				✓	How IS could help and create value in terms of economic, social, and environmental sustainability	<ul style="list-style-type: none"> <li>- How to bring the right economic, environmental, and social sustainable ISBV (three goals of eco-efficiency, eco-equity, and eco-effectiveness).</li> <li>- How to cope with the inequality issues at the individual and enterprise levels (e.g., gender, location, age, size).</li> <li>- How to design circular economy business models in view of different levels, relationships, dynamism, and contextualization aspects.</li> </ul>