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Tracing the Clouds. A research taxonomy of cloud-ERP in SMEs

Siarhei Yasiukovich
Kristiania University College, yassia18@student.kristiania.no

Moutaz Haddara
Kristiania University College, moutaz.haddara@westerdals.no

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A research taxonomy of cloud-ERP in SMEs

Siarhei Yasiukovich
Kristiania University College
siarhei.yasiukovich@gmail.com

Moutaz Haddara
Kristiania University College
moutaz.haddara@kristiania.no

Abstract. Cloud computing is an enabler and accelerator of digital transformation, which has brought many advantages that only large companies had before for any start-up and small firm could benefit. Cloud-based computing in the form of SaaS (Software as a Service) has given rise to a revolutionary new way of delivering software applications via the Internet on a pay-per-use basis. Cloud-ERP (Enterprise Resource Planning) solutions have become more affordable, easier to implement, simpler to maintain, and thus especially suitable for small and medium-sized enterprises (SMEs), which have limited resources and may not be willing to invest in on-premise solutions. Employing this technology empowers integrated management of business processes and has the potential to add technical and strategic business value for small businesses. Given the claimed significance of SMEs in a structure of the world economy, we embarked on a detailed study of the existing published literature to determine the status quo of research on cloud-ERP technology in SMEs and how it has evolved in terms of quantity, content, and publication outlets. This is achieved by systematically reviewing 74 articles from 43 journals and 22 conferences published between 1 January 2010 and 30 June 2019. Using the ERP life-cycle-based framework by Esteves and Pastor (1999), articles are classified according to six life-cycle phases: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement. The findings, derived from a meta-analysis, illustrate that while current literature and studies related to the adoption decision phase are very rich, research on other phases of the ERP life cycle lacks strong empirical validation, due to a limited amount of publications. This study presents a comprehensive, structured literature review on cloud-based ERP adoption among SMEs and provides both academics

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and practitioners with a holistic view of the state of the current body of knowledge on the topic along with an understanding of how cloud-ERP in SMEs research is evolving.

Key words: Cloud Computing (CC), Enterprise Resource Planning (ERP), Small and Medium Enterprises (SME), Systematic Literature Review (SLR)

1 Introduction

Both entrepreneurship development and small and medium-sized enterprises (SMEs) comprise the economic backbone across multiple regions of the world, wherein the SME sector plays an important role in generating national wealth by contributing substantially to exports development, gross domestic product (GDP) growth, employment generation, and poverty alleviation (Agyapong 2010; Ayyagari, Demirguc-Kunt, and Maksimovic 2011; Oke, Burke, and Myers 2007). According to a global research report, "Growing the Global Economy through SMEs", commissioned by the Edinburgh Group, SMEs constitute a dominant position in the global business arena. They represent more than 95% of all firms across the world, remain an important source of job creation, accounting for approximately 70% of global employment, and contribute about 50% of value-added on average. Small and medium-sized entrepreneurial firms represent a key segment in a structure of the world economy, but even so, the value-added contribution made by SMEs can vary broadly across countries and regions (Bouri et al. 2011). Global research from the International Trade Centre (ITC), the multilateral agency of the World Trade Organisation (WTO) and the United Nations (UN), underline the fact that SMEs tend to have lower firm-level productivity than that of larger enterprises. This gap in productivity tends to be far wider in emerging economies, exacerbating income and social inequality. Inclusive and sustainable economic growth will require start-ups and SMEs to close this gap and redefine productivity in the value chain. However, in tomorrow's dynamic business environment, this will depend to a large extent on the ability of SMEs to pursue a digital transformation strategy and adopt innovations which could enable integrated management of all key business processes. To unlock value in the long-term, SMEs need to consider ERP technologies that can induce the desired boost to their business models in order to become more competitive, efficient, and productive (Zadeh, Akinyemi, Jeyaraj, and Zolbanin 2018). Nevertheless, because of the high direct and indirect costs associated with the selection and implementation process (Haddara 2011), an ERP deployment is a major and risky endeavour (Al-Johani and Youssef 2013). It is for this reason that the traditionally locally hosted ERPs, often so-called on-premise, are more common in large organisations (Gupta, Misra, Singh, Kumar, and Kumar 2017). Although on-premise solutions are

more common in larger enterprise businesses, cloud-based ERP systems are best suited for start-ups and smaller firms, mainly due to lower up-front costs, speed of implementation, flexibility, and scalability (Zadeh et al. 2018). Cloud computing, as an emerging computing paradigm, appears to be a promising future environment for ERPs as it provides extensive benefits and facilities to SMEs (Al-Johani and Youssef 2013; Attaran and Woods 2019; Ross and Blumenstein 2015) that only large companies attained before. Several prior studies demonstrated that SMEs, and small firms in particular, can best exploit cloud-based ERPs since many of the benefits they bring are more relevant for them (AL-Shboul 2018; Johansson, Alajbegovic, Alexopoulo, and Desalermos 2015). The cloud computing trend is gradually transforming the way information system services are developed, scaled, maintained, delivered, and paid for (Alshamaila, Papagiannidis and Li 2012). As noted by Leimeister, Böhm, Riedl and Krcmar (2010), several researchers refer to cloud computing as a new IT paradigm and revolutionary concept in which ERP systems are now offered on the cloud under the SaaS (Software as a Service) model, in which resources are provided on an as-needed and when-needed basis (Seethamraju 2015). For SMEs, moving the core enterprise application to the cloud is considered the best opportunity to take advantage of the low initial costs, lower operational expenses, lower total cost of ownership, access to cutting-edge IT resources, higher availability, and scalability, to name just a few (Johansson et al. 2015; Sharma et al. 2010).

To survive in a highly competitive business environment, many SMEs will choose to adopt cloud solutions (Al-Isma'ili, Li, Shen, and He 2016a). This is supported by the fact that cloud computing has become one of the fastest-growing technology segments in the information technology industry. In this context, the SaaS market is projected to grow 92.3% by 2021 to total $113.1 billion, up from $58.8 billion in 2017, according to Gartner, Inc. In this regard, cloud-based ERP systems came into sight as inheritors to traditional on-premises ERP systems. Consequently, both in academia and practice, cloud computing has received growing attention in recent years. Among these studies are some literature reviews (Abdollahzadegan, Hussin, Razak, Gohary, and Amini 2013; Duan, Faker, Fesak, and Stuart 2013; Javaid 2014; Neves, Marta, Correia, and Neto 2011). Although these manuscripts provide actionable insights and create a knowledge foundation on cloud ERPs in SMEs, the focus here has primarily been limited to issues related the adoption decision stage, rather than treating the adoption of cloud ERP as a continuous multiple-stage process, including pre-implementation, implantation, and post-implementation phases.

To bridge this gap in the literature, our study aims to review cloud-ERP technology adoption as a process rather than immediate action in order to address the complex-

ity and the highly volatile nature of ERP adoption in SMEs. Hence, this paper seeks to address this challenge by adopting the ERP life-cycle methodology framework developed by Esteves and Pastor (1999) to systematically review literature according to life-cycle stages: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement. The objective of this paper is to present an updated comprehensive review to outline current lines of research in this field and provide insight into major theoretical, methodological, and empirical trends over the years. The results of this study provide a holistic landscape on cloud-ERP in SMEs research published between 1 January 2010 and 30 June 2019. The rest of this paper is structured in four additional sections. First, the research methodology is presented and illustrated in Section 2. In Section 3, we draw on a model proposed by Esteves and Pastor (1999) to reflect on the six phases of the ERP life cycle and to present our main findings derived from this study. Subsequently, discussions and research recommendations are presented in Section 4. In Section 5, we offer our conclusions and discourse on the practical research implications.

2 Research methodology

In this section, we discuss the research methodology followed and present the classification framework adopted for reviewing the literature.

2.1 Systematic literature review

The refinement and accumulation of scientific knowledge increasingly rely on the integration of previous studies and findings (King and He 2005). A review of prior, relevant literature is an essential approach to conceptualise the current state of knowledge in a particular subject area, identify major relationships or patterns, and unmask the probable research gap (Webster and Watson 2002). Following King and He (2005), the review of literature can be conducted by using several techniques. These different review techniques range from purely qualitative to moderately quantitative to pure quantitative systematic reviews with a meta-analysis component (Figure 1).

Figure 1. Literature review methods on a qualitative-quantitative continuum. Adapted from King and He (2005)

After reviewing the arguments for and against various literature synthesis methods, in this study, we increase the strength of our focus towards meta-analysis. Several motivations can justify the choice of synthesising a body of literature rigorously and quantitatively. In contrast to qualitative interpretation of the literature, meta-analysis is an efficient statistical synthesis method that provides the opportunity to view the bottom line in a research context by combining and analysing the quantitative results of many empirical studies (Glass 1976), and therefore, meta-analysis is considered a more accurate and more credible approach (King and He 2005). Meta-analysis has also been widely acknowledged as much less judgemental and less vulnerable to subjectivity than other literature review methods (King and He 2005). Also, our literature classification process was also guided by the meta-characteristic taxonomy development method (Nickerson et al. 2013). In this taxonomy development method, the researchers determine the characteristics of the objects of interest (e.g., research articles within a certain domain). The classification of the characteristics can be based on and guided by a theory or a framework (Nickerson et al. 2013). Hence, the ERP life-cycle model adopted in this research served as a basis for our taxonomy development process.

The primary focus of this study is to present a comprehensive structured literature review on cloud-based ERP adoption among SMEs in order to illustrate the current body of knowledge on the topic and aid researchers and ERP developers with future research suggestions. In this context, in order to keep up with an ever-increasing plethora of studies and view the whole picture, we believe that meta-analysis technique is of great potential and can provide credible statistical support for our literature review. To ensure an effective and systematic approach, we followed the fundamental guidelines for conducting literature reviews and delineated the contextual and temporal boundaries on our research (Webster and Watson 2002). Accordingly, as a contextual boundary, this paper considers small to medium-size enterprises as the unit of analysis. Subsequently, we use a timeline as a temporal limitation and present a systematic review of the relevant literature published from 1 January 2010 to 30 June 2019.

2.2 Data sources and search strategy

The process of querying relevant scholarly literature for this review involved searching by topic across major electronic databases. The selection of research manuscripts was conducted in two phases. As a first step, top management information systems journals (Association for Information Systems 2011) were targeted individually. Webster and Watson (2002) suggested that the major contributions are likely to be in the leading journals (basket of eight). However, to avoid bias towards certain journals and ensure

that we accumulate a relatively complete and credible census of relevant literature, we attempted to enlarge the data pool and include as many studies as possible. Consequently, a wider search was conducted in the following electronic databases such as AIS Electronic Library (AISeL), ACM Digital Library, IEEE Xplore Digital Library, ScienceDirect, Wiley Online Library, and Google Scholar. According to Levy and Ellis (2006), these databases cover an extensive list of IS leading journals and, therefore, represent a credible research field knowledge base to justify the current status of scholarly literature on cloud computing and ERP adoption among SMEs. Figure 2 represents a phased study selection process that we adopted from Dybå and Dingsøyr (2008).

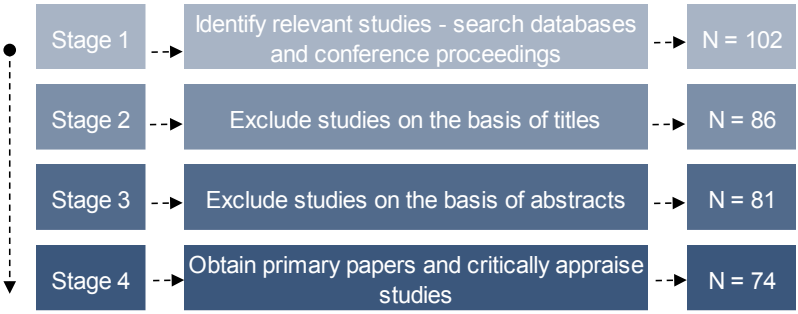

Figure 2. Stages of study selection process. Adapted from Dybå and Dingsøyr (2008)

In stage 1, to identify relevant articles, we conducted multiple full-text database searches using different sets of keywords, such as 'cloud', 'ERP', 'SME' and phrases such as 'cloud computing', 'enterprise resource planning', 'small and medium enterprises', and possible word combinations of a given concept. This search strategy resulted in 102 manuscripts. At stage 2, the initial list of research articles was subject to manual filtering based on titles. At this stage, we discarded papers not related to cloud-based solutions. For instance, since our initial search included the phrase 'Enterprise Resource Planning', the search engines returned several results related to on-premise ERP systems. Although useful for the systematic review process, the articles' titles can be quite misleading at times. In this case, the remaining 86 articles were included for further assessment in the next stage. At stage 3, further checks were conducted to exclude papers if their focus was not related small to medium businesses or if they did not report grounded theoretical points or empirical evidence. This step excluded five articles and resulted in 81 articles for further evaluation. However, at this phase of the selection process, it became evident that some of the research articles failed to fulfil important assessment criteria (Dybå and Dingsøyr 2008). The poor quality and reliability of em-

pirical evidence in some studies created a need for a final quality assessment. The final round involved verifying empirical research evidence, clear objectives, research methodologies, and justified conclusions. Following Dybå and Dingsøyr (2008), these are some of the main issues pertaining to quality that need to be considered when assessing the studies identified in the review process. It is important to note that all the steps mentioned above were conducted by both authors of this study, and the inclusion or exclusion of papers was based on consensus after discussions and arguments between the authors. In total, 74 articles were finally considered for classification and further systematic analysis.

2.3 Inclusion and exclusion criteria

To identify research articles to be considered for our study, we have applied a set of inclusion/exclusion criteria. In this manner, studies were qualified for inclusion if they embodied empirical evidence and/or grounded theoretical points on cloud computing and ERP adoption process, with regard to SMEs, in particular. Studies were excluded if their focus was not related to cloud-based solutions and if they did not report grounded theoretical points or empirical evidence. Furthermore, as our research objectives are concerned with small to medium-size businesses as the unit of analysis, studies that solely focused on large enterprises were excluded as well. The selection of papers was performed during June 2019. Hence, we consider qualitative and quantitative research studies published during the period 1 January 2010-30 June 2019. Only studies published in English were included. Dissertations, books, and working papers were omitted from this review.

2.4 Classification framework

As previously reported in the extant literature, the decision to adopt cloud technology, product selection, as well as the successful implementation of an ERP system are challenging tasks. Pre-implementation, implementation, and post-implementation phases usually comprise complex organisational transformation processes that encompass multiple stages and iterations between various stakeholders (Salim 2013). Treating the adoption of cloud ERP as a one-off dichotomous decision in a single phase can lead to erroneous adoption decisions (Salim, Sedera, Sawang, Alarifi, and Atapattu 2015). Thus, our review proposes that the adoption of cloud ERP phenomena should be treated dynamically as a continuous process with multiple phases.

Within the context of existing scholarly literature, there has been several process theory methodologies developed as support foundations for promoting risk aversion during ERP implementation projects (Kachur and Kleinsmith 2013). Despite a large number of studies on process theory approaches, there is currently no consensus expressed on what is the most fundamental and appropriate life-cycle model. Certainly, cloud ERP is still comparably new, polyhedral phenomenon, and hence, classification schemes are obscure and challenging. To keep accord with previous literature reviews within the ERP in SMEs domain (e.g., Haddara and Zach 2011), the ERP life-cycle-based framework developed by Esteves and Pastor (1999) was adopted for this research (Figure 3). The phases of the ERP life cycle represent a sequence of stages in the life of an ERP system project within an organisation. The six phases which an ERP system cycles through during its lifespan are adoption decision, acquisition, implementation, use and maintenance, evolution and retirement. The proposed framework provides a more granular yet generic environment for allocation of research issues according to all phases of the entire ERP life cycle without providing a partial picture of the ERP system adoption that evacuates the role of time and relevance of process thinking (Langley 2007). Furthermore, this framework is helpful in understanding the origins and impacts of temporal change and thus provides a foundation for systematic analysis and synthesis of research issues in cloud-based ERP systems in SMEs.

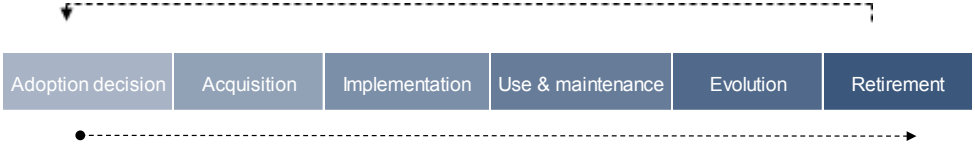

Figure 3. ERP life-cycle model. Adapted from Esteves and Pastor (1999)

Because of the rapid development of the technology and proliferation of cloud services, the traditional ERP life-cycle process needs to be revalidated to ensure that the old process theory approaches for ERP implementation lifecycles are still relevant and valid. In this context, Kachur and Kleinsmith (2013) argue that conventional process theory methodologies are still valid given the movement to cloud, as without a structured approach, enterprises will not be able to mitigate the risk during the implementation process. Demi and Haddara (2018) further acknowledge that cloud ERP systems may generally have longer life-cycle timeframes in comparison to on-premise ERP but may have a shorter retirement phase than their predecessors.

The first step in the classification process comprised a thorough reading of the selected publications by both authors. Subsequently, an open coding approach was applied to classify the phenomenon under consideration and reveal major research themes

according to their research focus and ERP life-cycle phases. In addition, the findings from reviewing 74 publications were mapped into a concept matrix (Webster and Watson 2002) and presented in the light of the following dimensions: year of publication, publication outlets, theories and frameworks, research approach, research method, time orientation, geographical distribution, market sector, and industry focus. It is important to note that an article could contain the research issues related to more than one phase and theme, and hence may fall under several phases or themes in the findings of this study.

3 Findings

This section reports the findings of our review based on the methodology and classification framework introduced in Section 2.

3.1 Research themes

The first part of Section 1 notes the major research themes in the reviewed publications in terms of their research focus and their appurtenance with a particular ERP life-cycle phase proposed by Esteves and Pastor (1999), as shown in Figure 4.

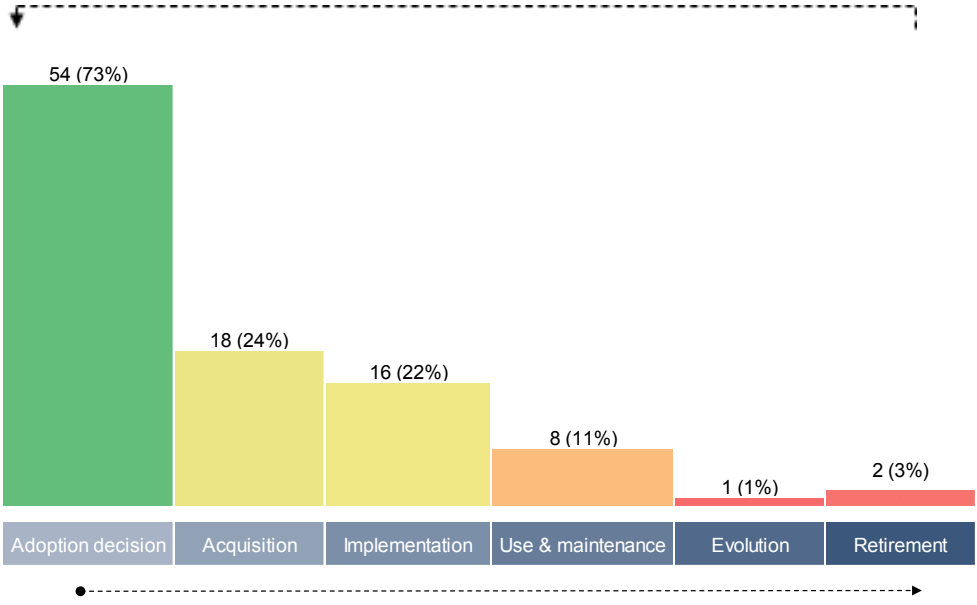

Figure 4. Number of articles (final set of papers) per ERP life-cycle phase

Adoption decision phase

This phase is the first stage of the ERP system life cycle and comprises a set of activities to determine system requirements, evaluate its benefits, and question the need for a new ERP system.

Several studies conducted a scoping review to assess and depict the factors that should be considered by SMEs when evaluating the strategic decision to adopt cloud computing technology (Javaid 2014; Mahara 2013b; Neves, Marta, Correia, and Neto 2011). These authors investigate opportunities and threats due to political, economic, social, and technological forces by using PEST analysis. Although useful in the adoption decision phase, PEST methodology addresses only external macro-environmental factors and their influence on the adoption decision, not taking into account the role of internal drivers. Research by Bhat (2013) discussed the adoption of cloud computing by Indian SMEs according to the institutional factors perspective, where the author has adopted Transaction Cost Economics (TCE) theory to identify institutional factors (laws and regulations) which may encourage cloud adoption by SMEs. Drawing upon aspects of the Diffusion of Innovation (DOI) theory and Technological, Organisational and Environmental (TOE) framework as a theoretical lens, several studies (e.g., Albar and Hoque 2015; Alshamaila et al. 2013; Amini and Bakri 2015; Salum and Rozan 2017) proposed a research model to increase understanding of why some SMEs choose to adopt cloud computing services, while others with similar conditions do not. Research by Amini and Bakri (2015) revealed the main contextual factors that were identified as playing a significant role in the adoption of cloud services by SMEs in Malaysia were: relative advantage, compatibility, security concerns, cost savings, technology readiness, top management support, competitive pressure, and regulatory support. Likewise, a qualitative exploratory study (Alshamaila et al. 2013) conducted in the northeast of England aimed to investigate the key drivers which influence decision-making on the adoption of cloud computing technologies in SMEs. The results of semi-structured interviews in 15 different SMEs and service providers suggested that the dimensions of the TOE framework are interrelated to each other and significantly influence the adoption decision-making process. The main drivers that were identified as playing a vital role on the adaption decision included clear understanding of the relative advantages of cloud services, data confidentiality and trusting service provider, the level of compatibility and complexity using cloud services, the trialability before implementation, the size of the organisation, top management commitment and support, prior IT experience, industry- and sector-specific compliance, the scope of the market, and supplier computing support. Furthermore, a study conducted in Penang, Malaysia (Qian, Baharudin, and Anaan-Jebna 2016) argues that competitive

pressure is not a significant determinant of the SMEs' intention to adopt cloud-based ERP systems in both manufacturing and service sectors. Also, the results of the study indicated that the top management commitment and support factor significantly and positively correlates with the adoption evaluation. Similarly, some other studies (Alshamaila et al. 2013; Seethamraju 2015) did not find enough evidence that competitive pressure was a significant determinant of cloud computing adoption in SMEs. On the contrary, a study by Makena (2013) related to SMEs in Kenya and a study by Amini and Bakri (2015) in Malaysia suggested competitive and trading partner pressure to be a significant factor in the adoption decision process. Morgan and Conboy (2013) revealed that factors impacting cloud adoption tend to be psychological as well, where they further reported ICT managers' concerns around digital transformation. Based on theoretical models and qualitative interviews among German companies, the study by Stieninger and Nedbal (2014) proposed a valence model of influencing factors which sheds light on the differing relevance of individual, organisational, technical, and environmental factors in both positive and negative directions. Several papers (Neves et al. 2011; Purohit, Jaiswal, and Pandey 2012; Vidhyalakshmi and Kumar 2016; Zadeh et al. 2018) emphasised the essence of tangible and intangible benefits for SMEs such as operational efficiency, availability, faster deployment, flexible cost structure, and scalability which are particularly important when considering their transition to cloud technologies. Likewise, another research (Duan et al. 2013) depicted and classified the benefits and drawbacks that cloud-based ERP systems can bring in comparison to traditional on-premises ERP systems. This study identified that positive factors influencing the adoption decision, such as lower upfront investment, lower total cost of ownership, access to modern technology and advanced computing resources, ability to ramp up and scale down resources, and a rapid implementation process remain more germane to SMEs than large enterprises (LEs). According to another study conducted in India (Sharma et al. 2010), SaaS ERP systems are less resource-intensive for its acquisition and maintenance and provide lower per-user annual cost than traditional, on-premise ERP systems. Moreover, the findings of this research reveal that traditional ERP systems imply a higher level of difficulty in terms of adaptability than the cloud-based ERP. Other researchers (Johansson et al. 2015) explored the role of organisational size in cloud ERP adoption. It was reported in the literature that it is SMEs that are most well-suited to benefit from a cloud ERP implementation. Ross and Blumenstein (2015) have noted cloud-based technology's impact on SME strategies and further suggested that reduced opportunity costs and scalability were of particular benefit for SMEs by allowing them to compete better with LEs in terms of access to ICT resources. The purpose of another study was to identify the barriers which prevent managers of some SME

sectors in Poland from implementing cloud computing solutions. In this study, Jelonek and Wysłocka (2014) argued that the vast majority of Polish SME managers evaluate the decision to implement cloud computing as highly risky, especially in the context of losing full control over information resources. The analysis of the survey results showed a lack of knowledge and lack of trust are the most serious barriers, as well as privacy and data protection. Likewise, another study in the Czech Republic (Marešová and **Hálek** 2014) confirmed that the greatest obstacle is the lack of awareness of cloud benefits. Furthermore, a multiple-case study of SMEs in Baltic countries (Kreslins, Novik and Vasiljeva 2018) illustrated organisational and environmental contexts which contain significant impediments for the adoption of cloud computing in that region. Likewise, findings from an exploratory study into cloud computing adoption among Irish SMEs outlined the preparatory steps for cloud ERP adoption and depicted reasons for non-adoption (Carcary, Doherty and Conway 2014).

Acquisition phase

The second phase in the ERP system life cycle involves selecting and acquiring the package that best fits the requirements of the organisation. This phase also includes the process of implementation partner and vendor selection.

Several authors (Mahara 2013a; Sangeetha and Chandar 2015) proposed a benefit-threat framework on economic, technologic, and people perspectives that SMEs can adopt while selecting ERP in a cloud environment. The results indicated the economic perspective as the major benefit for selection of a cloud-based ERP package, whereas the major threats are the technological issues such as vendor's reliability performance, disaster recovery, and continuation of vital technology infrastructure, security planning, and interoperability. Likewise, the study by Seethamraju (2015) found that the determining factors in ERP package and vendor selection are the software vendor's reputation in the market, software fit to the business, the potential willingness of the vendor to support the customer throughout the product life cycle and the vendor's participation in co-creation of value for the customer. Another study by Gupta and Misra (2016) acknowledged the compliance standards as a factor that can play a crucial role in the selection of a cloud vendor. Similarly, a study by Nussbaumer and Liu (2013) demonstrated that factors such as cost, reliability, performance, security, flexibility, as well as support and service, have a pivotal role for cloud vendor selection. Another paper (Vidhyalakshmi and Kumar 2016) addressed the importance of financial metrics such as return on investment (ROI) and total cost ownership (TCO) before venturing into the cloud. Likewise, Bharathi and Mandal, (2015) argued that cost-related factors such

as subscription fees and implementation and maintenance costs featured among the top five critical factors, followed by service-level agreements, business continuity planning, disaster recovery, and IT resources cost, as well as data confidentiality. Another paper (Al-Isma'ili, Li, Shen, and He 2016b) presented a systematic approach to evaluating cloud computing services and developed a cloud computing decision model—using a multi-criteria decision method, PAPRIKA—to serve and support the decision-making process in Australian SMEs. The model illustrated how different alternatives among cloud-based services could be ranked. However, it was reported in the literature that the acquisition phase is not a single, one-off dichotomous activity. This phase implicates several various activities that take place at different times. In contrast to prior studies, the next paper notes the adoption decision and acquisition as an evolving process in which Salim (2013) explores 27 transition factors contributing to the adoption of cloud ERP and how these factors evolve. This research extends the understanding of technology adoption from a process perspective and suggests a conceptual framework for the adoption and selection of a cloud ERP system among SMEs.

Implementation phase

The implementation stage deals with the installation, configuration, and customisation of the ERP package to best fit the organisation's needs.

In the study of Deshmukh, Thampi and Kalamkar (2015) the authors systematically investigated parameter correlations between dependent and independent variables to test the impact of various critical success factors (CSFs) on cloud ERP implementation in Indian SMEs. The data collected from 95 SMEs revealed that training, hardware and software, project management, and top management's support factors were found to influence the successful implementation process significantly. Likewise, another empirical study (Amini, Bakri, Sadat Safavi, Javadinia and Tolooei 2014) confirmed a positive relationship between top management support and implementation success of cloud technology, where the authors emphasised the importance of top management behaviour during the implementation and post-implementation phases. This study identified the essential top management behaviours important to the successful implementation of cloud-based technology for SMEs. Moreover, a study by Gupta and Misra (2016) revealed factors influenced by cloud users and vendors. Based on responses to a questionnaire completed by 208 respondents associated with SMEs in India, this research found that people-related factors and compliance indicated a positive impact on the success of cloud ERP, whereas network and security factors failed to show a significant impact. Furthermore, some papers (Al-Johani and Youssef 2013; Zhang and Wang 2013) pro-

posed a computing model for a cloud-based ERP service system for SMEs within the Service-Oriented Architecture (SOA) framework as a means to reduce the factor of expenditure cost and implementation delays. In a subsequent study, Nussbaumer and Liu (2013) presented a systematic migration methodology to assist small businesses in migrating business processes to the cloud. The framework focuses on the analysis and eventual migration of business processes using the service-oriented paradigm. However, as Nussbaumer and Liu (2013) further acknowledge, "the suggested migration methodology does not consider the economic factors of the cloud migration. For the framework to become a fully-fledged tool that covers the whole migration life cycle, it is necessary to complement the model with economics-driven approaches that assess and evaluate the cost-effectiveness of the migration". The research issues reported in another paper (Conway, Curry and Donnellan 2014) have been investigated in the context of the IT-Capability Maturity Framework which identified a several critical IT processes and described an approach to designing maturity frameworks for each process. The following study (Al-Isma'ili et al. 2016b) argued that companies need to understand their existing business processes adequately in the course of a cloud migration. Hence, a systematic migration methodology was introduced that helped in analysing business processes, its underlying services, and data to decide whether or not a certain component is qualified for cloud migration. Likewise, another study (Hentschel, Leyh and Baumhauer 2019) proposed a cloud service selection and implementation framework that can support user companies and vendors in the implementation of cloud services.

Use and maintenance phase

The fourth stage involves continuous use of the ERP system along with regular maintenance.

In the following study (Lewandowski, Salako and Garcia-Perez 2013), the authors studied the views of early adopters of cloud-based ERP systems in the United States and Europe in order to understand the impact of such systems on SME's as well as factors that determine their success. This paper addressed the negative-impact factors such as limitation in usability, functionality, reliability, compatibility, and serviceability. Furthermore, this study revealed the need for a conceptual implementation framework of cloud ERP in SMEs which considers not only the critical success factors but also the lessons learned from project failures in order to avoid some of the most common pitfalls and provide policy recommendations for implementation and use of cloud ERP systems in SMEs. Evaluating the potential benefits of cloud computing for SMEs in Gauteng South Africa, Tshiyole and Jokonya (2016) found a significant correlation

between the independent variables such as information quality, system quality, and user satisfaction and subsequently with cloud computing success. This study revealed that information quality and system quality positively impact an individuals' user experience by increasing their level of satisfaction. Likewise, another study (Deshmukh, Thampi and Kalamkar 2015) revealed the post-implementation effect of various independent variables, such as training, hardware and software used, project management, skill of the workforce as well as top management support on quality measures for the success of ERP implementation. The following empirical research (Trigueros-Preciado, Pérez-González and Solana-González 2013) on 94 industrial SMEs located in the northern region of Spain explored and depicted the key barriers for adoption of cloud computing in industrial SMEs. The authors identified the low degree of knowledge about cloud computing technology as well as information security as the two most important barriers. However, in the confirmatory phase of the study, they concluded that with the usage of cloud computing technology, privacy and security concerns have decreased across selected sample SMEs. Moreover, a study in Indian SMEs (Kanchana and Sri 2018) identified several advantages and benefits of cloud ERP, such as improved customer service, improved productivity, improved internal communication, and reduced operational costs. Dillon and Vossen (2014) reported on the results of a longitudinal study comparing how cloud computing attitudes and practices had changed over the past three years in Germany and New Zealand.

Evolution phase

This phase corresponds to general system updates and extended applications integrated into the original ERP system to obtain additional benefits. Such an extension can, for example, be business intelligence (BI), supply-chain management (SCM), or customer relationship management (CRM) modules.

The one article we were able to find is an attempt to contribute to an area which is currently under-researched in the existing literature. Through the established ERP life-cycle framework developed by Esteves and Pastor (1999), Bjelland and Haddara (2018) investigated the process of system updates in a cloud ERP context with a focus on the evolution phase of the ERP life cycle in the light of four related dimensions: change management, process, people, and product. This research presents a multiple case study conducted in Norway using data collected through in-depth interviews with 10 Norwegian clients/users of one ERP vendor. The study found that the vendor and the users view the process of system updates differently. Meanwhile, findings revealed issues related to the frequency of updates, while the main challenges reported from the

users' perspective were the size and date of the updates, lack of information during the process, and extinction of certain functionalities.

Retirement phase

Eventually, the value-adding to the business will start to shrink, and this is what is known as the retirement stage. This phase corresponds to discontinuing or switching the current ERP system.

Using the ERP life-cycle framework by Esteves and Pastor (1999) as the basis of their discussion, Demi and Haddara (2018) focus on how ERP in the cloud may potentially affect the ERP life cycle and the retirement phase in particular. This was performed by exploring the phenomenon within its real-life context using data collected from ERP and sales consultants at a cloud-based vendor in Norway through semi-structured, in-depth qualitative interviews. This study has proved that the ERP life-cycle framework proposed by Esteves and Pastor is still relevant and valid. Further, the authors acknowledged that ERPs in the cloud may have a shorter ERP retirement phase in contrast to ERPs on-premise but still longer life-cycle timeframes in general. By adopting the questionnaire survey and secondary data, the aim of another study by Huang (2018) was to explore several important issues in the retirement stage of the ERP life cycle, such as status before and after the ERP switching/reversion, business objectives and requirements, the specific process of implementation, and the information regarding previous and current ERP vendor/system. Based on the process model of Rasmussen's Cognitive Control of Decision Processes and the survey results, this study proposed a descriptive model with a rational process that provides a robust, practical method for making decisions related to ERP switching/reversion in the retirement stage.

3.2 Publications per year

The production of the publications in the studied period 1 January 2010-30 June 2019 is presented in Table 1 and Figure 5. The years 2010 and 2011 recorded equally one article in each year, while in the year 2012, we were able to identify only three articles. In 2013, there was a peak and the figure of 14 publications was achieved, representing 19% of the total articles published in the revised period.

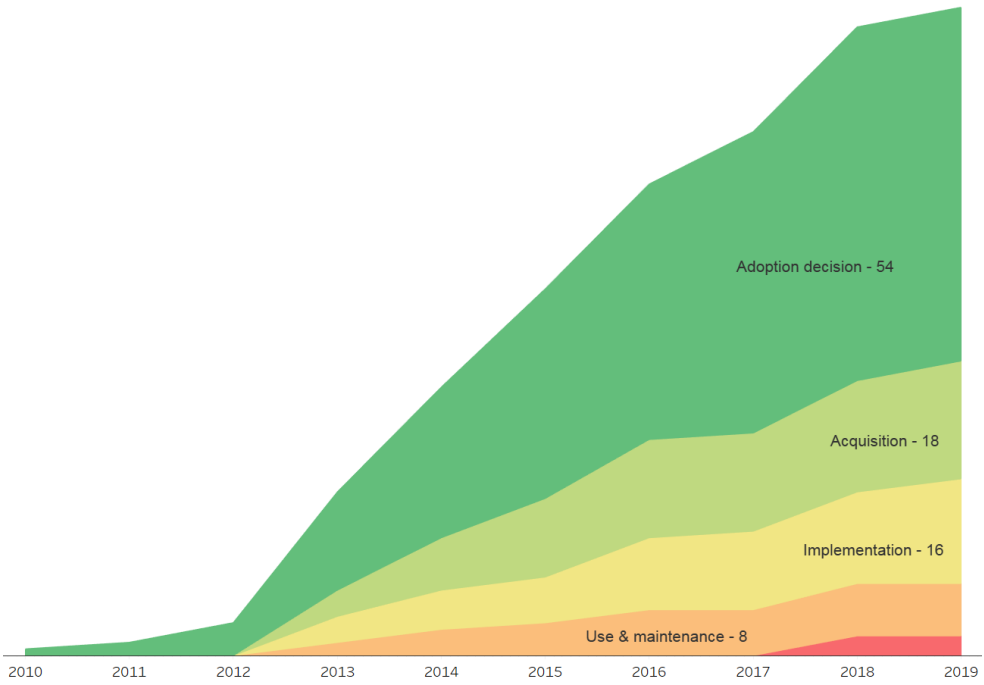

Figure 5. Cumulated number of articles per year of publication and ERP life-cycle phase

The year 2014 saw nine articles published, followed by 2015 with ten articles, then 2016 with 13 articles, and 2017 with eight articles. The year 2018 recorded 13 articles. It is important to mention that the two manuscripts published in 2019 do not represent the full year.

3.3 Publication outlets

The complete overview of publication outlets in which the manuscripts were published is presented in Table 2. The outlet types are categorised as journal articles and conference papers. The main body of the research literature (47 papers, 64%) originates from 44 journals. The remaining 27 papers (36%) are conference proceeding from 22 conferences.

Year of publication	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
2010	1 (1%)	1	0	0	0	0	0
2011	1 (1%)	1	0	0	0	0	0
2012	3 (4%)	3	0	0	0	0	0
2013	14 (19%)	10	4	4	2	0	0
2014	9 (12%)	8	4	2	2	0	0
2015	10 (14%)	9	4	1	1	0	0
2016	13 (18%)	7	3	4	2	0	0
2017	8 (11%)	7	0	1	0	0	0
2018	13 (18%)	8	2	2	1	1	2
2019	2 (3%)	0	1	2	0	0	0

Table 1. Frequency of reviewed articles per year of publication and ERP life-cycle phase

Publication type	*Publication name*	*Number of articles*
Journal Articles	African Journal of Information Systems (AJIS)	1
	Asian Journal of Applied Science and Technology (AJAST)	1
	Asian Journal of Management (AJM)	1
	Australasian Journal of Information Systems (AJIS)	1
	Australian Journal of Basic and Applied Sciences (AJBAS)	1
	Australian Journal of Information Systems AJIS	1
	Business Process Management Journal (BPMJ)	1
	Data in brief NLM Title Abbreviation: Data Brief.	1
	Electronic Journal Information Systems Evaluation (EJISE)	1
	Electronic Markets. The International Journal on Networked Business	1
	Human Systems Management (HSM)	1
	Indian Journal of Science and Technology (INDJST)	2
	International Journal of Automation and Logistics (IJAL)	1
	International Journal of Business Information Systems (IJBIS)	1
	International Journal of Communication Systems (IJCS)	1
	International Journal of Computer Applications Technology and Research (IJCATR)	1
	International Journal of Computer Science and Information Security (IJCSIS)	1
	International Journal of Computer Science Issues (IJCSI)	1
	International Journal of Engineering and Technology (IJET)	1
	International Journal of Engineering Research and Technology (IJERT)	1
	International Journal of Information Systems and Project Management (IJISPM)	2
	International Journal of Innovation, Management and Technology (IJIM)	1
	International Journal of Quality and Reliability Management (IJQRM)	1

Table 2. Number of articles per publication type

Journal Articles	International Journal of Web and Grid Services (IJWGS)	1
	International Journal on Cloud Computing: Services and Architecture (IJCCSA)	1
	International Journal on Information Systems and Technologies (IJIST)	1
	Journal EandM Economics and Management (E&M)	1
	Journal Information Systems Frontiers	1
	Journal of Advanced Research in Dynamical and Control Systems (JARDCS)	1
	Journal of Cases on Information Technology (JCIT)	1
	Journal of Computing	1
	Journal of Enterprise Information Management	1
	Journal of Information and Communication Technology (JICT)	1
	Journal of Information Systems Research and Research Innovation (JISRI)	1
	Journal of Innovation Management in Small and Medium Enterprises (JIMSME)	1
	Journal of International Technology and Information Management (JITIM)	1
	Journal of Organizational Change Management (JOCM)	1
	Journal of Small Business and Entrepreneurship (JSBE)	1
	Journal of Theoretical and Applied Information Technology (JATIT)	2
	Journal Technology Analysis and Strategic Management (TASM)	1
	Pacific Asia Journal of the Association for Information Systems (PAJAIS)	1
	Systems | An Open Access Journal from MDPI	1
	Transactions on Cloud Computing (TCC)	1
	World Journal of Computer Application and Technology (WJCAT)	1
		47 (64%)

Table 2. Number of articles per publication type (cont.)

Conference Papers	2012-13 course on Advanced Resource Planning W.J.H. van Groenendaal	1
	AIMS International Conference on Management (AIMS)	1
	Americas Conference on Information Systems (AMCIS)	1
	Annual Irish Academy of Management (IAM) Conference	1
	Conferência da Associação Portuguesa de Sistemas de Informação (CAPSI)	1
	European Conference on Information Systems (ECIS)	1
	European Research Center for Information Systems (ERCIS)	1
	Hawaii International Conference on System Sciences (HICSS)	4
	Institute of Electrical and Electronics Engineers (IEEE) National Conferences	1
	International Computers, Software and Applications Conference Workshops, COMPSACW)	1
	International Conference on Advances in Computing, Communication and Control (ICAC3)	1
	International Conference on Cloud Computing (ICCC)	1
	International Conference on Computational and Information Sciences (ICCIS)	1
	International Conference on e-Business Engineering (ICEBE)	1
	International Conference on Health and Social Care Information Systems and Technologies (HCist)	2
	International Conference on Information Resources Management (Conf-IRM)	1
	International Conference on Information Science and Applications (ICISA)	1

Table 2. Number of articles per publication type (cont.)

Conference Papers	International Conference on Information Systems (ICIS)	1
	International Conference on Internet and Web Applications and Services (ICIW)	1
	International Research Conference: Management Challenges in the 21st Century	1
	International Workshop on Mobile Cloud Computing systems, Management, and Security (MCSMS)	1
	Pacific Asia Conference on Information Systems (PACIS)	2
		27 (36%)

Table 2. Number of articles per publication type (cont.)

3.4 Research theories and frameworks

Table 3 shows the classification of the literature based on the theories/frameworks used and ERP life-cycle phase. The findings illustrate that Technology-Organisation-Environment Framework (TOE) framework proposed by Tornatzky and Fleischer (1990) and the Diffusion of Innovation (DOI) theory developed by Rogers (1962; 1986; 2003) remain the most popular.

Conceptual approach	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Technology-Organization-Environment Framework (TOE; Tornatzky and Fleischer 1990)	21 (28%)	21	2	0	0	0	0
Diffusion of Innovations Theory (DOI; Rogers 1962; 1986; 2003)	11 (15%)	11	1	0	0	0	0

Table 3. Frequency of reviewed articles per conceptual approach and ERP life-cycle phase

Perceived Characteristics of Innovation (PCI; Moore and Benbasat 1991)	1 (1%)	1	1	0	0	0	0
Technology Acceptance Model (TAM; Davis 1989)	2 (3%)	2	1	0	0	0	0
Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al. 2003)	1 (1%)	1	1	0	0	0	0
Fit-Viability Model (FVM; Tjan 2001)	1 (1%)	1	0	0	0	0	0
PEST/Benefit-Threat Analysis	5 (7%)	5	3	0	0	0	0
Total Cost Ownership (TCO)	4 (5%)	4	2	0	0	0	0
Return on Investnet (ROI)	1 (1%)	1	1	0	0	0	0
Transaction Cost Economics Theory (TCE; Coase 1937)	1 (1%)	1	0	0	0	0	0
Theory of Planned Behaviour (TPB; Ajzen 1991)	1 (1%)	1	1	0	0	0	0
Multi-stage Adoption Model (Ettlie 1980)	1 (1%)	1	1	0	0	0	0
Conceptual Framework for Cloud ERP Adoption-Process View Approach (Salim 2013)	1 (1%)	1	1	0	0	0	0
Conceptual Framework for Successful Selection and Implementation of Cloud ERP	4 (5%)	0	3	4	1	0	0

Table 3. Frequency of reviewed articles per conceptual approach and ERP life-cycle phase (cont.)

Potentially All Pairwise RanKings of all possible Alternatives (PAPRIKA)	1 (1%)	0	1	1	0	0	0
Service-Oriented Architecture Implementation Framework (SOAIF)	2 (3%)	0	0	2	0	0	0
IT Capability Maturity Framework (IT CMF; The Innovation Value Institute (IVI)	1 (1%)	0	0	1	0	0	0
Conceptual Framework for Cloud ERP Migration-Business Process Modelling Approach	1 (1%)	0	1	1	0	0	0
Conceptual Model for Post-Implementation ERP Success Assessment (Deshmukh et al. 2015)	1 (1%)	0	0	1	1	0	0
Delone and McLean IS Success Model (DeLone and McLean 1992; 2002; 2003)	1 (1%)	0	0	0	1	0	0
Quinn's Model of Leadership Roles (Hart and Quinn 1984; 1988; 1993)	1 (1%)	1	1	1	1	0	0
Resource Dependence Theory (RDT; Pfeffer 1978)	1 (1%)	0	0	1	0	0	0
Cognitive Control of Decision Processes (Rasmussen 1985; 1993)	1 (1%)	0	0	0	0	0	1
ERP life-cycle model Esteves and Pastor (1999)	2 (3%)	0	0	0	0	1	1
General Concepts	24 (32%)	19	3	4	4	0	0

Table 3. Frequency of reviewed articles per conceptual approach and ERP life-cycle phase (cont.)

3.5 Research approaches

Table 4 illustrates the distribution of cloud ERP in SME articles across the selected period by type of research approach and ERP life-cycle phase. Four research approaches were differentiated: quantitative, qualitative, mixed, and conceptual. As shown in Table 4, the research approach is somewhat balanced between quantitative (31 papers, 42%) and qualitative (24 papers, 32%) research methods, followed by conceptual (14 papers, 19%) and mixed approach (5 papers, 7%).

Research approach	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Quantitative	31 (42%)	23	8	7	6	0	0
Qualitative	24 (32%)	17	5	5	1	1	1
Mixed	5 (7%)	3	1	1	1	0	1
Conceptual	14 (19%)	11	4	3	0	0	0

Table 4. Frequency of reviewed articles per research approach and ERP life-cycle phase

3.6 Research methods

Four research methods were differentiated: case studies, surveys, conceptual papers, and literature reviews. Table 5 shows the assignments of the articles according to the research method and ERP life-cycle phase. It should be noted that throughout the life-cycle phases, the survey method (37 papers, 50%) has been observed more frequently in comparison to other methods, followed by case studies (19 papers 26%), conceptual studies (13 papers, 18%), and finally literature reviews (5 papers, 7%). It is interesting to note that literature reviews previously published on a topic are mainly limited to issues related to the adoption decision phase.

Research method	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Case study	19 (26%)	12	4	5	2	1	1
Survey	37 (50%)	27	10	8	6	0	1
Conceptual paper	13 (18%)	10	4	3	0	0	0
Literature review	5 (7%)	5	0	0	0	0	0

Table 5. Frequency of reviewed articles per research method and ERP life-cycle phase

3.7 Time orientation

The articles in this sub-section were classified into three categories in relation to time orientation: cross-sectional (single snapshot), cross-sectional (multiple snapshots), and longitudinal (process traces). The findings (Table 6) demonstrate that cross-sectional research design (73 papers, 99%) remains the most popular throughout the years. We were able to find only one research paper with a longitudinal research design and process orientation.

Time orientation	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Cross-sectional (single snapshot)	71 (96%)	53	18	14	6	1	2
Cross-sectional (multiple snapshots)	2 (3%)	0	0	2	1	0	0
Longitudinal (process traces)	1 (1%)	1	1	0	1	0	0

Table 6. Frequency of reviewed articles per time orientation and ERP life-cycle phase

3.8 Geographical distribution

We investigated the geographical distribution of the reviewed articles as an indicator of the research productivity of individual regions. We combine articles into geographical regions used as data sources for empirical research or as the main focus for the papers reviewed. While many countries contributed to the distribution matrix (Table 7), the geographical focus was heavily dominated by North Asia Pacific, followed by the general/not specified category. Articles in the general/not specified category are generic manuscripts that do not have a geographical characteristic. The distribution of the articles is as follows: North Asia Pacific (21 papers 29%), general/not specified (15 papers 20%), Middle East and Africa (12 papers, 16%), South Asia Pacific (11 papers, 15%), Central and Eastern Europe (7 papers, 9%), Western Europe (8 papers, 11%), and North America (4 papers, 5%).

Geographical distribution	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
General / Not Specified	15 (20%)	11	3	4	0	0	0
North Asia Pacific	21 (28%)	12	7	7	2	0	1
South Asia Pacific	11 (15%)	9	3	1	1	0	0
Middle East and Africa	12 (16%)	10	2	2	2	0	0
Central and Eastern Europe	7 (9%)	6	3	0	1	0	0
Western Europe	8 (11%)	4	1	1	3	1	1
North America	4 (5%)	3	0	1	1	0	0

Table 7. Frequency of reviewed articles per geographical distribution and ERP life-cycle phase

3.9 Market sector and industry focus

This section reviews the literature related to market sector and industry focus. As shown in Table 8, the research in cloud computing and ERP in SMEs is significantly tilted towards general studies that are not industry-focused (61 paper, 82%). Articles in the general/not specified category are generic manuscripts that do not have a sector or industry characteristic. The general/not specified category is followed by consumer cyclical (10 papers, 14%), industrials (9 papers, 12%), basic materials (1 paper, 1%), technology (1 paper, 1%), energy (1 paper, 1%), financial services (1 paper, 1%), and real estate (1 paper, 1%).

Market sector and industry	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
General / Not specified	61 (82%)	44	16	15	7	0	1
Consumer Cyclical	10 (14%)	8	2	0	0	1	1
Industrials	9 (12%)	7	1	0	1	1	1
Basic Materials	1 (1%)	1	0	0	0	0	0
Technology	1 (1%)	1	0	0	0	0	0
Energy	1 (1%)	0	0	1	0	0	0
Financial Services	1 (1%)	0	0	0	0	1	0
Real Estate	1 (1%)	0	0	0	0	1	0
Healthcare	0 (0%)	0	0	0	0	0	0
Communication Services	0 (0%)	0	0	0	0	0	0

Table 8. Frequency of reviewed articles per market sector and ERP life-cycle phase

4 Discussion and future research avenues

In this section, we present discussions of our main research findings introduced in Section 3 and provide our future research recommendations per theme.

4.1 Research themes

Adoption decision phase

As mentioned earlier, the adoption decision phase is the first stage of the ERP system life-cycle as developed by Esteves and Pastor (1999). The adoption decision phase comprises a set of activities to first determine the business requirements and question the need for adopting an ERP system to support those requirements. The research issues in the adoption decision phase have been widely studied in the period between 1 January 2010 and 30 June 2019, accumulating 54 publications, representing 74% of the total amount considered in our study (Figure 4). This is not surprising because, in most cases, this decision will have an impact on business process management and strategic management of a business enterprise. Based on the arguments in the literature regarding their lower up-front costs, rapid implementation durations, and the minimal need for skills and human resources during the adoption phases, the extant literature focused primarily on why some types of organisations should make a strategic decision to adopt cloud-based ERP technology. Also, several studies investigated the driving factors which may inhibit or encourage adoption decisions and discussed the corresponding risks and benefits of this adoption. Moreover, some studies investigated the feasibility of adopting cloud ERP systems in the public and private sectors.

Suggestions for future research. While the majority of existing research is concentrated in the area of adoption decision and illustrate perspectives from different angles, previous cross-sectional studies could still be improved by a longitudinal examination in order to understand how corresponding risks and benefits may change as SMEs progress through various growth stages. Furthermore, future work could distinguish between different categories of SME sector, namely: micro, small, and medium enterprises or businesses. Although all SMEs share common characteristics, previous studies have acknowledged the global diversity and specific attributes with regard to different categories of SMEs (e.g., Lucky and Olusegun 2012). The effect of size, manpower capacity, capital investment, and economic contributions could be examined in more detail in future studies. Likewise, bivariate comparison and level of difference between family and non-family SMEs (Kotey 2005; Smith 2008) could produce valuable research insights.

Acquisition phase

The research issues in the acquisition phase mainly embraced the selection methods and cluster of influencing factors affecting the cloud ERP package and vendor selection. This phase is considered as a critical phase, as a wrong or non-fitting ERP system selection may lead to implementation failures or project cancellations (Haddara 2018). Although we can easily acknowledge the critical importance of selection decision process during an ERP adoption, the scientific production in this area is somewhat limited. Meanwhile, the growth in the quantity and diversity of data brings a myriad of new opportunities for SMEs. The study by Elragal (2014) reveals that integration between ERP systems and big data has the potential to change the ERP life-cycle phases and its related activities. For instance, in the course of the acquisition phase, firms may potentially make use of semi-structured as well as unstructured data from social media to evaluate ERP alternatives. Thus, we recommend more research in this area.

Suggestions for future research. Future research may further investigate how predictive analytics and big data may potentially affect the ERP life-cycle, especially the acquisition phase and the process of cloud ERP package and vendor selection in SMEs. In addition, comparative studies identifying the contrast between on-premise and cloud-based ERP systems' selection process can be insightful. It is common that organizations may hire an ERP consultant to aid them in the ERP selection process during the acquisition phase. Hence, practical studies focusing on the change in consultants' role (if any) during this phase can be enlighting.

Implementation phase

Software implementation is a daunting task (Al-Johani and Youssef 2013). This phase includes business process modelling, implementation methodology selection, efficient and effective planning, systems testing, user training and the actual ERP installation. Thus, the success and failure of an ERP system can be a consequence of multiple determinants. This is why it is crucial not only know how to roll out the ERP platform but also be prepared for any issues that one may encounter along the way. While existing literature encompasses issues related to implementation success, factors which inhibit implementation, business process reengineering, as well as security issues, there is a need for further development of risk management methodologies to control technical, business, and organisational risks.

Suggestions for future research. Several studies reported security and risk management issues during ERP implementations in SMEs. However, they did not propose any

risk assessment methodology to ensure a systematic approach identifying areas of risk and proactively managing those areas in cloud ERP implementation projects. Thus, we recommend more research in this area using empirical evidence to enable both practitioners and scholars to discover the best ways to manage successful cloud-based ERP implementations in SMEs. While cloud ERP systems have a high and progressive market peneteration, our results show that ERP systems customizations in the cloud are rare (Bjelland and Haddara 2018). Thus, future research may investigate how ERP vendors will accommodate clients who require system customizations to suit their competitive business processes. Moreover, in an on-premise ERP setting, the implementation phase contains various procedures including the choice of the implementation methodology, actual installation of the system, system customization, testing, choice of the go-live strategy and others. Hence, future studies can also report on the methodological and practical difference in the transformation of this critical phase from the on-premise context to the cloud environment.

Use and maintenance phase

Only a few works in the course of the literature review were identified related to the use and maintenance phase. Thus, the number of studies is not sufficient to create a body of knowledge in the area. The existing studies in the use and maintenance phase primarily focused on limitations and factors that affect cloud-ERP usage and post-implementation benefits. According to DeLone and McLean (2003), the multidimensional and interdependent nature of IS success requires a clear definition and measurement of various success dimensions. Although various factors having an impact on the successful selection and implementation of cloud-based ERP solutions have been reported in prior studies, there is little to no empirical investigations of the multidimensional relationships among measures of ERP project success.

Suggestions for future research. Longitudinal studies that employ continuous measures to follow particular critical success factors over prolonged periods are highly recommended. These will provide empirical support on exploring the ERP project success and failure along the corresponding lifespan of a project and provide a better understanding of the multidimensional relationships between critical success factors, ERP project success dimensions, and key determinants of business success, such as profitability, operational efficiency, and competitiveness. Thus, a more systematic and theoretical analysis is required to explore the critical success factors and classify them according to the stage of implementation to investigate further their impact on implementation success and effect on business performance.

Evolution phase

This phase corresponds to general system updates and integration of additional capabilities into the ERP system, which should envisage obvious benefits for SMEs. Some of the newer extended applications of modern ERP packages, such as business intelligence (BI), supply-chain management (SCM), and customer relationship management (CRM) let the light show the way forward for everyone from executives to production managers, accountants, human resources managers, and sales and marketing professionals (Antoniadis, Tsiakiris, and Tsopogloy 2015; Chan and Chong 2013). These strategic management capabilities can transform the way businesses operate, by improving financial transparency, increasing accountability, streamlining the supply chain and operations, as well as improving a firm's business performance by integrating all resources and information in a single platform (Antoniadis, Tsiakiris, and Tsopogloy 2015). Although we can easily see how the evolution stage applies to strategic importance for SMEs, the results of this study verify a research gap, previously acknowledged by Bjelland and Haddara (2018), and reaffirm that academia has not been concerned enough about the evolution phase. Overall, the number of studies is not sufficient to create a body of knowledge in this area. We found only one publication related to the evolution stage. A closer look at the literature reveals a critical research gap and indicates the evolution stage in terms of cloud-based ERP in SMEs does exist empirically.

Suggestions for future research. While the incentives that cloud ERP systems have to offer have been widely reported in the literature, further research is required to shed light upon the role and impact of various extended components that can be embodied in cloud ERP systems, the success factors for integrating and using the extended applications, as well as to explore what new benefits SMEs can derive from their usage. Moreover, due to the unprecedented interest and evolution of data science disciplines, future research may investigate the relevance of big data and predictive analytics within the cloud ERP domain. As ERP systems are more and more exposed to big data and shifting towards predictive modelling (Babu and Sastry 2014), future work may focus on predictive capabilities of cloud ERP systems and further investigate the joint impacts of cloud ERP and big data (Gupta, Qian, Bhushan and Luo 2018) on the performance of SMEs.

Retirement phase

A highly dynamic external environment in which SMEs compete and function is constantly changing. The pace of change and technological progress is accelerating such that technological innovation becomes a primary driver for sustainability and compet-

itive advantage (Puklavec, Oliveira, and Popovič 2018) When the current ERP system no longer supports all key business processes and the value-adding activities along with internal efficiency start to shrink, there is no reason not to evaluate the adoption of new technology if the organisation has the required budgets and other resources (Haddara and Elragal 2011). Thereby, the ending stage of the ERP life cycle is gaining recognition as an important shifting period in firms' strategic planning (Huang 2018). A recent study by Demi and Haddara (2018) conforms to our findings and suggests that the phase of ERP retirement in terms of cloud-based ERP in SMEs needs further investigation. Overall, the number of studies is not sufficient to create a body of knowledge in this area. This is supported by the fact that only two papers were identified in our findings that focus on the retirement phase. Thus, in this study, we reaffirm the need for more research in this area using empirical evidence, which is so far lacking in the scientific literature.

Suggestions for future research. The current literature related to the retirement phase needs to be extended further in order to provide insights into when and how to make decisions on switching an ERP system in the last stage of its life cycle. Specifically, there is a need to provide a more empirical and systematic analysis of the underlying drivers that lead to the ERP switching/reversion, risk factors and benefits of switching to a new system, as well as other determinants of the lifespan of a cloud-based ERP solution. In addition, some major vendors currently advise their clients to move to the cloud version of their existing ERP solutions that are also offered over the cloud. This process of moving from the on-premise to the in-cloud ERP for using the same system is interesting to be investigated. And also, when an on-premise system is replaced by the exact system but in the cloud, would it be considered as the on-premise have reached the retirement phase or is it just evolving?.

4.2 Publications per year

It was observed that from the year 2010 to 2012 the production of scientific articles has the lowest growth rate, accumulating four publications and representing 5% of the total amount considered in this literature review. This situation changed dramatically in 2013 when there was a peak, and 14 publications were achieved, representing 19% of the total number of articles. In the following years, the volume of scholarly papers has declined slightly, being replaced by a semi-flat trend. Although the period between 2014 and 2019 does not indicate a higher level of production, the total figure of published articles reaches 55 (74%). This dynamic may indicate a lack of focus within the research community on this specific topic; however, there is an evident tendency to

grow (Figure 4). Given the declared significance of cloud computing benefits for SMEs, we predict more research studies are yet to be conducted in this area in the coming years, as more enterprises will be adopting cloud ERP solutions and going through various phases of the ERP life-cycle.

4.3 Publication outlets

Cloud computing and ERP are interdisciplinary and combine a broad array of disciplines in social and applied science such as computer science, information systems, human resources, management, and communication studies, to name just a few. Thus, the literature reviewed here was found in journals in these fields. While several journals and conferences contributed to the formation of a scientific discipline on cloud-based ERP in SMEs, only a few of them were responsible for more than two manuscripts. The fact that the body of research in the area of cloud computing in SMEs, while growing, is still a patchy picture, can explain the relative paucity of attention from individual journals and conferences. Nonetheless, because increasing attention is focused on the cloud services market and its further growth at a faster rate is predicted, we believe that more research is coming in the near future in other premier, top-tier journals.

4.4 Research theories and frameworks

It was observed that a relatively high number of various methodologies and frameworks were used in the studies reviewed. Out of 74 studies, only 24 articles did not employ any framework or methodology. While several theories, frameworks, and models contributed to the formation of theoretical landscapes in the reviewed studies, only two of them have until now been the most popular: the Technology-Organisation-Environment Framework (TOE) proposed by Tornatzky and Fleischer (1990) and the Diffusion of Innovation (DOI) theory developed by Rogers (1962; 1986; 2003).

Suggestions for future research. More qualitative research is needed in this area to develop new theories and further advance the process-related frameworks for cloud ERP adoption in SMEs. As presented in the findings, some papers suggest that the well-established on-premise ERP life-cycle models may require revisions and modifications when it comes to the cloud-based ERP systems. Thus, future research may redefine the ERP adoption phenomena into a new structure, implying that the life-cycle perspective encompasses all relevant phases of the ERP life cycle within the cloud ERP environment.

4.5 Research approaches and methods

Our findings indicate that research approaches identified in the extant literature were fairly balanced between quantitative and qualitative research methods.

Suggestions for future research. Taking into consideration the relative newness of the research on cloud ERP in SMEs, we call for more exploratory qualitative research that can increase the information details. Consequently, more quantitative research is needed in order to quantify the hypothesis and transform findings into usable statistics. Overall, due to research gaps and limited empirical evidence related to the acquisition, implementation, use and maintenance, evolution, and retirement phases, more theoretical and empirical research on this topic is strongly recommended. In terms of research methods, we call for more case study research that may be useful for testing how scientific theories and models apply to the real world. We call also for more evidence-based reporting on the benefits and challenges of cloud ERP system adoption and use within organisations.

4.6 Time orientation

As presented in our results, over the years, the ratio of static, cross-sectional (single snapshot) studies have not been reduced and remain the most popular research design. The downside of this approach is that it makes it difficult to see how the research phenomenon evolves over the years, as it lacks any information on timing and does not distinguish between cause and effect when exploring ERP adoptions. Only a few papers included longitudinal process traces (e.g., Dillon and Vossen 2014; Salim 2015; Huang 2018).

Suggestions for future research. Consequently, we recommend more longitudinal research on this topic to be considered with a focus on an observational analytical approach including exploring events in chronological order to be able to distinguish between cause and effect and learn from mistakes and failures.

4.7 Geographical distribution

As illustrated in this paper and verified by others (Dillon and Vossen 2014), previous empirical research on cloud ERP in SMEs has focused almost exclusively on single-country contexts. Despite several commonalities across countries and geographical areas, country-specific differences are evident. A qualitative exploratory study by Alshamaila et al. (2013) was conducted in northeast England to investigate the key drivers which influence decision-making on the adoption of cloud computing technologies in

SMEs. The results of semi-structured interviews in 15 different SMEs and service providers suggested that competitive pressure was not a significant determinant of cloud computing adoption in SMEs. On the contrary, a study by Makena (2013) related to SMEs in Kenya and a study by Amini and Bakri (2015) in Malaysia suggested competitive and trading partner pressure to be a significant factor in the adoption decision process. Meanwhile, a longitudinal study by Dillon and Vossen (2014) uncovered key differences between SMEs in New Zealand and Germany and their different perception of benefits and threats in regard to cloud ERP adoption. Furthermore, some researchers (e.g., Tshiyole and Jokonya 2016), focusing on specific geographic locations, mentioned potential limitations and gaps in methodology and questioned the reliability and validity of their findings in the context of other regions and countries. This raises the question of whether there are some differences in views around the driving factors that inhibit and encourage cloud ERP adoption in SMEs across multiple locations, countries and regions and what are the reasons.

Suggestions for future research. This paper identifies a number of shortcomings related to the geographical distribution of cloud ERP in SMEs research. Thus, future studies could consider investigating contextual and social idiosyncratic issues related to cloud ERP adoption across multiple countries in both qualitative and quantitative way. Consequently, more comparative studies could underline further knowledge gaps and pin down research directions that may be useful for practitioners and scholars towards better design and delivery of cloud-based ERP software for SMEs.

4.8 Market sector and industry focus

The nature of the market sector and particular industry characteristics may influence and, in many cases, even determine the level of IT infrastructure needed (Alshamaila et al. 2013). According to Goode and Stevens (as cited in Alshamaila et al. 2013), the business sector that a company operates is one of the factors which significantly and positively correlates with the adoption of technology. Although the key characteristics of different sectors and domains are critical for ERP vendors to understand, this paper reveals a clear deficit (Table 8) in the literature with a focus on sector and industry characteristics. Despite various articles investigated the impact of various CSFs on cloud ERP implementation, no standard industry cloud ERP implementation framework has been identified. Some studies (e.g., Stieninger and Nedbal 2014; Marešová and Hálek 2014) investigated multiple sectors and industries, which means that there was no singular focus on each industry. This is problematic because each market sector and industry has its own requirements and characteristics.

Suggestions for future research. Our study indicates a critical research gap in current literature with a focus on sector and industry characteristics. Future research could investigate further how certain sectors are adopting cloud ERP technologies by exploring individual samples and looking at the various sectors and characteristics of firms individually.

5 Conclusion

This paper reports the findings of a systematic review on cloud ERP in SMEs research published between 1 January 2010 and 30 June 2019. In particular, research on cloud ERP in SMEs has covered a wide range of important issues and topics, including factors that should be considered by SMEs when evaluating the strategic decision to adopt cloud computing technology, essence of tangible and intangible benefits for SMEs, selection methods and cluster of influencing factors affecting ERP package and vendor selection, issues related to implementation success as well as factors that affect cloud ERP usage. Consequently, in both academia and practice, cloud computing and ERP has received growing attention in recent years. However, an extensive review of the literature identified several issues and gaps in this particular subject area. It can be concluded that the majority of existing ERP and cloud literature tends to skew towards the adoption decision phase. On the other hand, issues related to the acquisition, implementation, use, and maintenance phases are rarely found in the literature. In addition, extremely few studies have been conducted to examine the evolution and retirement phases. This implies the need to go beyond the adoption decision phase and explore other phases of the ERP life cycle in the cloud environment. Researches should also consider exploring cloud-ERP adoption as a continuous process, focusing on structured lifecycle models that can encompass all phases of the ERP life cycle. Future research should outline not only the 'why' but focus on 'how' and 'when'. Moreover, this study provides an insight into what cloud ERP in SMEs future studies may focus on in terms of methodology to add more severity to this scientific area. Furthermore, studies comparing the methodological and practical differences between cloud-based and on-premise ERP systems are highly indispensable.

The obvious limitation of this study is related to the fact that it is limited to 74 articles. Furthermore, our research objectives were concerned with small to medium businesses as the unit of analysis. Perhaps the inclusion of studies that did not focus on SMEs would have yielded additional useful data. Some of the choices that we made during the classification process are debatable. However, we believe this paper outlines

the main research trends and highlights the underexplored areas that can be found useful from the practitioner's and researcher's points of view.

Overall, due to the magnitude of cloud technologies in general and numerous advantages of cloud ERP for SMEs in particular, further theoretical and empirical research on this topic is strongly recommended.

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Appendix A. Publications per year

Year of pulication	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintnance*	*Evolution*	*Rtirement*
2010	1 (1%)	Sharma, et al. (2010)					
2011	1 (1%)	Neves, Marta, Correia, and Neto (2011)					
2012	3 (4%)	Purohit, Jaiswal, and Pandey (2012); Alshamaila, Papagiannidis, and Li (2012); Li, Yu, Zhao, and Li (2012)					
2013	14 (19%)	Bhat (2013); Hedau, Malviya, and Chakraborty (2013); Trigueros-Preciado, Pérez-González, and Solana-González (2013); Salim (2013); Mahara (2013a); Mahara (2013b); Morgan and Conboy (2013); Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Makena (2013); Duan, Faker, Fesak, and Stuart (2013)	Salim (2013); Mahara (2013a); Mahara (2013b); Nussbaumer and Liu (2013)	Al-Johani and Youssef (2013); Lewandowski, Salako and Garcia-Perez (2013); Nussbaumer and Liu (2013); Zhang ad Wang (2013)	Triguer-os-Preciado, Pérez-González, and Solana-González (2013); Lewandowski, Salako and Garcia-Perez (2013)		
2014	9 (12%)	Jelonek and Wysłocka (2014); Weng and Hung (2014); Javaid (2014); Stieninger and Nedbal (2014); Carcary, Doherty, and Conway (2014); Marešová and Hálek (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Stieninger and Nedbal (2014); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Conway, Curry, and Donnellan (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Dillon and Vossen (2014)		

2015	10 (14%)	Seethamraju (2015); Sangeetha and Chandar (2015); Amini and Bakri (2015); Shetty and Kumar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); AlBar and Hoque (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Ross and Blumenstein (2015)	Seethamraju (2015); Sangeetha and Chandar (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015)	Deshmukh, Thampi, and Kalamkar (2015)	Deshmukh, Thampi, and Kalamkar (2015)		
2016	13 (18%)	Mikkonen and Khan (2016); Vidhyalakshmi and Kumar (2016); Hamburg and Bucksch (2016); Salum and Rozan (2016); Qian, Baharudin, and Anaan-Jebna (2016); Isma'ili, Li, Shen, and He (2016a); Miss, Victoria, and Tulimevava (2016)	Gupta and Misra (2016a); Vidhyalakshmi and Kumar (2016); Isma'ili, Li, Shen, and He (2016b)	Gupta and Misra (2016a); Gupta and Misra (2016b); Gupta, Misra, Singh, Kumar, and Kumar (2016); Isma'ili, Li, Shen, and He (2016b);	Tshiyole and Jokonya (2016); Assante, Castro, Hamburg, and Martin (2016)		
2017	8 (11%)	Ramasamy and Singh (2017); Kreslins, Novik, and Vasiljeva (2017); Salum and Rozan (2017); Pathan, et al. (2017); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Hassan (2017); Kumar, Samalia, and Verma (2017)		Hasheela-Mufeti and Smolander (2017)			
2018	13 (18%)	Friedrich-Baasner, Fischer, and Winkelmann (2018); Habahbeh, Fadiya, and Akkaya (2018); Fahad (2018); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Mohammed, GhaithJaafar, and Burhanuddin (2018)	Kanchana and Sri (2018); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018)	Kanchana and Sri (2018); Gupta, Misra, Kock, and Roubaud (2018)	Kanchana and Sri (2018)	Bjelland and Haddara (2018)	Huang (2018); Demi and Haddara (2018)
2019	2 (3%)		Hentschel, Leyh, and Baumhauer (2019)	Hentschel, Leyh, and Baumhauer (2019); Attaran and Woods (2019)			

Appendix B. Research theories and frameworks

Conceptual approach	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Technology-Organization-Environment Framework (TOE); Tornatzky and Fleischer 1990)	21 (28%)	Alshamaila, Papagiannidis, and Li (2012); Morgan and Conboy (2013); Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Makena (2013); Seethamraju (2015); Stieninger and Nedbal (2014); Amini and Bakri (2015); AlBar and Hoque (2015); Kreslins, Novik, and Vasiljeva (2017); Salum and Rozan (2017); Pathan, et al. (2017); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Friedrich-Baasner, Fischer, and Winkelmann (2018); Fahad (2018); Kumar, Samalia, and Verma (2017); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Qian, Baharudin, and Anaan-Jebna (2016); Isma'ili, Li, Shen, and He (2016a); Li, Yu, Zhao, and Li (2012)	Seethamraju (2015); Stieninger and Nedbal (2014)				

Diffusion of Innovations Theory (DOI; Rogers 1962; 1986; 2003)	11 (15%)	Stieninger and Nedbal (2014); Amini and Bakri (2015); AlBar and Hoque (2015); Salum and Rozan (2017); Fahad (2018); Kumar, Samalia, and Verma (2017); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Miss, Victoria, and Tulimevava (2016); Li, Yu, Zhao, and Li (2012)	Stieninger and Nedbal (2014)				
Perceived Characteristics of Innovation (PCI; Moore and Benbasat 1991)	1 (1%)	Stieninger and Nedbal (2014)	Stieninger and Nedbal (2014)				
Technology Acceptance Model (TAM; Davis 1989)	2 (3%)	Stieninger and Nedbal (2014); Kumar, Samalia, and Verma (2017)	Stieninger and Nedbal (2014)				
Unified Theory of Acceptance and Use of Technology (UTAUT; Venkatesh et al. 2003)	1 (1%)	Stieninger and Nedbal (2014)	Stieninger and Nedbal (2014)				
Fit-Viability Model (FVM; Tjan 2001)	1 (1%)	Salum and Rozan (2017)					

PEST/Benefit-Threat Analysis	5 (7%)	Mahara (2013a); Mahara (2013b); Javaid (2014); Sangeetha and Chandar (2015); Neves, Marta, Correia, and Neto (2011)	Sangeetha and Chandar (2015); Mahara (2013a); Mahara (2013b)				
Total Cost Ownership (TCO)	4 (5%)	Vidhyalakshmi and Kumar (2016); Sharma, et al. (2010); Purohit, Jaiswal, and Pandey (2012); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018)	Vidhyalakshmi and Kumar (2016); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018)				
Return on Investnet (ROI)	1 (1%)	Vidhyalakshmi and Kumar (2016)	Vidhyalakshmi and Kumar (2016)				
Transaction Cost Economics Theory (TCE; Coase 1937)	1 (1%)	Bhat (2013)					
Theory of Planned Behaviour (TPB; Ajzen 1991)	1 (1%)	Salim, Sedera, Sawang, Alarifi, and Atapattu (2015)	Salim, Sedera, Sawang, Alarifi, and Atapattu (2015)				
Multi-stage Adoption Model (Ettlie 1980)	1 (1%)	Salim, Sedera, Sawang, Alarifi, and Atapattu (2015)	Salim, Sedera, Sawang, Alarifi, and Atapattu (2015)				
Conceptual Framework for Cloud ERP Adoption-Process View Approach (Salim 2013)	1 (1%)	Salim (2013)	Salim (2013)				

Conceptual Framework for Successful Selection and Implementation of Cloud ERP	4 (5%)		Gupta and Misra (2016a); Hentschel, Leyh, and Baumhauer (2019); Kanchana and Sri (2018)	Gupta and Misra (2016a); Hentschel, Leyh, and Baumhauer (2019); Kanchana and Sri (2018); Attaran and Woods (2019)	Kanchana and Sri (2018)		
Potentially All Pair-wise RanKings of all possible Alternatives (PAPRIKA)	1 (1%)		Isma'ili, Li, Shen, and He (2016b)	Isma'ili, Li, Shen, and He (2016b)			
Service-Oriented Architecture Implementation Framework (SOAIF)	2 (3%)			Zhang ad Wang (2013); Al-Johani and Youssef (2013)			
IT Capability Maturity Framework (IT CMF; The Innovation Value Institute (IVI)	1 (1%)			Conway, Curry, and Donnellan (2014)			
Conceptual Framework for Cloud ERP Migration-Business Process Modelling Approach	1 (1%)		Nussbaumer and Liu (2013)	Nussbaumer and Liu (2013)			
Conceptual Model for Post-Implementation ERP Success Assessment (Deshmukh et al. 2015)	1 (1%)			Deshmukh, Thampi, and Kalamkar (2015)	Deshmukh, Thampi, and Kalamkar (2015)		
Delone and McLean IS Success Model (DeLone and McLean 1992; 2002, 2003)	1 (1%)				Tshiyole and Jokonya (2016)		
Quinn's Model of Leadership Roles (Hart and Quinn, 1984, 1988; 1993)	1 (1%)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014)		

Resource Dependence Theory (RDT; Pfeffer 1978)	1 (1%)			Gupta, Misra, Kock, and Roubaud (2018)			
Cognitive Control of Decision Processes (Rasmussen 1985; 1993)	1 (1%)						Huang (2018)
ERP life-cycle model Esteves and Pastor (1999)	2 (3%)					Bjelland and Haddara (2018)	Demi and Haddara (2018)
General Concepts	24 (32%)	Hedau, Malviya, and Chakraborty (2013); Trigueros-Preciado, Pérez-González, and Solana-González (2013); Jelonek and Wysłocka (2014); Weng and Hung (2014); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Marešová and Hálek (2014); Shetty and Kumar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); Bharathi and Mandal (2015); Mikkonen and Khan (2016); Ramasamy and Singh (2017); Hassan (2017); Habahbeh, Fadiya, and Akkaya (2018); Hamburg and Bucksch (2016); Salum and Rozan (2016); Ross and Blumenstein (2015); Duan, Faker, Fesak, and Stuart (2013); Mohammed, GhaithJaafar, and Burhanuddin (2018)	Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Bharathi and Mandal (2015)	Lewandowski, Salako and Garcia-Perez (2013); Gupta, Misra, Singh, Kumar, and Kumar (2016); Gupta and Misra (2016b); Hasheela-Mufeti and Smolander (2017)	Trigueros-Preciado, Pérez-González, and Solana-González (2013); Lewandowski, Salako and Garcia-Perez (2013); Dillon and Vossen (2014); Assante, Castro, Hamburg, and Martin (2016)		

Appendix C. Research approaches

Research approach	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Quantitative	31 (42%)	Li, Yu, Zhao, and Li (2012); Mahara (2013b); Makena (2013); Jelonek and Wysłocka (2014); Carcary, Doherty, and Conway (2014); Marešová and Hálek (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Amini and Bakri (2015); Shetty and Kumar (2015); AlBar and Hoque (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Pathan, et al. (2017); Hassan (2017); Habahbeh, Fadiya, and Akkaya (2018); Fahad (2018); Kumar, Samalia, and Verma (2017); Sharma, et al. (2010); Qian, Baharudin, and Anaan-Jebna (2016); AL-Shboul (2018); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Isma'ili, Li, Shen, and He (2016a)	Mahara (2013b); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Gupta and Misra (2016a); Kanchana and Sri (2018)	Deshmukh, Thampi, and Kalamkar (2015); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Gupta and Misra (2016a); Gupta and Misra (2016b); Gupta, Misra, Singh, Kumar, and Kumar (2016); Gupta, Misra, Kock, and Roubaud (2018); Kanchana and Sri (2018)	Deshmukh, Thampi, and Kalamkar (2015); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Assante, Castro, Hamburg, and Martin (2016); Kanchana and Sri (2018); Tshiyole and Jokonya (2016)		

Qualitative	24 (32%)	Alshamaila, Papagiannidis, and Li (2012); Morgan and Conboy (2013); Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Seethamraju (2015); Javaid (2014); Stieninger and Nedbal (2014); Sangeetha and Chandar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); Mikkonen and Khan (2016); Kreslins, Novik, and Vasiljeva (2017); Friedrich-Baasner, Fischer, and Winkelmann (2018); Salum and Rozan (2016); Ross and Blumenstein (2015); Duan, Faker, Fesak, and Stuart (2013); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); Neves, Marta, Correia, and Neto (2011); Miss, Victoria, and Tulimevava (2016)	Seethamraju (2015); Stieninger and Nedbal (2014); Sangeetha and Chandar (2015); Hentschel, Leyh, and Baumhauer (2019); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018)	Al-Johani and Youssef (2013); Lewandowski, Salako and Garcia-Perez (2013); Conway, Curry, and Donnellan (2014); Hentschel, Leyh, and Baumhauer (2019); Hasheela-Mufeti and Smolander (2017)	Lewandowski, Salako and Garcia-Perez (2013)	Bjelland and Haddara (2018)	Demi and Haddara (2018)
Mixed	5 (7%)	Trigueros-Preciado, Pérez-González, and Solana-González (2013); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Mohammed and Burhanuddin (2018)	Isma'ili, Li, Shen, and He (2016b)	Isma'ili, Li, Shen, and He (2016b)	Trigueros-Preciado, Pérez-González, and Solana-González (2013)		Huang (2018)
Conceptual	14 (19%)	Bhat (2013); Hedau, Malviya, and Chakraborty (2013); Salim (2013); Mahara (2013a); Weng and Hung (2014); Vidhyalakshmi and Kumar (2016); Ramasamy and Singh (2017); Salum and Rozan (2017); Hamburg and Bucksch (2016); Purohit, Jaiswal, and Pandey (2012); Mohammed, GhaithJaafar, and Burhanuddin (2018)	Salim (2013); Mahara (2013a); Vidhyalakshmi and Kumar (2016); Nussbaumer and Liu (2013)	Nussbaumer and Liu (2013); Zhang ad Wang (2013); Attaran and Woods (2019)			

Appendix D. Research methods

Research method	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Case study	19 (26%)	Alshamaila, Papagiannidis, and Li (2012); Trigueros-Preciado, Pérez-González, and Solana-González (2013); Morgan and Conboy (2013); Stieninger and Nedbal (2014); Sangeetha and Chandar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); Mikkonen and Khan (2016); Kreslins, Novik, and Vasiljeva (2017); Salum and Rozan (2016); Ross and Blumenstein (2015); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); Miss, Victoria, and Tulimevava (2016)	Stieninger and Nedbal (2014); Sangeetha and Chandar (2015); Hentschel, Leyh, and Baumhauer (2019); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018)	Al-Johani and Youssef (2013); Lewandowski, Salako and Garcia-Perez (2013); Conway, Curry, and Donnellan (2014); Hentschel, Leyh, and Baumhauer (2019); Hasheela-Mufeti and Smolander (2017)	Trigueros-Preciado, Pérez-González, and Solana-González (2013); Lewandowski, Salako and Garcia-Perez (2013)	Bjelland and Haddara (2018)	Demi and Haddara (2018)

Survey	37 (50%)	Li, Yu, Zhao, and Li (2012); Mahara (2013b); Makena (2013); Seethamraju (2015); Jelonek and Wysłocka (2014); Carcary, Doherty, and Conway (2014); Marešová and Hálek (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Amini and Bakri (2015); Shetty and Kumar (2015); AlBar and Hoque (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Pathan, et al. (2017); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Hassan (2017); Friedrich-Baasner, Fischer, and Winkelmann (2018); Habahbeh, Fadiya, and Akkaya (2018); Fahad (2018); Kumar, Samalia, and Verma (2017); Sharma, et al. (2010); Qian, Baharudin, and Anaan-Jebna (2016); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Isma'ili, Li, Shen, and He (2016a)	Mahara (2013b); Seethamraju (2015); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Gupta and Misra (2016a); Isma'ili, Li, Shen, and He (2016b); Kanchana and Sri (2018)	Deshmukh, Thampi, and Kalamkar (2015); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Gupta and Misra (2016a); Gupta and Misra (2016b); Gupta, Misra, Singh, Kumar, and Kumar (2016); Gupta, Misra, Kock, and Roubaud (2018); Isma'ili, Li, Shen, and He (2016b); Kanchana and Sri (2018)	Deshmukh, Thampi, and Kalamkar (2015); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Tshiyole and Jokonya (2016); Assante, Castro, Hamburg, and Martin (2016); Kanchana and Sri (2018)		Huang (2018)

Conceptual paper	13 (18%)	Bhat (2013); Hedau, Malviya, and Chakraborty (2013); Salim (2013); Mahara (2013a); Weng and Hung (2014); Vidhyalakshmi and Kumar (2016); Ramasamy and Singh (2017); Salum and Rozan (2017); Hamburg and Bucksch (2016); Purohit, Jaiswal, and Pandey (2012)	Mahara (2013a); Seethamraju (2015); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Gupta and Misra (2016a); Isma'ili, Li, Shen, and He (2016b); Kanchana and Sri (2018)	Nussbaumer and Liu (2013); Zhang ad Wang (2013); Attaran and Woods (2019)			
Literature review	5 (7%)	Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Javaid (2014); Duan, Faker, Fesak, and Stuart (2013); Neves, Marta, Correia, and Neto (2011); Mohammed, GhaithJaafar, and Burhanuddin (2018)					

Appendix E. Time orientation

Time orientation	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
Cross-sectional (single snapshot)	71 (96%)	Alshamaila, Papagiannidis, and Li (2012); Li, Yu, Zhao, and Li (2012); Bhat (2013); Hedau, Malviya, and Chakraborty (2013); Trigueros-Preciado, Pérez-González, and Sola-na-González (2013); Salim (2013); Mahara (2013a); Mahara (2013b); Morgan and Conboy (2013); Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Makena (2013); Seethamraju (2015); Jelonek and Wysłocka (2014); Weng and Hung (2014); Javaid (2014); Stieninger and Nedbal (2014); Carcary, Doherty, and Conway (2014);	Stieninger and Nedbal (2014); Sangeetha and Chandar (2015); Hentschel, Leyh, and Baumhauer (2019); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); Mahara (2013a); Mahara (2013b); Seethamraju (2015); Carcary, Doherty, and Conway (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015);	Conway, Curry, and Donnellan (2014); Hentschel, Leyh, and Baumhauer (2019); Hasheela-Mufeti and Smolander (2017); Deshmukh, Thampi, and Kalamkar (2015); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Gupta, Misra, Singh, Kumar, and Kumar (2016); 19)	Trigueros-Preciado, Pérez-González, and Sola-na-González (2013); Deshmukh, Thampi, and Kalamkar (2015); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Tshiyole and Jokonya (2016);	Bjelland and Haddara (2018)	Huang (2018); Demi and Haddara (2018)

Cross-sectional (single snapshot) (cont'd)		Marešová and Hálek (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Sangeetha and Chandar (2015); Amini and Bakri (2015); Shetty and Kumar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); AlBar and Hoque (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015Bharathi and Mandal (2015); Mikkonen and Khan (2016); Vidhyalakshmi and Kumar (2016); Ramasamy and Singh (2017); Kreslins, Novik, and Vasiljeva (2017); Salum and Rozan (2017); Pathan, et al. (2017); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Hassan (2017);	Bharathi and Mandal (2015); Gupta and Misra (2016a); Gupta and Misra (2016b); Isma'ili, Li, Shen, and He (2016b); Kanchana and Sri (2018); Seethamraju (2015); Carcary, Doherty, and Conway (2014); Dillon and Vossen (2014); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Bharathi and Mandal (2015); Kanchana and Sri (2018)	Gupta, Misra, Kock, and Roubaud (2018); Isma'ili, Li, Shen, and He (2016b); Gupta and Misra (2016a); Gupta and Misra (2016b); Kanchana and Sri (2018); Nussbaumer and Liu (2013); Zhang ad Wang (2013); Attaran and Woods (20	Assante, Castro, Hamburg, and Martin (2016); Kanchana and Sri (2018) Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Tshiyole and Jokonya (2016); Assante, Castro, Hamburg, and Martin (2016); Kanchana and Sri (2018)		

Cross-sectional (single snapshot) (cont'd)		Friedrich-Baasner, Fischer, and Winkelmann (2018); Habahbeh, Fadiya, and Akkaya (2018); Hamburg and Bucksch (2016); Salum and Rozan (2016); Ross and Blumenstein (2015); Duan, Faker, Fesak, and Stuart (2013); Fahad (2018); Kumar, Samalia, and Verma (2017); Sharma, et al. (2010); Purohit, Jaiswal, and Pandey (2012); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); Qian, Baharudin, and Anaan-Jebna (2016); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Neves, Marta, Correia, and Neto (2011); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Isma'ili, Li, Shen, and He (2016a); Miss, Victoria, and Tulimevava (2016); Mohammed, GhaithJaafar, and Burhanuddin (2018)					

Cross-sectional (multiple snapshots)	2 (3%)			Al-Johani and Youssef (2013); Lewandowski, Salako and Garcia-Perez (2013)	Lewandowski, Salako and Garcia-Perez (2013)		
Longitudinal (process traces)	1 (1%)	Dillon and Vossen (2014)	Dillon and Vossen (2014)		Dillon and Vossen (2014)		

Appendix F. Market sector and industry focus

Geographical distribution	*Number of articles*	*Adoption decision*	*Acquisition*	*Implementation*	*Use and maintenance*	*Evolution*	*Retirement*
General / Not Specified	15 (20%)	Salim (2013); Morgan and Conboy (2013); Abdollahzadegan, Hussin, Razak, Moshfegh Gohary, and Amini (2013); Weng and Hung (2014); Javaid (2014); Sangeetha and Chandar (2015); Johansson, Alajbegovic, Alexopoulo, and Desalermos (2015); Salum and Rozan (2017); Hamburg and Bucksch (2016); Duan, Faker, Fesak, and Stuart (2013); Neves, Marta, Correia, and Neto (2011)	Salim (2013); Sangeetha and Chandar (2015); Nussbaumer and Liu (2013)	Al-Johani and Youssef (2013); Conway, Curry, and Donnellan (2014); Nussbaumer and Liu (2013); Attaran and Woods (2019)			
North Asia Pacific	21 (28%)	Li, Yu, Zhao, and Li (2012); Bhat (2013); Hedau, Malviya, and Chakraborty (2013); Mahara (2013a); Mahara (2013b); Seethamraju (2015); Shetty and Kumar (2015); Vidhyalakshmi and Kumar (2016); Ramasamy and Singh (2017); Kumar, Samalia, and Verma (2017); Sharma, et al. (2010); Purohit, Jaiswal, and Pandey (2012)	Kanchana and Sri (2018); Zadeh, Akinyemi, Jeyaraj, and Zolbanin (2018); Vidhyalakshmi and Kumar (2016); Gupta and Misra (2016a); Seethamraju (2015); Mahara (2013a); Mahara (2013b)	Deshmukh, Thampi, and Kalamkar (2015); Gupta and Misra (2016a); Gupta and Misra (2016b); Gupta, Misra, Singh, Kumar, and Kumar (2016); Gupta, Misra, Kock, and Roubaud (2018); Zhang ad Wang (2013); Kanchana and Sri (2018)	Deshmukh, Thampi, and Kalamkar (2015); Kanchana and Sri (2018)		Huang (2018)

South Asia Pacific	11 (15%)	Amini and Bakri (2015); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Hassan, Nasir, Herry, Khairudin, and Adon (2017); Hassan (2017); Salum and Rozan (2016); Ross and Blumenstein (2015); Qian, Baharudin, and Anaan-Jebna (2016); Senarathna, Wilkin, Warren, Yeoh, and Salzman (2018); Isma'ili, Li, Shen, and He (2016a)	Dillon and Vossen (2014); Salim, Sedera, Sawang, Alarifi, and Atapattu (2015); Isma'ili, Li, Shen, and He (2016b)	Isma'ili, Li, Shen, and He (2016b)	Dillon and Vossen (2014)		
Middle East and Africa	12 (16%)	Makena (2013); Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); AlBar and Hoque (2015); Bharathi and Mandal (2015); Pathan, et al. (2017); Habahbeh, Fadiya, and Akkaya (2018); AL-Shboul (2018); Mohammed and Burhanuddin (2018); Miss, Victoria, and Tulimevava (2016); Mohammed, GhaithJaafar, and Burhanuddin (2018)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Bharathi and Mandal (2015)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Hasheela-Mufeti and Smolander (2017)	Amini, Bakri, Sadat Safavi, Javadinia, and Tolooei (2014); Tshiyole and Jokonya (2016)		
Central and Eastern Europe	7 (9%)	Jelonek and Wysłocka (2014); Stieninger and Nedbal (2014); Marešová and Hálek (2014); Dillon and Vossen (2014); Kreslins, Novik, and Vasiljeva (2017); Friedrich-Baasner, Fischer, and Winkelmann (2018)	Stieninger and Nedbal (2014); Dillon and Vossen (2014); Hentschel, Leyh, and Baumhauer (2019)		Dillon and Vossen (2014)		

Western Europe	8 (11%)	Alshamaila, Papagiannidis, and Li (2012); Triguer-os-Preciado, Pérez-González, and Solana-González (2013); Carcary, Doherty, and Conway (2014); Mikkonen and Khan (2016)	Carcary, Doherty, and Conway (2014)	Le-wandowski, Salako and Garcia-Perez (2013)	Triguer-os-Preciado, Pérez-González, and Sola-na-González (2013); Le-wandowski, Salako and Garcia-Perez (2013); As-sante, Castro, Hamburg, and Martin (2016)	Bjelland and Hadd-ara (2018)	Demi and Hadd-ara (2018)
North America	4 (5%)	Ross and Blu-menstein (2015); Fahad (2018); Zadeh, Akinyemi, Jeyaraj, and Zol-banin (2018)		Le-wandowski, Salako and Garcia-Perez (2013)	Le-wandowski, Salako and Garcia-Perez (2013)		