


Review

Modeling of Business Intelligence Systems Using the Potential Determinants and Theories with the Lens of Individual, Technological, Organizational, and Environmental Contexts-A Systematic Literature Review

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Abstract: Race towards industry 4.0 increases the hyper competition and puts pressure on organizations to integrate the advanced technologies. Business intelligence system (BIS) is one of the top prioritized technologies that attracted the significant attention of policy-makers and industry experts due to its ability to provide more informed and intelligent knowledge for decision-making processes. It is evident by literature that organizations and industries are prone to integrate the BIS at large scale, but more than 70% BIS projects fail to give the expected results. Hence, it is pertinent to explore the significant determinants that influence the BIS adoption and acceptance in organizations. Although previous literature did not have any comprehensive review relevant to the individual, technological, organizational, and environmental determinants. Therefore, the current study tries to narrow this gap by a systematic literature review (SLR) of 84 studies that were published during the period of 2011–2020. A total of 93 determinants are identified based on content analysis by using text mining techniques of Yoshikoder and human coding skills. The identified determinants are ranked according to their frequency of use. A theoretical framework has been developed with potential determinants and theories. The study results will enrich the recent BIS literature and improve the understanding of practitioners' decision-making processes to leverage maximum value from the adoption of BIS.

Keywords: business intelligence systems; adoption; acceptance; determinants; theories

1. Introduction

Business environments are becoming complex in the era of Industry 4.0. Therefore, enterprises need advanced innovations and technologies for quick response to the dynamic markets [1,2]. The emergence of Business Intelligence Systems (BIS) is led by the rapid growth of technology and diffusion of the internet in the mid-90s [3,4]. BIS is generally known as a complete suite of tools, techniques, and methodologies that enable the firms to integrate and analyze large data sets in order to identify

their weakness, strengths, and opportunities [5–7]. BIS is an information system (IS) that facilitates decision-making by (i) management, aggregation and integration of unstructured and structured data, (ii) handling with large datasets such as big data, (iii) offering ad-hoc queries, reporting, forecasting, and analysis solutions, (iv) end-users support with advanced processing abilities to explore new knowledge [3,8]. BIS has the ability to boost the internationalization process of organizations by sorting, summarizing, filtering and data integration from multiple channels [9], such as competitors, host markets, and local government [10]. In contemporary trade, due to hyper-competition and technological advances with big data [11,12]. BI technology is still positioned among the best technological priorities of several decision-making authorities including business owners, chief executive officers (CEO) and chief information officers [3,13,14].

To compete in the traditional markets or online business, the BI solutions have attained great attention of industry practitioners for delivering better products and services with improved processes and managerial practices [15]. It is depicted by a drastic increase of the worldwide BIS market that increased almost 7.3% in 2017, with revenues up to \$18.3 and it is expected to reach \$22.8 billion by the end of 2020 [3,16]. It is evident by previous studies, that enterprises are failed to harness the true benefits from the adoption of BIS [3,14,17,18]. In spite of its extreme importance, great market expansion and growing investments, more than 70% BI projects have failed to give the expected results [3,17,19]. Enterprises are struggling hard to find the best determinants to make their BIS and big data integration successful by yielding the maximum benefits from the BIS [18,20]. The academic research related to Big Data and BIS has thrived [21,22]. In a large number of published studies, the practitioners and scholars are still discussing the tactical, management, and strategic approaches to the successful integration and adoption of BIS [11,23]. However, the existing body of knowledge is insufficient in this perspective. For example, Ting-Peng Liang and Yu-Hsi20 Liu have published a bibliometric study from 1990 to 2017 to identify emerging topics of BIS and big data analytics [18]. Whereas, Hatta et al. have conducted a systematic literature review of BIS adoption studies during the period of 2009 to 2015, they reviewed the theories which are used for BIS adoption in small and medium enterprises (SME) [24]. A systematic literature review of two decades (2000–2019) was conducted recently by Ain et al., they discussed the BIS adoption, utilization and success comprehensively [3]. It is evident by literature review and bibliometrics studies on BI analytics that an extensive stream of BIS studies has been published till date [18,25].

However, to date, no comprehensive review is available in the perspective of adoption/acceptance with most significant determinants, theories and models at individual level or organizational levels. It is also suggested in the literature that BIS adoption decisions are influenced deeply by considering the appropriate determinants [14,26]. Enterprises also require to focus on user acceptance challenges to enhance the success of BIS projects [3]. Qlik-Gartner-2019 report has predicted that by 2020, the number of data and analytics in enterprises would increase at three times than the rate of information technology (IT) experts, which will put pressure on organizations to rethink their organizational skills, expertise and models [27]. Thus, this systematic literature review (SLR) aims to fill the existing gaps regarding the identification of potential determinants with the lens of individual, technological, organizational and environmental contexts. This study contributes a rich overview of BIS research from 2011 to 2020, presenting the recent development of theories/framework/models and significant determinants relevant to the BIS which led to the substantive guidelines for a novel theory. The theory, labeled as “Conceptual model and Theoretical framework for the BIS Adoption. The proposed framework would guide the industry practitioners to understand what kind of determinants and theories; organizations require to take into consideration with highest priority to leverage the true value of BIS. It may also serve to improve the scholars and practitioners’ abilities to perform efficiently and effectively within the theoretical field [28]. The following research questions (RQ) are addressed to achieve the study objective;

RQ1: What are the most deployed models/framework/theories in studies regarding the significant determinants for the BIS adoption and acceptance?

RQ2: What are the most significant determinants identified with frequency of use in the BIS adoption and acceptance studies?

RQ3: How to develop a theoretical framework with potential determinants and theories for the BIS adoption.

The remaining paper is structured as follows. Research methods including content analysis are elaborated in the Section 2. Findings are discussed in the Section 3. A theoretical framework is designed using potential determinants with the lens of most applied theories and models in the Section 4. The theoretical and practical implications are discussed in Sections 5 and 6 respectively. The section seven outlines the research limitations and future research guidelines. The last Section 8 presents the conclusion.

2. Methodology

This study is conducted following the suggested guidelines of Kitchenham [29]. An appropriate protocol was designed to guide this study with essential elements of SLR. A content analysis technique has been chosen to extract the appropriate content and address the research questions in order to establish an appropriate theoretical foundation for the BIS adoption. Content analysis is a technique, which is used commonly for making valid and replicable inferences from texts in the context of their utilization [30,31]. Thus, it is helpful to ascertain the focused attention on huge amounts of text by utilizing quantitative and qualitative research approaches [32,33]. To attain the inferential and predictive content of an article, a content analysis process is applied to extract the required data, by using theories analysis, determinants analysis, determinant frequencies, and adopted research methods for studies that were conducted in different regions of the world. An analyst can drive the implications for managerial practice by examining and interpreting the content analysis output [32]. Therefore, we carried a content analysis by applying the following criteria to extract the potential determinants. Data analysis was done by considering a series of steps. Three phase technique is adopted to extract, analyze, and report the findings which are based on identified studies.

- First, a set of criteria is defined for including and excluding research articles to identify the required items from selected papers for review.
- Second, a coding protocol has been developed appropriately and identified any potential determinant and theory that might influence the adoption and acceptance of BIS. All the determinants have been selected from the identified articles in accordance with research objectives.
- Third, the results were obtained, examined and explained the findings, inferring and demonstrating the results validity. A text mining software, Yoshikoder and human coding both were used to improve the assessment and reliability of data analysis.

A database is constructed on all relevant papers. The constructed database made it possible to elaborate the information from various points of view. The complete review process is depicted in Figure 1.

2.1. Journal Selection

In order to consider the impact and quality of papers, eight prominent online databases are selected. The selected databases are presented in Table 1. Only mainstream industry and academic journals were targeted because available studies related to BIS as a whole entity are still limited in the IS field, most of BIS studies including some reports of empirical research are published in industry journals. Therefore, some distinguished and high-quality industry journals, conferences, reports have been chosen to address the research questions effectively. The targeted keywords and databases are listed in Table 1.

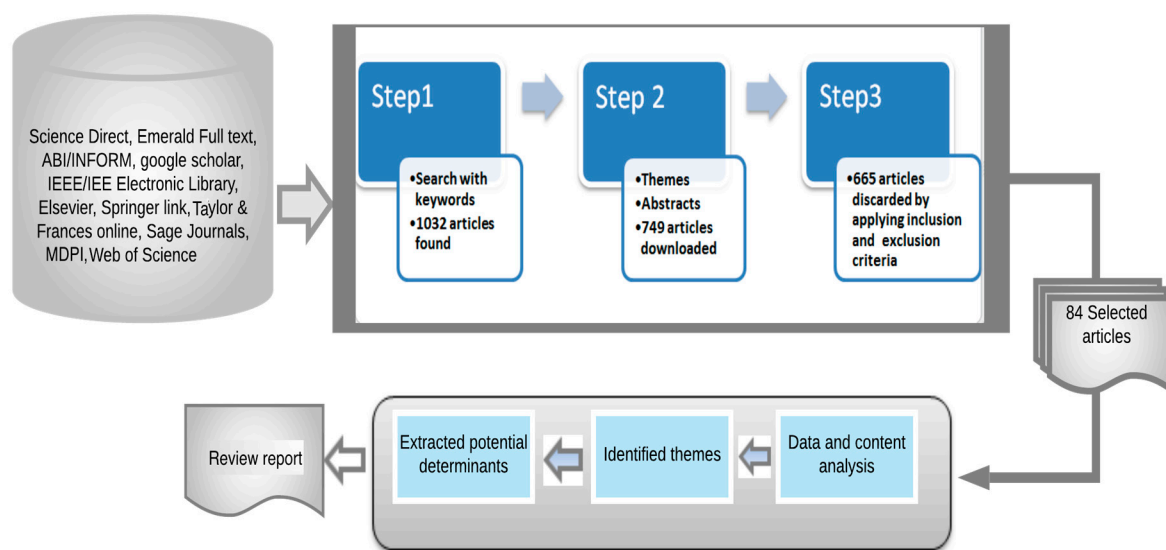


Figure 1. Papers selection and analysis process.

Table 1. Keywords and databases.

Years	2011–2020
Keywords	“Business intelligence systems”; “Business intelligence adoption/acceptance”, “Individual determinants/factors”; “Organizational determinants/factors”; “Technological determinants/factors”; “Environmental determinants/factors”; “Model/framework”; “Theories”, (for business intelligence systems adoption and acceptance)
Databases	ScienceDirect; Emerald Full text; ABI/INFORM; Google Scholar; IEEE/IEE Electronic Library; Elsevier; Springer link; Taylor & Frances online; MDPI; Sage Journals; Web of Science

2.2. Articles Selection

Based on developed protocol for this study, articles were searched by utilizing the keywords, BIS adoption/acceptance, theories, determinants/factors and models/frameworks in individual, technological, organizational and environmental contexts.

The inclusion and Exclusion Criteria for SLR

Inclusion /exclusion search criteria was set to make sure that studies must be relevant to the research objectives [33]. The inclusion criterion included: (1) behavioral studies that comprised the conceptual models, theories and preposition, (2) studies that observed the BIS adoption and acceptance. The exclusion criterion consisted of: (2) all technical studies related to BIS adoption/acceptance, and (3) studies about the BIS research in other languages except English language. As the review study is a part of the information technology (IT)/IS field, which is changing rapidly. The process of inclusion and exclusion is also presented in Table 2. Thus, the time span of this study is from 2011 to 2020. The studies are also excluded those published before 2011. An additional check was applied by all authors to maintain high reliability.

Table 2. Inclusion and exclusion criteria for systematic literature review (SLR).

Criteria	Description
Inclusion criteria	Studies published from 2011 to 2020 Studies published in the English language Full-length peer-reviewed studies Studies on conceptual models, theories/preposition Available in selected electronic databases Studies that observed BIS adoption/acceptance
Exclusion criteria	Studies published before 2011 Studies published in other languages No full-length peer-reviewed studies Duplicate studies Non-Scholarly studies All technical studies related to the BIS

The retrieval process of studies has been done by two coders independently with IS background. If any article was confronted with a disagreement, the paper was discussed by all co-authors until reaching an agreement. By looking at the title and keywords, a total of 1032 articles were selected. 749 articles were downloaded after reading the abstract. 665 studies were discarded by applying the inclusion and exclusion criteria. Only 84 studies were selected for the current study. Table 3 presents the list of selected journals.

Table 3. Journals list.

Selected Scholarly Journals	Selected Industry Journals
Information & Management	Harvard Business Review
European Journal of Research	Accounting Review
International Journal of Information Management	Gartner Reports
Expert Systems with Applications	MIS Quarterly Executive (MISQE)
Journal of Business Research	Communications of the ACM
Behaviour & Information Technology	Economic and Business Review
Decision Support Systems	
Journal of Information Systems	
MIS Quarterly	
Telematics and Informatics	
Journal of Organizational and End User Computing	
Journal of Management Information Systems	
Industrial Management & Data Systems	

2.3. Quality Assessment

Quality Assessment (QA) criterion is used to assess the quality of 84 identified studies. The objective of the QA was to ensure the quality of selected articles for attaining the better interpretations and results [29,34]. Therefore, four questions were designed to evaluate the selected studies with QA criteria:

Q1: Is the research topic relevant to factors/ determinants, conceptual models for the BIS adoption/acceptance?

Q2: Is the purpose of the study clearly mentioned?

Q3: Is the methodology explained clearly the data collection and data analysis procedures?

Q4: Is the research approach adequately discussed?

Three level quality rankings were applied for quality evaluation of selected studies. Rankings were given the name “high, medium, and low” for QA criterion [30]. In this study, score 4 (i.e., 4 × 1) is considered as highly relevant to the 4 QA criteria and 0 was considered as a lowest rank. Score 1 was assigned to each study after assessing the criterion. On the other hand, if any study satisfied the

quality criterion partially, it was ranked 0.5 and if any study did not meet the quality criterion, score 0 was assigned to it. The high-quality standard was applied on each study, if it ranked more than 3, considered the medium quality standard if ranked <3 and >1 e.g., 1 and 2 numbers were given to low quality rank. A total of 72 studies have met the high-quality standard and 12 articles were ranked to be medium quality groups whereas 10 studies were found to be low quality. Thus, only 84 studies were qualified for the review after exclusion of 10 low-quality studies from the basket of selected articles.

2.4. Coding Method

Data were coded by using Microsoft Excel spreadsheet, Yoshikoder, and Mendeley. Two coder process is utilized to code the selected papers. First, all the determinants were identified that might influence the adoption decision regarding the BIS. In addition, different forms of expression might be utilized by different authors to identify the specific determinant and given determinant might be mentioned in any part of the paper. The frequent repetition of many determinants was observed, it showed the adoption and acceptance behavior of BIS in organizations. Hence some determinants are bunched under the one determinant such as cost determinant is representing the technology cost, organizational cost and affordability. Although, the determinants frequency has been counted because of their sustained utilization with the same name without any specific judgment but sometimes similar terms have been utilized differently by some researchers. Content analysis by humans helps to overcome the limitations of the software analysis tool in finding relevant determinants. The reliability is also improved to combine both methods of analysis. The intensity of frequency was focused on analyzing the papers. The Yoshikoder is used to calculate the frequency accurately by analyzing specific keyword in-context documents. This computer-assisted software is used for content analysis with basic text mining function [20,35]. However, the human coding process cannot be replaced by computer software. Therefore, basic results interpreted manually to attain the relevant precise results for the contextualized documents. This effort would help to diminish the software limitations in digging the related determinants. The software analysis can improve the reliability of the results.

The usage frequency of each determinant was calculated, if one determinant was repeated multiple times in the selected studies, its frequency was measured in order to the number of times it stated in the papers. The determinants were explored and categorized into four dimensions in accordance with the proposed theoretical framework. The dimensions are individual, technological, organizational, and environmental. Two coding techniques have minimized the biases and maintained the high reliability [20]. The one coder has identified manually all the determinants and highlighted the texts that have all the influential determinants for BIS adoption and acceptance at an organizational level and individual level. The other coder examined the notes manually, which were highlighted by the first coder. All identified determinants were grouped together after mutual consensus by all authors. All the obtained results were recorded in the Microsoft Excel spreadsheet. Data coding has been done of 84 identified studies relevant to the study objective. Many researchers have prescribed various methods for data extraction from the literature [31–34]. At this stage, a form was designed to store the extracted information from the selected articles to make sure the completeness of the data retrieval process [24]. The form has several headings, such as study ID, study type, study year, study context, study objective, country, research methodology, key factors/determinants, theory/framework/model, and study sector. The final agreement coefficient in this process was 85%.

3. General Findings

3.1. Studies Distribution in Chronological Order

The research on the BIS adoption has attained great attention over the last two decades, but prominent increase has been observed from 2009 to 2019 [3]. From 2000 to 2009, researchers had mostly focused on components of the BIS such as online analytical processing (OLAP) and data warehouse (DW) or some other tools such as dashboards etc. The focus of researchers has shifted to the BIS as a

whole entity during 2009 to 2019 [3]. Therefore, the selected period of SLR is from 2011 to 2020 in the perspective of BIS adoption and acceptance as a whole entity. Thus, a total of 84 studies are part of this review. It is revealed by the analysis that limited papers are published in the years of 2011 (3), 2012 (7) and 2013 (5). Whereas the publications are increased little bit in 2014 (9), 2015 (8) and 2016 (9) but a significant increase is observed in 2017 (12) and 2018 (18). While sudden decline is noticed in 2019 (10) and 2020 is going on with 5 studies. The distribution of all studies is done according to the significant dimensions and the year of publication in Figure 2 and Table 4. It is revealed by the analysis of results that most studies were conducted in an organizational dimension as compared to other three dimensions. Individual (users) and environmental dimensions attained less attention from researchers, but it showed by Table 4 that the technological dimension was neglected by researchers.

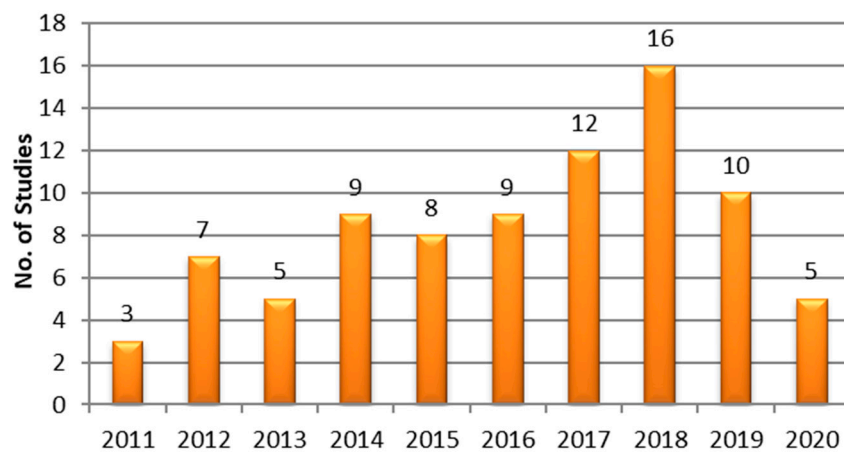


Figure 2. Publications distribution by years from 2011 to 2020.

Table 4. Distribution of studies into dimensions by year of publication.

Categories \ Years	Individual Context	Technology Context	Organization Context	Environment Context	Miscellaneous
2011	[36]		[37,38]		
2012	[39,40]		[8,41]		[42–44]
2013	[45,46]		[47]	[45]	[48]
2014	[6,49–51]	[51]	[19,23,52]	[51]	[12,53]
2015	[7,54]	[25]	[24,55,56]	[57]	[17,25]
2016	[58–60]		[61,62]	[14]	[15,16,63]
2017	[64]		[13,65–69]		[15,21,28,70]
2018	[71]	[72]	[68,73–78]	[72,79,80]	[18,33,81]
2019	[82]	[83]	[26,75,82,84,85]	[82,84]	[3,22,86]
2020			[1,5,11]	[9,10]	

3.1.1.1. Research Methods

Various research methods and approaches have been used to adopt the BIS in the literature such as conceptual, quantitative, qualitative, and mixed methods. It is noticed by the findings of the current review that quantitative research approach based on survey has been adopted frequently by most of the researchers (52.20%) for the BIS adoption. In this research approach, web and paper-based questionnaires were used for data collection from targeted respondents with authoritative positions such as IT executives, managers/owners and BI professionals [45,49,53]. Whereas only 21.15% of total identified studies have adopted a qualitative research approach based on case study or Delphi study in which data were collected with in-depth interviews of individuals (case study), or group of experts (Delphi study [63,81]. Only a total of 6.30% of studies have utilized mixed methods (quantitative & qualitative) for data collection. The results also showed that the case study method was used by six studies in which data collection has been done by conducting in-depth interviews. Four studies have used observations with interviews, whereas, only one study has used the Delphi method. The Delphi

method and in-depth interviews are helpful to know the perception of targeted respondents about the BIS [65,81] and 19.40% studies were conceptual. The summary of mentioned scenarios is depicted in Figure 3.

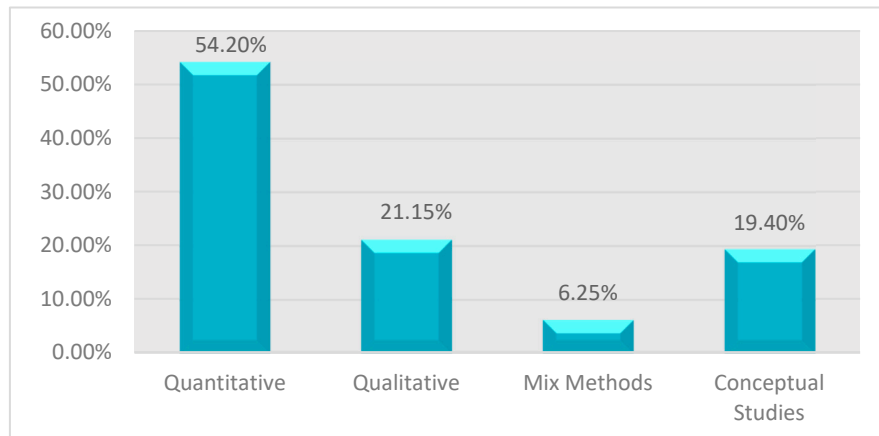


Figure 3. Distribution of research approaches (2011–2020).

3.1.2. Geographical Distribution of Articles

This review study has covered six continents with 19 countries of the world as depicted in Figure 4. Overall, the continent Asia was ranked high with 33.33% studies, including Malaysia, Thailand, Taiwan, Iran, UAE, and India for the BIS research. Europe ranked as the second highest continent with 27.07% BIS published studies, this region consisted of Slovakia, Slovenia, Croatian, Portugal, Poland, Spain and the United Kingdom. In addition, North America has contributed 16.50% to the number of studies which were conducted in the USA and Canada. On the other hand, a total of 11% studies were published in the African region including South Africa and Ghana etc. Whereas, South America with two countries “Brazil and Colombia” is ranked low with 5.55% published articles and Australia has scored the lowest with 1% published study only. Some studies (5.55%) were conducted across the world relevant to the study topic. The findings showed that researchers have focused more on developed countries especially the USA and neglected the developing countries like Africa, Middle East, and South Asian countries for the BIS research.

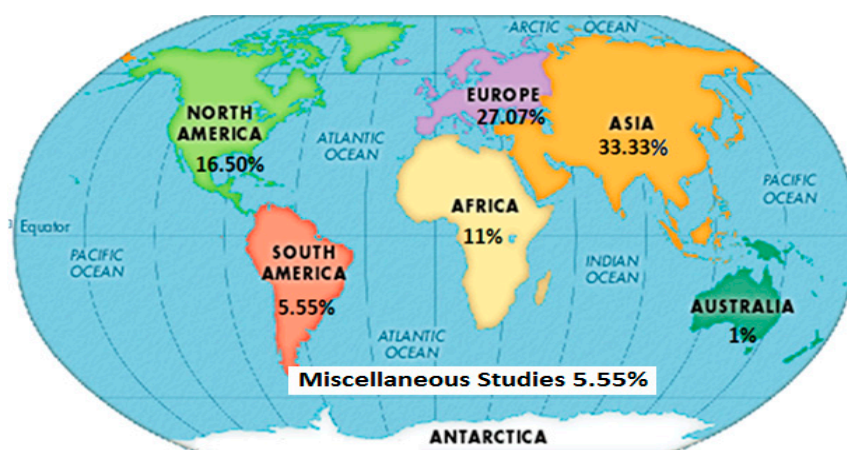


Figure 4. Studies distributed by continents.

3.1.3. Sector-Wise Distribution of Articles

Various sectors were identified for the BIS research after the analysis of the results. It is found that researchers have focused more on the banking sector (23%), multiple companies (18%), small and

medium enterprises (SME) (17%), telecommunication sector (9), and healthcare sector (7%). On the other hand, insurance companies (5%), retail chain (3%), supply chain (3%), logistic services (3%), BI vendor companies (3%), electronic industry (4%), and academic (3%) have attracted less attention of the researchers as also shown by Figure 5.

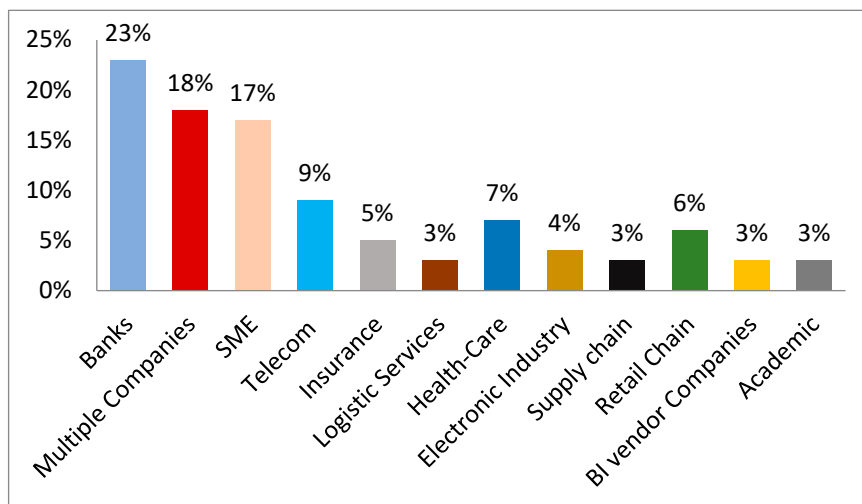


Figure 5. Sector-wise distribution of articles.

3.2. Key Findings Addressing the Research Questions

3.2.1. Potential Theories, Frameworks/Models Used for the BIS Research

The result analysis shows; the identified articles have utilized a broad array of theories, frameworks, and models to investigate the significant determinants for the BIS adoption and acceptance. It is found that a total of 8 theories, models and frameworks were frequently used for the BIS adoption/acceptance in the research field. The majority of the studies have used diffusion of innovation (DOI) theory (48.50%), technology organization environment (TOE) framework (35.40%) and institutional theory (32.25%) regarding the BIS adoption in the literature, while for the BIS acceptance; unified theory of acceptance and use of technology (UTAUT) (12.90%), theory of planned behavior (TPB) (9.67%) and technology acceptance model (TAM) (9.67%) are deployed frequently. DOI, institutional theory, resource-based view (RBV) and TOE were used for BIS adoption at firm level and UTAUT, TPB, and TAM were used for BIS acceptance at an individual level. Many researchers applied DOI for the BIS research at both individual level and organizational level [74]. (DOI) theory formulated by Rogers in which he claimed that the rate of adoption of any innovations is influenced majorly by five determinants: relative advantage, compatibility, complexity, trialability, and observability [87]. Rogers explained further that relative advantage, observability, trialability and compatibility are normally related positively with the innovation adoption rate but complexity is mostly related negatively with the adoption rate [87]. However, previous studies revealed that researchers have emphasized more on technology compatibility, relative advantage, and technology complexity as the main antecedents to innovations adoption [62,73,88].

TOE is the most utilized framework/model for BIS adoption in selected studies. The TOE framework was developed by Tornatzky and Fleischer in 1990. They have introduced the dimensions by which organizations adopt and implement new technologies [66]. It has three dimensions that influence the adoption of technological innovation within organization [62]. These three dimensions reveal opportunities as well as challenges for the adoption of any innovation. Technological dimension includes internal and external technologies that may comprise both tools and processes which are essential to the organization [73]. Organizational dimension includes the firms’ size, degree of scope, degree of centralization, number of slack resources (e.g., human and other resources), managerial

structure of organization, and environmental dimension consists of industry structure, size, the macroeconomic context, the competitors, and government policies/regulations etc. [67,73]. A large number of studies have selected this framework to describe the BIS adoptions as shown by Table 5.

Institutional theory is also the most deployed theory after the DOI and TOE [73,79]. Organizations operate in an environment that is influenced by economic, socio-political, and technological pressures which gives rise to institutional isomorphism [89–91]. Generally, institutional theory comprises three different kinds of institutional isomorphism which are, coercive, mimetic, and normative [92]. Coercive isomorphism refers to both formal and informal pressures deployed in the firm by other firms including policies and regulations of government. Mimetic isomorphism refers to the pressures that imitate the organizations by others to adopt innovation in the same industry. Normative isomorphism is a powerful force that relates to the professionalization of the industry, defined as “the collective effort of members of the profession to decide the condition and methods of their professional work; to dictate the production of future specialists with basics and legitimacy of their professional autonomy [92]. The role of the institutional environment can be highlighted by using institutional theory by describing and defining the organizational change [20,93]. In the BIS adoption context, this theory pointed out that organizational decisions and the adoption process of any innovation is strongly influenced not only by organizational objectives but also driven by external environmental determinants including others social determinants, for instance: social and political pressures. Due to these pressures, enterprises in the same sector are encouraged to emulate the industry leader’s actions and become counterparts. According to this theory, pressures from trading partners, competitors, suppliers, customers, and governments can affect companies’ decision to embrace the innovation adoption such as BIS. Previous research has applied this theory to describe the adoption of IT innovations [20,93–95]. Thus, many organizations in the same industry become homologous with the passage of time, as competitive pressure from suppliers, customers, and other stakeholders drive them to follow their peers in the same business domain [96]. Currently, several researchers have deployed the institutional theory to investigate the BIS adoption as presented in Table 5. Some researchers have also blended the institutional theory with the TOE framework [20,41,47,54,55,61,66,73,76].

The data analysis also revealed another important finding that UTAUT, TPB, and TAM are commonly used for the BIS acceptance at an individual level in organizations. UTAUT appears to be the most recently cited model from scholars on the acceptance but some studies used for adoption, management, and efficacy of a technology [46,64,97]. Venkatesh et al. developed the UTAUT model by combining eight models in (2003). The four primary variables were identified by this integration that were considered as potential determinants of intention and technology use: performance expectancy (PE) is the perception a user has, That in use technology is beneficial; effort expectancy (EE) is the perception a user has that a particular technology can be easily operated; facilitating condition (FC) is the perception, a user has sound existing technical facilities to enhance the technology use; and social influence (SI) is the influence of superiors on others towards using a particular technology. TPB theory has frequently been adopted with UTAUT and TAM for innovation acceptance [25,98]. T. Grublješić and J. Jaklič have mentioned in their study that Azjen himself later extended the theory of reasoned action to bring about TPB [25]. The essence of this new theory is to hypothesize a person’s action with limited voluntary control. TPB assumes that the actual behavior of an individual is influenced by intention to that behavior. Similarly, intention is greatly influenced by subjective norm, attitude, and the person’s ability to execute that action necessary for acceptance of any innovation [50].

Technology acceptance model (TAM) shows a significant theoretical contribution towards comprehending acceptance, adoption, and usage of new information systems [40,70,99]. It is the most applied model in the identified studies to investigate user acceptance and forecast user adoption of the BIS [36,39,51,57,60,98] as depicted in Figure 6. In 1989, Davis proposed the (TAM) that is used to predict user behavior in accepting new technologies [74,99]. The aim of this model development is to explain the association with environmental variables on an individual’s attitude, intentions, and beliefs with perceived ease of use (PEOU) and perceived usefulness (PU), which determines the individual’s

attitudes to adopt new technology. The TAM suggests that, if technology is easy to use and perceives useful, it will affect positively on the user’s behavior for innovation and if not, it will lead to a negative effect on the adopter’s decision in future, concerning new technology. Consequently, if adopters have positive behavior, it will motivate the users to adopt the innovation in minimum time. However, when users meet a new technology, they may encounter several factors that determine their decision about how and when they will use it. Self-efficacy is the extent to which a user believes he or she can use technology. Perceived incentives are defined as an impression a user has for using that new technology, would result in financial incentives; all these independent variables are measured to determine the user’s behavioral desire to use an innovation. Whereas, resource-based view (RBV), and critical success factor (CSF) theory usage is low as depicted in Table 5.

Table 5. Theories and models used for business intelligence system (BIS) adoption and acceptance.

Theories/Frameworks/Models	References
Diffusion of Innovation (DOI)	[41,47,51,52,54,55,58,61,68,73,75,76,82,86,100,101]
Technology-Organization -Environment (TOE)	[19,41,47,54,55,61,68,69,73,76,80,84,101]
Institutional Theory	[41,43,47,54,55,61,73,76,101]
Unified Theory of Acceptance and Use of Technology (UTAUT)	[25,50,57,100]
Theory of Planned Behavior (TPB)	[25,59,82,98]
Technology Acceptance Model (TAM)	[36,39,51,57,60,98]
Resource-Based View (RBV) Theory	[59,72,75]
Critical Success Factor (CSF) Theory	[59]
Maturity Model	[59]

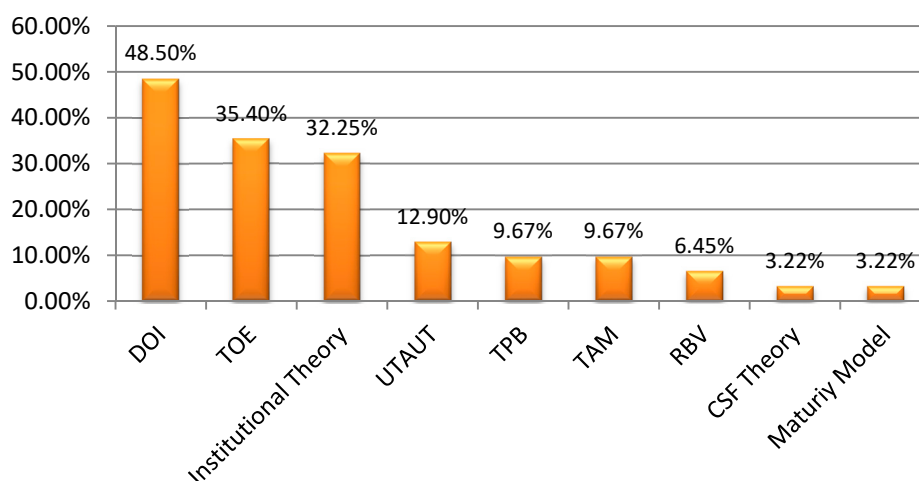


Figure 6. Theories and frameworks/models used for the BIS adoption/acceptance.

3.2.2. Identified Determinants for the BIS Adoption and Acceptance

Identification of potential determinants is very important for successful implementation of BIS as it will guide the decision-makers to remove the barriers in the adoption and acceptance of BIS. The content analysis of models and theories has been done by rigorous review of the literature regarding the identification of the determinants. Total 93 determinants are identified within the given subject of the study. The most frequent determinants are presented in Table 6 that have influenced the adoption and acceptance of BIS in organizations. The significant determinants are presented with name, rank, frequency, and category code in Table 6. The analysis reveals clearly that determinant “organization size” ranked the top of the list with a total frequency of 13, industry size; company size, business size, and organization size are merged in one determinant “organization size”. Relative advantage is ranked at second with usage frequency of 12, followed by determinant complexity with frequency 11, competitive pressure 9, compatibility, and cost with frequency 8, and organization readiness and top

management support with frequency 7 and 6 respectively. Technology cost, organization cost, and affordability are considered as one determinant under the name of determinant “Cost”.

Table 6. Identified determinants that have influenced the BIS adoption and acceptance.

Determinants	Category	Frequency	Rank
Organization size	OC	13	1
Relative advantage	TC	12	2
Complexity	TC	11	3
Competitive pressure	EC	9	4
Compatibility	TC	8	5
Cost	OC	8	5
Organizational readiness	OC	7	6
Top management Support	OC	6	7
Information quality	OC	4	8
Presence of Champion	OC	4	8
Perceived usefulness	IC	4	8
Perceived ease of use	IC	4	8
Social influence	EC	4	8
Regulatory body/ compliance	EC	3	9
Trialability	TC	3	9
Observability	TC	3	9
Rival’s absorptive capacity	EC	3	9
Organizational resources	OC	3	9
Behavioral beliefs	IC	3	9
Control beliefs	IC	3	9
Normative beliefs	IC	2	10
Market trends	EC	2	10
Infrastructure capacity	OC	2	10
Result demonstrability	OC	2	10
Facilitating conditions	OC	2	10
Managers’ innovativeness	OC	2	10
Requisite knowledge & skills	IC	2	10
Institutional isomorphism	EC	2	10
Organization culture	OC	2	10
Information access	OC	2	10
Performance perceptions	IC	2	10
Vendor support	EC	2	10
Industry type	OC	2	10
Technology readiness/availability	TC	2	10
BIS integration with ERP	OC	2	10
Effort perception	IC	2	10
Organizational data Environment	OC	2	10
External support	EC	2	10
Government support	EC	1	11
Industry competition	EC	1	11
Routine use	IC	1	11
Innovative use	IC	1	11
Relational decision-making culture	OC	1	11
Impact of Performance perceptions	IC	1	11
Level of BI use	OC	1	11
Problem space complexity	OC	1	11
External technology support infrastructure	EX	1	11
Core beliefs	IC	1	11
Intrinsic motivation	IC	1	11
extrinsic motivation	EC	1	11
Organizational structures	OC	1	11
Control systems	OC	1	11

Table 6. Cont.

Determinants	Category	Frequency	Rank
User training	OC	1	11
Distribution of power	OC	1	11
Awareness	IC	1	11
User interface	OC	1	11
Focus on the customer	OC	1	11
User participation in implementation	IC	1	11
Information culture	OC	1	11
Job relevance	OC	1	11
Change management	OC	1	11
IT infrastructure	OC	1	11
Personal capabilities	IC	1	11
Organizational transformation	OC	1	11
Consistency	OC	1	11
Organization implementation intention	OC	1	11
External technology support infrastructure	IC	1	11
Market structure	IC	1	11
Decision confidence	IC	1	11
Perceived tangible benefits	IC	1	11
Organizational learning climate	OC	1	11
Voluntariness of use	IC	1	11
behavioral intention to use	IC	1	11
Industry characteristics	IC	1	11
Gender	IC	1	11
Experience	IC	1	11
Stakeholder Support	EC	1	11
Strong business focus & ownership	OC	1	11
Executive buy-in & involvement	OC	1	11
Organizational legitimacy	OC	1	11
Technology familiarity	TC	1	11
Quantitative skills	OC	1	11
Formal and informal structure	TC	1	11
Technological characteristics	OC	1	11
linkage communication processes	OC	1	11
Age	EC	1	11
Individual adoption intention	EC	1	11
Perceived cost	EC	1	11
Perception of strategic values	TC	1	11
Managers' involvement	OC	1	11
Decision timeliness	TC	1	11
Perceived intangible benefits	TC	1	11
Performance expectancy	TC	1	11
Consumers' pressure	EC	1	11
Risk management	OC	1	11

Note: IC: Individual Context; Technology Context; OC: Organization Context; EC: Environment Context.

The most utilized determinants at an individual level were perceived usefulness, perceived ease of use, behavior beliefs, control beliefs, and normative beliefs. Technological determinants consist of relative advantage, complexity, trialability, technology cost and observability. The most prominent organizational determinants are organizational size, top management support, organizational readiness, presence of champion, information quality, manager innovativeness, and manager's involvement/ownership. The environmental determinants encompass competitive pressure, external support, state support, regulatory compliance/body, rival absorptive capacity, market trends, vendor relationship/support, and institutional isomorphism. The above results exhibit clearly the important determinants and their frequency of use by decision-makers' concern in the adoption of BIS.

All determinants are ranked by their frequency of use. A determinant with higher frequency generally implied higher consideration by practitioners and scholars. Each determinant is also given a specific category code that would indicate its classification. To exhibit the specific range of each determinant and how we calculate the frequency in the coding process, we assigned the general definition and used some common keywords for data analysis. The examples and definitions gave initial understanding of these determinants. For instance, the organization size, relative advantage, complexity, competitive pressure, compatibility and cost are ranked high in Table 6 and followed by compatibility, trialability, perceived ease of use, perceived usefulness, normative beliefs, control beliefs and behavior beliefs considered low with frequency of 4 and 3. Some determinants are ranked lowest with frequency 2 and 1.

The determinants with lowest ranks show that they did not play a significant role in the adoption and acceptance process of BIS at individual level or organizational level. Whenever, organization size, top management support, organizational readiness, and presence of champion are considered significant in the context of organizational determinants. Only competitive pressure determinant is ranked high in the perspective of environmental determinants. Some other environmental determinants have scored better rank such as regulatory body, social influence, market trend, rival's absorptive capacity but ranked low as compared to the technological and organizational determinants. It is indicated that unlike other technological and organizational determinants, environmental and individual determinants were given less attention by researchers and practitioners for the BIS adoption and acceptance. Some new determinants are also emerged by the analysis of the findings such as infrastructure, result demonstrability, facilitating conditions, requisite knowledge & skills, institutional isomorphism, organization culture, information access, performance perception, vendor support, level of BIS use, capacity, compliance body, user participation and involvement, information culture, intrinsic motivation, extrinsic motivation, playfulness, perceived enjoyment, computer anxiety, distribution of power, decision confidence, perception value of strategy, positive mood outcomes, trust, risk management, consumer pressures, and some others, that have not used commonly for the BIS adoption in selected studies. It is confirmed by the previous studies that technological determinants are more stable influencing the adoption decisions of BIS as compared to other both organizational and environmental determinants [62,74,91] and this perception is validated by the findings of the current study again. A limited number of studies endorsed and addressed the significance of the environmental and individual determinants. The BIS adoption has been influenced the least or neglected by the researchers in terms of environmental and individual determinants in prior studies [3,80,102]. In addition, the outcomes of some studies endorsed that significance of determinants are based on their context of use. For example, some studies have used technological, organizational and environmental determinants at an organizational level, and some have used the same determinants at individual level.

A tag cloud is created which is based on the frequency of use of each determinant. The larger text font in Figure 7 reveals the higher frequency of that particular determinant. This figure is provided a convenient way to compare and visualize the significance of each determinant. For instance, organization size, cost, relative advantage, competitive pressure, complexity, compatibility, organization readiness, and top management support were highly ranked and showed in larger font All determinants font size is depicted according to their rank.

4. Proposed Conceptual Model and Theoretical Framework

Scholars give a great importance to theory or framework development. In spite of its great importance within information discipline, the refinement of existing frameworks/models, theories, and development of new theory or theoretical frameworks have been neglected by the researchers [44,84]. It is confirmed by the literature, a limited number of studies are available on theory development in the IS context and especially for the BIS adoption process. By rigorous systematic literature review, we have found just a few studies with theories and frameworks for the BIS adoption. A good quality

theory or framework is considered a significant element to improve the knowledge of scholars and practitioners within the theoretical domain [28,103].

Weber has suggested various methods to develop theory or framework in [44]. He also stated; theory or framework might make novel contributions to a discipline:

- If the focal phenomena of a specific theory had not been discovered by previous theories.
- An existing and well-known theory or framework is considered to be novel if its focal phenomena modify in new ways. it might enhance the novelty of theory.
- A theory might be considered novel, if some significant changes brings to a well-established theory –possibly deleting or adding associations and constructs, specifying the existing constructs and associations more comprehensively.



Figure 7. Tag cloud visualization of the potential determinants that influence the BIS adoption and acceptance.

The proposed theoretical framework in Figure 8; consists of four contexts; individual context, technological context, organizational context, and environmental context. The purpose of this framework is to develop a conceptual BIS adoption model with concise prediction and clear explanation of the main constructs and determinants. The framework is developed with the blend of most potential models and theories such as TOE, TAM, DOI, and institutional theory. The earlier published literature has confirmed that the TOE framework has been integrated frequently with other theories to examine the adoption of innovations [86]. Initially, the TOE does not provide a tactile model with determined factors that influence the firms’ decision for technology adoption [104]. It provides only taxonomy for categorization the determinants within their respective context. For example, TOE has no determinants in technological and environmental context [96]. Therefore, it always integrates the DOI theory and institutional theory in these contexts, the frequent integration of both theories is considered now an integral part of TOE [56,61]. On the other hand, TOE has no specific constructs for innovation acceptance at individual level. As a result, TAM is integrated to fill this gap. TAM is considered as one of the most parsimonious and famous models for evaluating individuals’ IT acceptance. The major contribution of TOE and TAM is to provoke and encourage the practitioners and researchers to adopt the innovation at firm and individual level [71,102].

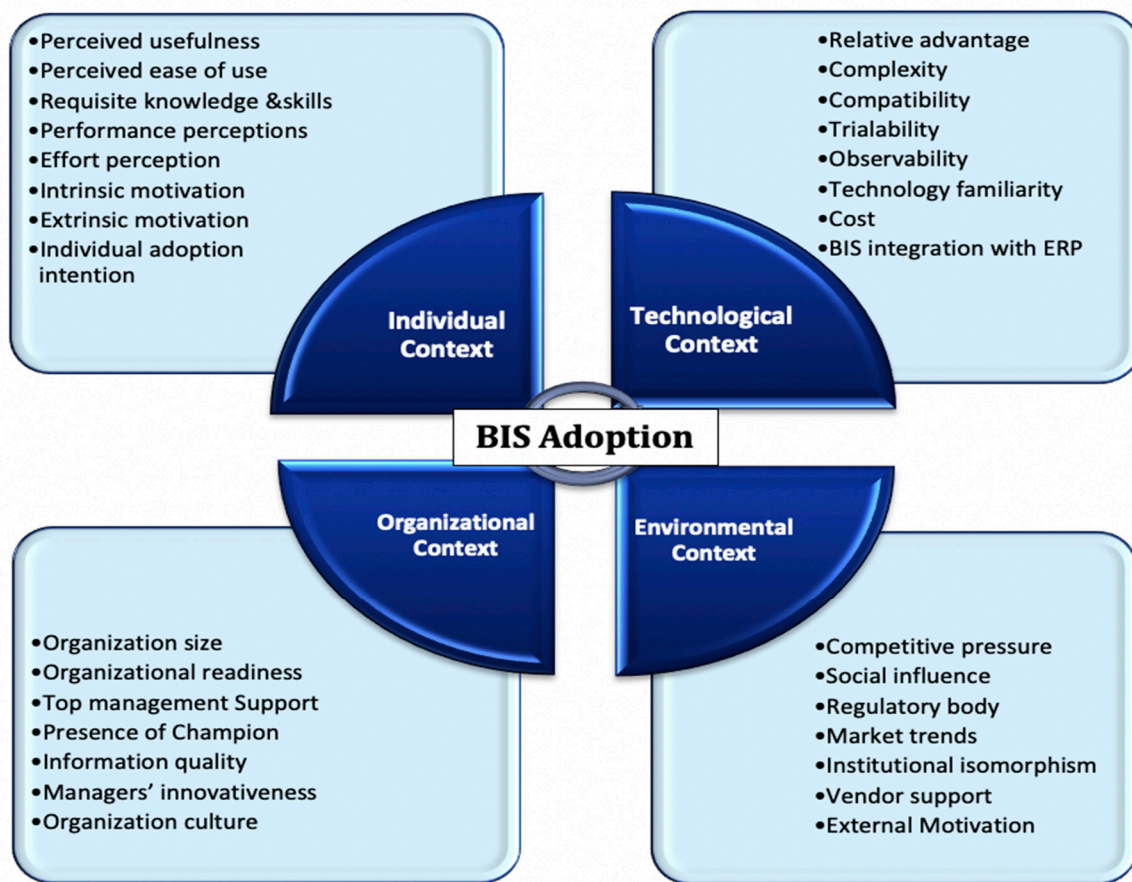


Figure 8. A conceptual model and theoretical framework for BIS adoption.

5. Theoretical Implications

The development of BIS theoretical framework is intended to provide a precise description of potential determinants and clear prediction about the successful adoption of BIS in organizations. It may influence the decisions of practitioners before integrating and adopting the BIS in their enterprises. The proposed framework would also contribute significantly in the development of theory for the BIS acceptance/adoption at same time that is almost non-existent in the existing literature. There have been a handful of developed models and theories proposed for the BIS adoption at organizational level as well as for the BIS acceptance at individual level considering two different categories. This is the first theoretical framework that has integrated the construct for acceptance at individual's level as well as technological, organizational and environmental constructs with the intention to adopt the BIS at firm level. All contexts have been widely addressed and investigated independently in the literature, but limited researchers have touched the importance of user acceptance to complete the BIS adoption at firm level. First, even though BIS adopts at an organizational level, user's acceptance cannot be taken out of the framework. Users' acceptance is critical for the optimal success of BIS [3,25,50]. By focusing on this important point, identification of users' acceptance determinants for the BIS adoption is crucial and must be considered carefully prior to the BIS implementation. This framework contributes to the knowledge about BIS research which leads the practitioners to understand the users' significance for successful adoption of BIS. Second, the conceptual model and theoretical framework will not only contribute to the body of knowledge in the BIS field but also open the new horizons of research. Further, existing models or theories can be extended or refined by the proposed conceptual model. Industry experts can gain optimal results to identify the users, technology, organization and environment-related determinants and it will greatly contribute to the success of BIS projects.

6. Practical Implications

The current article is based on a systematic literature review of selected studies from industry and academic journals. First, the findings presented a list of most potential determinants with the frequency of use in prior studies. However, determinants were utilized in different contexts of each sector for the BIS adoption and acceptance in organizations, but same determinants might lose their significance in other business scenarios. Thus, selection of determinants according to the business and industry requirement is crucial for attaining the better results from BIS projects. Second, the findings of the current study show that the BIS enhances the business value majorly in banking and SME sectors and generally in other industries such as health-care sector, telecommunication, insurance companies, academic, supply chain, and retail chain companies etc. For instance, telecommunication and financial companies' chief concerns are better marketing strategies and promotions with prediction of cost and revenues; they can use the relative advantage and management support. Competitive pressure and regulatory body determinants are main concerns for retail, supply chain, and manufacturing companies. This review would contribute greatly to decision-making processes before the BIS integration in companies. Particularly, this study empowers the industry experts and policy-makers to attain a deeper understanding of the determinants with different dimensions for the successful BIS adoption. Various determinants are highlighted here; can attract managerial attention such as management support, manager's innovativeness/ awareness and managers involvement. To follow these study findings, managers need to consider the crucial measures that lead to the successful adoption of BIS in firms. Organizations can also be aware of the critical threats and risks associated with the BIS adoption in terms of environmental determinants. This study can guide the BI vendors and cloud service providers to pay attention in solving the compatibility, cost, and complexity issues especially for medium to small organizations in developing countries for the BIS investments. According to the findings, firms would consider the organization readiness, perceived usefulness, and compatibility determinants before the BIS integration and refrain from the BI projects' failure.

7. Research Limitations and Future Research Guidelines

The study results have various limitations. First, the determinants are investigated initially from theoretical context greatly due to the nature of the published studies. The determinants are extracted from those identified studies which were conducted for SME, multiple companies, academic, healthcare, telecommunication, supply chain, retail and banking sectors. There might be different determinants for different industries that influence the firms' decisions to the BIS adoption in different contexts. Second, the current study presents a general theoretical framework that comprises the most frequently used theories, and models. There might be different theories and different frameworks that can greatly affect the particular business or industry for the BIS adoption. Third, the main objective of this review was to explore the significant determinants which can influence the organizations' intention to adopt the BIS conceptually. The analysis was performed on previously collected quantitative and qualitative studies results from theoretical context. Most of the studies were survey-based. There is a lack of case studies that are required to prove the current study findings more applicable in a practical way. In order to extend the current study results further, practical implementations are required by practitioners and industry experts. Fourth, biases could not be avoided in content analysis because of human interference in forced-set coding rules, the ambiguity of word meanings and textual analysis process, although, maximum efforts are made to make sure the results are more objective and minimize the biases. Therefore, the findings might reflect common phenomena from a theoretical perspective. Only 13.8% studies addressed the individual level acceptance of BIS. Researchers should consider and propose individual level theories and models such as motivation theory, social cognitive theory, stakeholder theory, and decision theory for the BIS adoption. RBV, Dynamic Capability View, and critical success factors (CSF) theories should also be considered before the adoption decision of BIS in organizations. These proposed theories will be helpful in identifying the important resources and capabilities that configure to build competitive advantage and will contribute to the success

of BIS projects [99]. Lastly, this study has investigated the determinants comprehensively with theoretical lenses that were most influential for the BIS research area. However, it did not provide any relationship among determinants and their specific effect on success outcomes, such as the efficiency and effectiveness of the decision-making process. Further, research could employ a meta-analysis to extend the knowledge in this field.

8. Conclusions

A systematic literature review was conducted to explore the most potential determinants and theories that influence the BIS adoption and acceptance in organizations. A total of 84 studies were identified which have been published in the recent decade (2011–2020). Many researchers believed that BIS adoption and BIS acceptance words are used in the same context but results of the current review study contradict this perception by exploring the application of different theories and determinants which were used for each category independently. For example, DOI, TOE, and institutional theory have been used for the BIS adoption at firm level and UTAUT, TPB, and TAM theories and models mostly used for the BIS acceptance at individual level in literature. A total of 93 determinants are identified after the analysis of the results. The determinants have categorized into four contexts, individual, technological, organizational, and environmental. Organization size, cost, relative advantage, complexity, compatibility, top management support, organizational readiness, and competitive pressure are ranked high among all the BIS adoption determinants at firm level and perceived usefulness and perceived ease of use are ranked high for the BIS acceptance at individual level in firms. In addition, TOE and TAM are the most deployed frameworks/models in review studies with frequent integration of UTAUT, DOI, TPB, and institutional theories. Furthermore, the results related to the applied research approaches show that quantitative methods remained the most adopted research approach as compared to qualitative and mixed methods research approaches. Additionally, the identified studies were distributed in accordance with different sectors/industries such as banks, SME, multiple organizations, communication, healthcare, insurance, electronic companies, supply chain, retail chain and academic administration sectors. It is also observed by the results that most of the BIS research with the current study subject was conducted for Banks, SME and multiple companies in developed countries, especially in the USA. Therefore, researchers should also pay attention to the developing countries from the perspective of BIS adoption. Finally, it is recommended that further studies are required to conduct in regard to determinants identification that might influence the BIS projects by applying some other models and theories including refining the existing theories and models such as TAM, TOE, DOI, UTAUT, TPB, and institutional theory. It is also noticed that there is ample space to verify and validate the proposed theoretical framework and conceptual model with quantitative, qualitative, and mix method research approaches and come out with more refined models in the future.

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