



## RESEARCH ARTICLE

# Bibliometric Analysis and Mapping of the Benefits and Challenges of Cloud ERP Systems

Önder Şahinaslan<sup>1</sup> , Ahmet Şahin<sup>2</sup> , Ender Şahinaslan<sup>3</sup> 

## Abstract

Enterprise resource planning is an effective tool in achieving management goals. Cloud ERP systems and applications are platform-independent offerings of this management tool in a cloud environment. This study was carried out to make sense of the advantages, difficulties and relationships of the cloud ERP system with scientific studies. For this purpose, the Scopus, Web of Science and Google Scholar databases and the Publish or Perish, WOSviewer and Excel applications were used. Statistical analysis, text mining, word network association, visual mapping and trend analysis were performed. As a result of the analysis, it was found that the total rate of publications produced in the last 3 years was 43%, the most cited work was Springer (20%) and the country was the USA (10%). It was determined that the three most frequently used keywords were 'cloud ERP', 'ERP system' and 'ERP'. A strong correlation was found between 'study' and 'challenge' in text mining. The challenge was closely related to 'SMEs', 'data', 'provider', 'technology', 'literature' and 'cloud environment'. In recent studies, the concept of 'cloud ERP implementation' in SMEs has come to the fore.

## Keywords

Cloud ERP, Information Systems, Bibliometric Analysis, Text Mining, Visual Mapping

## Introduction

Today, technological progress and developments cause radical and rapid transformations in business processes and applications (Şahinaslan and Şahinaslan, 2021). With the developments in Industry 4.0, internet of things and digital technologies, the demand for these technologies is increasing exponentially (Şahinaslan, 2020). Companies are becoming more dependent on the opportunities and innovations offered by information technologies day by day. On the other hand, the success of factors such as quality, efficiency, speed and cost in global competition is directly proportional to technological innovation and timely adaptation to opportunities. Keeping up with technology also offers the chance to react positively to change and seize opportunities. Along with the transition and transformations to current digital technologies, many traditional processes and practices applied in company management

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are evolving into radical changes and transformations. In this process of change, companies use up-to-date technological tools and practices to move from traditional management models to modern management models. Since the rapid development of technology is also reflected in information technologies, companies develop software and systems that solve their own needs in keeping up with this development and integrate them into their organizations.

Companies move forward more confidently into the future by being inspired by the historical process, constantly renewing and developing. Today, when many new businesses are established, some of the businesses are also closed. The existence and continuity of both newly opened businesses and existing businesses depends on the institutional management of the enterprises, their keeping up with the economic and social developments, and the use of information at the right time and place at the most affordable cost. Enterprise resource planning (ERP) is the general name of the system and application software developed for the effective management of the corporate processes of planning, procurement, design, production and distribution of the resources of an enterprise. With ERP, all data and information used by managers, employees, suppliers, customers, in short, all units and relevant persons who are connected with the business and deemed necessary, can be managed from a central point and automatically obtained and conveyed to the relevant places (Ari and Diri, 2019). Thus, all corporate resources and processes of the enterprise are controlled and managed through a single application. ERP application, on the one hand, contributes to the prevention of losses caused by human mistakes in enterprises, and on the other hand, it saves time and money by using the resources of the enterprises effectively and efficiently. This is an important advantage for businesses to compete globally in today's market conditions.

The concept of cloud computing refers to a new approach to the provision and use of information services (Seyrek, 2011). Cloud ERP is the general name given to running the ERP system and application on a solution provider's virtual server, not on the local business network. Today, cloud ERP solutions that serve SMEs over cloud computing infrastructures are offered. ERP solutions integrate and automate key financial and operational business processes wherever possible. It provides resources to identify assets such as people, goods, money, maintain inventory, and manage ordering, procurement, and delivery processes and performance to keep the procurement, production, and distribution processes running effectively. In an ERP system, where all these processes and resources work in an integrated manner on a corporate scale and their online performance needs to be observed, all users need easy access to this system to operate. Cloud-based ERP software and application offer a solution in meeting this need. In this structure, businesses access their software over the Internet, so all they need is an internet connection and a browser (Saritaş, T., Üner, N., 2013). Cloud ERP solutions offer the same or even more flexibility and functionality in terms of operation and cost advantages as in-house systems provided to businesses by traditional ERP software service providers. On the other hand, rapidly developing technology brings with it some weaknesses

or incompatibilities (Sahinaslan E. , 2019). In this respect, when deciding to use a new technology in a field, the opportunities, benefits and, if any, negative effects of technology should be investigated. This research can be obtained from academic studies in that field as well as experimental studies. Examining the written literature in a certain time period, analysing the topics and relationships are important for due diligence. The findings obtained from these studies also reveal how the researched subject has developed over time. Thus, it contributes to the identification of a problem or difficulty and to understanding its root causes. Bibliometric is the analysis of the relations between the studies produced by the determined people and institutions in a chosen field and period (Tabur, 2021). Examining bibliometric studies is a very effective and widely used method in order to have an idea about the subject by seeing the studies in the field as a whole (Şentürk and Fındık, 2015). Bibliometric techniques have shown a significant improvement over time and guide researchers in performing a detailed and more effective measurement (Akgün and Karataş, 2017). Bibliometric is also used in mapping and visualizing the results of analysis of relationships between academic studies in different disciplines. Web of Science and Elsevier Scopus are widely used databases in bibliometric analysis studies (Mongeon and Paul-Hus, 2016).

With up-to-date cloud technology, cloud ERP is offered as a useful solution for businesses. However, many difficulties and risk concerns complicate the transition of institutions to this technology. Revealing the opportunity, challenge and technological trend will facilitate the technological transformation of these institutions. On the other hand, although there are limited studies on the benefits and challenges of cloud ERP, no bibliometric analysis study has been found in this area. The lack of any bibliometric studies on this subject, which has become very popular especially for SMEs today, is our main motivation for starting this study. In this study, the Elsevier Scopus and Web of Science (ESCI) database and the Publish or Perish application, in which international scientific studies are indexed and comprehensive data on prestigious researches are shared, were used. Statistical and bibliometric data analysis was performed on key data related to Cloud ERP advantages and challenges. The sources identified in the study were classified in areas such as subject, author, institution, country, keyword, and citation, and statistical analyses were made. In addition, scientific field mapping, visualization and trend analysis studies were carried out using the VOSviewer application, and certain findings and results were achieved.

## Literature Review

Major studies have been carried out to reveal the advantages and challenges of Cloud ERP. Among these studies, Saini et al. listed the advantageous areas of cloud ERP as fast adaptation, scalability, advanced technology, and easy integration, while they stated security risk, functional limitations and subscription costs as disadvantages (Saini et al., 2011). Part-

hasarathy lists the advantages of cloud ERP as advanced technology, easy integration, fast adaptation, scaling, usage, while areas such as customization, data ownership, cost, IT employee competence, limited functionality are considered risky areas such as difficulty, compliance, security, and SLA (Parthasarathy, 2013). Peng and Gala list the advantageous areas of cloud ERP over ERP as fast installation and ease of updating, low cost of hardware and support, increase in system speed and performance, and ease of access from anywhere. In terms of difficulties, they list the difficulties experienced in the privacy and security of data, the problems arising from cloud providers in terms of service quality and legal compliance, insufficient management support due to the organization, internal communication, change management and business process integration difficulties (Peng et al., 2014). Albar and Hoque, in their research in Saudi Arabia, stated that cloud-based ERP systems emerged as a solution to the difficulties faced by the traditional ERP system. He stated that this new solution is more flexible and adaptable, provides financial gain, requires less upfront investment and can be implemented faster. As the difficulties arising from the cloud ERP system; security risk, integration and customization, limitations in some functions and cloud membership costs (AlBar and Hoque, 2015). Johansson et al conducted a study to identify the opportunities and concerns associated with enterprise-wide cloud ERP. They stated that SMEs and especially small companies benefit from them, most of the concerns are important for SMEs, on the other hand, they have a serious concerns because of the complex and different expectations for large organizations, and a hybrid solution for these can relieve the concerns of large organizations (Johansson et al., 2015). Scholtz and Atukwase emphasized that choosing a cloud ERP system over a traditional and familiar ERP system promises greater flexibility, better business efficiency and lower IT costs. However, he pointed out that despite these advantages, some of the companies still do not adopt cloud ERP, which is much higher in emerging markets such as Africa. He emphasized that one of the reasons for this was due to misperceptions arising from the lack of sufficient information about the benefits and difficulties of this system (Scholtz and Atukwase, 2016). Fayed et al, pointed out that artificial intelligence, block chain, IoT and sensors connected to this network produce real-time data on the source, capacity, forecast and performance of goods and materials, and classical ERP systems do not fully support such structures and innovations. It is emphasized that cloud ERP systems contribute to the strategic effort of the enterprise in terms of bringing this data together, reducing the work and satisfying the customer. According to research conducted on experienced individuals, they state that there are challenges to be overcome in artificial intelligence, machine learning, IoT and blockchain, which will have devastating effects in the near future (Fayed et al., 2020). In the study by Idoko, it was concluded that cloud ERPs have a significant impact on service quality, competitive advantage and corporate performance (Idoko, 2021).

## Material Method

This study aims to investigate the extent to which the benefits and challenges of cloud ERP, which has come to the fore with cloud computing and have become increasingly popular in recent years, have been the subject of international academic studies. For this purpose, the Scopus, Web of Science and Google Scholar databases were used over the Publish or Perish application, which are popular databases. The tools and methods used in the study, the data analysis study process stages are discussed in this section.

### Research Method and Design

In this study, the descriptive analysis method and content analysis from bibliometric quantitative research methods were used. The Publish or Perish (Harzing, 2016), Scopus (Scopus, 2021) and Web of Science (Science, 2022) databases were used as data sources. Studies obtained from these data sources as a result of certain criteria were subjected to preliminary examination and current academic studies on the subject were determined. Analysis, table, graphic and visual mapping studies were carried out using MS-Excel and VOSviewer applications. In addition, visual mapping and trend analysis in the Google Trends application were made on the key areas of the sources used in the study. The research method and design basic process steps are shown in Figure 1.



Figure 1. Study main process stage.

### Collecting of Data

The collection of data constituting the source of the study started with the use of the Publish or Perish application. However, due to the limitations or difficulties experienced in obtaining records on the Scopus and Web of Science databases, Scopus and Web of Science’s own application interfaces were used.

### Application of publish or perish

It is possible to collect the desired data from sources such as Google Scholar and Scholar Profile, Microsoft Academic, Scopus, Web of Science (WOS), PubMed, Semantic Scholar,

OpenAlex by using the Publish or Perish application of Harzing. The databases that the application can search are shown in Figure 2.

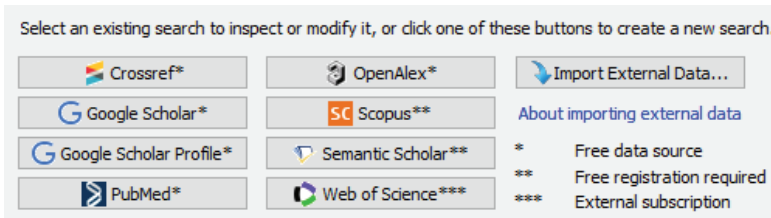


Figure 2. Application databases of Publish or Perish.

The Publish or Perish application includes a structured version of Scopus accepted parameters. A Scopus search is performed over these parameters and then analysed and converted into a set of statistics (Adams, 2017). The Publish and Perish program, which we use as a material, takes data from Google Scholar and calculates complex measures (Bensman, 2011). For searches to be made through this application, firstly, the database to be searched is selected. Then, on the screen that opens, a search is made by filling in selection parameters such as title, author, year, key field, and ISSN. It is possible to export the list obtained as a result of the search to environments such as MS Excel. This application was not preferred because prerequisites such as membership to the Scopus and Web of Science databases is required. Searches were made in the Google Scholar and PubMed databases, which are offered free of charge within the application. A screenshot of the search made in the Google Scholar database is shown in Figure 3.

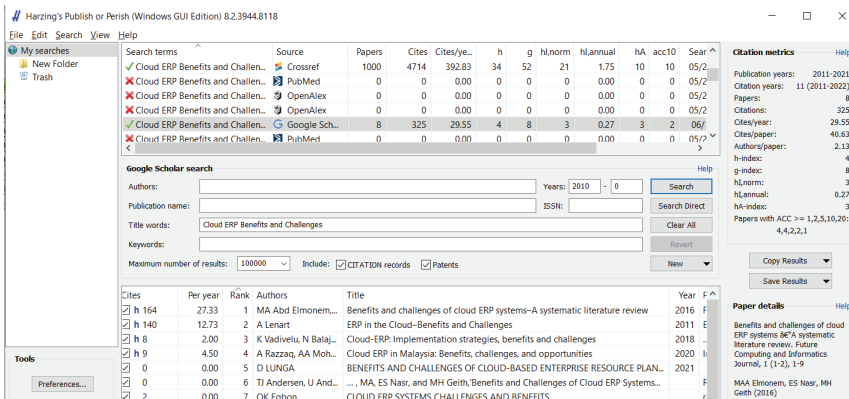


Figure 3. Search result of 'Google Scholar' on Publish or Perish.

The search term is used in the year field (2010 and later) and the title (Cloud ERP Benefits and Challenges). As a result of this search, data belonging to 8 academic studies published in English were obtained. A search of the PubMed database did not find any records. Thus, it

has been determined that a total of 8 articles obtained through the Publish or Perish application are related to cloud benefits and challenges. The data provided by the application such as the title, author, publisher, keyword, abstract, number of citations of these resources were collected in an Excel file.

## Scopus database

The Scopus bibliometric database allows the simple or advanced searching of articles in the database using various keywords. The inquiry of the research was carried out over the internet. In the advanced keyword search, the “Cloud ERP” (“Benefits” OR “Challenges”) and the “PUBYEAR > 2009” parameter are used in the “TITLE-ABS-KEY” field. The screenshot and result of the query are given in Figure 4. As a result of the query, 69 sources were obtained.

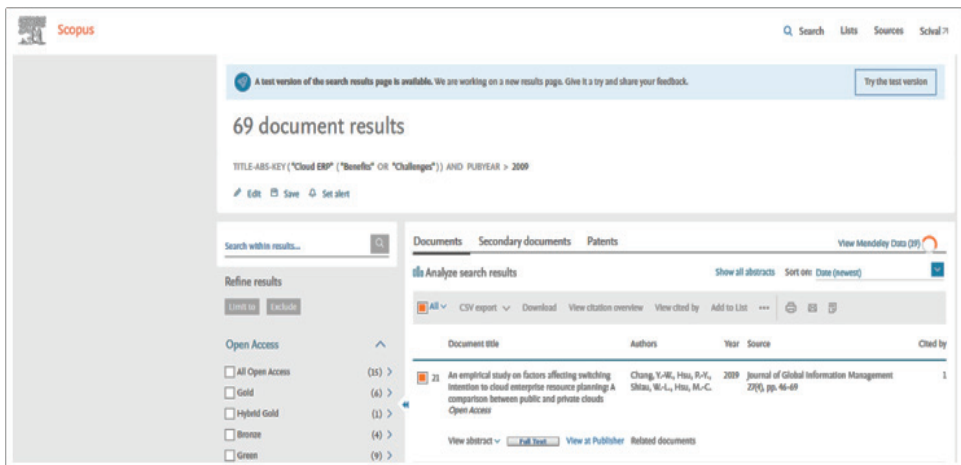


Figure 4. Screenshot of Scopus.

## Web of Science database

Searching the Web of Science database (“Cloud ERP” (“Benefits” OR “Challenges”) query was run. As a result of the query, 36 study data for 2010 and later were obtained. Certain fields were selected from the listed fields and exported to Excel. Screenshot of the query and the result is given in Figure 5.

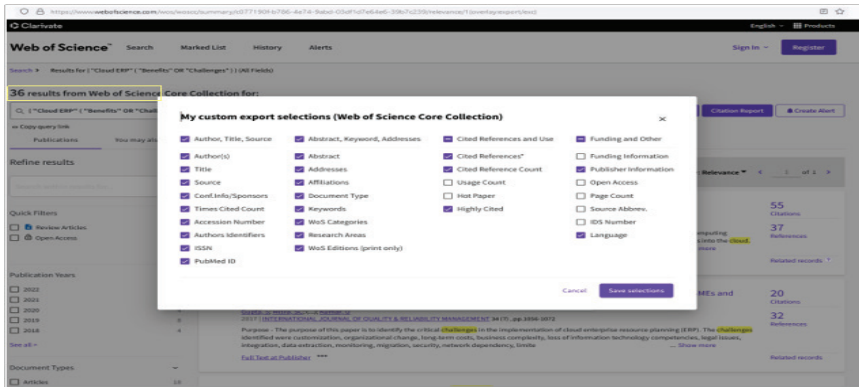


Figure 5. Screenshot of Web of Science.

### Pre-processing of Data

A total of 113 reference study lists, which were obtained as a result of queries made through Google Scholar, Scopus and Web of Science databases through the Publish or Perish application, were combined into a single Excel file. In combining, attention was paid to collecting all data such as author, title, key field, abstract, number of citations, document type, source, year, and publisher under the same data field. The amount of raw data collected by years on the basis of the data sources obtained is shown in Table 1.

Table 1  
Database distribution of raw data studies by years

|                | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Total |
|----------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Google Scholar | 1    | -    | -    | -    | -    | 2    | 1    | 1    | -    | 2    | 1    | -    | 8     |
| Scopus         | 1    | 2    | 3    | 5    | 4    | 9    | 10   | 5    | 11   | 11   | 7    | 1    | 69    |
| WOS            | 1    | -    | 1    | 2    | 2    | 3    | 4    | 4    | 7    | 5    | 5    | 2    | 36    |
| Overall Total  | 3    | 2    | 4    | 7    | 6    | 14   | 15   | 10   | 18   | 18   | 13   | 3    | 113   |

During the preliminary analysis of the data, each data field was subjected to a detailed analysis in terms of content. In the data obtained through the Publish or Perish application, it was seen that fields such as country, publisher, document type were empty. Incomplete data were completed by reaching the original of this study. In the preliminary examination made on the names and authors of the studies, it was determined that 3 studies were conference compilations and were removed from the study pool. It was determined that 33 of the remaining 110 studies were registered in different databases at the same time or in different document types in the same database. The document type-database match numbers of these resources are shown in Table 2.



Table 2  
Document type-database match numbers of duplicate records

|                   | Google Scholar | Scopus | Web of Science | Total |
|-------------------|----------------|--------|----------------|-------|
| Article           | 2              | 16     | 16             | 34    |
| Book Chapter      | -              | 1      | -              | 1     |
| Conference Paper  | -              | 14     | -              | 14    |
| Proceedings Paper | 1              | -      | 13             | 14    |
| Review            | -              | 2      | 2              | 4     |

Examples of duplicate records showing various differences in data areas are shown in Table 3. When these records are examined, it is seen that there are various differences in the title, country, number of citations and document type.

Table 3  
Examples of duplicate records

| Study  | Country        | Cited | Publisher  | Doc. Type         | Source         |
|--|----------------|-------|--|-------------------|----------------|
| Cloud ERP: A new dilemma to modern organisations?            | USA            | 55    | Taylor & Francis Inc.                                      | Article           | WOS            |
|  | United Kingdom | 70    | International Association for Computer Information Systems | Article           | Scopus         |
| ERP in the cloud - benefits and challenges                   | Poland         | 46    | Springer Verlag  | Conference Paper  | Scopus         |
|  | Germany        | 29    | Springer-verlag Berlin                                     | Proceedings Paper | WOS            |
|  | -              | 139   | Springer   | -                 | Google Scholar |
| Reducing integration complexity of cloud - based ERP systems | USA            | 2     | Assoc Computing Machinery                                  | Proceedings Paper | WOS            |
|  | Jordan         | 18    | Association for Computing Machinery                        | Conference Paper  | Scopus         |
| The effect of status quo bias on cloud system adoption       | USA            | 25    | Taylor & Francis Inc.                                      | Article           | WOS            |
|  | Taiwan         | 27    | International Association for Computer Information Systems | Article           | Scopus         |

In the data deduplication studies belonging to the same title and author were evaluated among themselves. The evaluation was carried out on the data fields of each record such as author, publisher, key field and abstract, as well as the data fields in Table 3. In this evaluation, the most appropriate study was tried to be determined. While the selected study was kept in the study records, other duplicate records were excluded from the study. After these eliminations, a detailed analysis was carried out on the title, key area and abstract data of the remaining 76 studies. As a result of all this preliminary examination and analysis, it was

determined that 30 publications were directly related to our study subject. Statistical, bibliometric analysis, visual analysis and mapping of the study were carried out on the studies in this list.

### **Data Analysis**

Statistical and bibliometric analysis studies were carried out on 30 study data fields written in English, which were determined during the data pre-processing phase. The term bibliometric, used as a data analysis technique, refers to mathematical analysis and models that appear in publications and documents. In bibliometric, documents in the scientific communication system are analysed using numerical and statistical techniques. Bibliometric deals with statistical analysis of scientific studies and data such as author, subject, citation, database, publisher, and country, and allows to make an inference and explain the situation in a particular field based on the statistical results obtained. In this sense, bibliometric variables for author, number of publications, number of citations, article source type, and keyword analysis were examined.

The VOSviewer package program was used in word analysis studies. This application is a free computer program used in bibliometric analysis and mapping studies (Van Eck, 2013). It was used to create visualization and density maps that facilitate better understanding and interpretation of datasets (Özköse and Gencer, 2017). In the study, word analysis and visualization studies were carried out in the fields of article title, keyword, abstract and author over 30 academic studies determined for bibliometric analysis. Google Trends analyses the queries on the Google internet search page and other related websites and presents the results obtained (Google, 2014). It allows downloading search results in certain formats so that users can further analyse their study. The Google Trends application provides the opportunity to analyse the access data collected in the internet search pool. It studies on an algorithm based on how many times a particular word or phrase is used in a Google search.

### **Visualization**

As a result of the analysis studies on the study data, the MS Excel application and VOSviewer application for analysis, mapping and text mining on selected keywords were used for statistical analysis and visualization of the data. The Google Trends application was used for trend analysis and visualization.

### **Findings and Discussion**

A total of 113 study data obtained separately from the Scopus (69), WOS (36), Google Scholar (8) databases were combined under a single Excel file. As a result of detailed examination and singularization studies on these raw data fields, 30 different studies on the subject

of the study were determined. Statistical and bibliometric analysis studies were performed on these studies presented in Table 4.

Table 4  
*Bibliometric analysis study resource publication list*

| No | Study Title  | Pub. Type         | Source         | Year |
|----|--|-------------------|----------------|------|
| 1  | Critical success factors and challenges for cloud ERP system implementations in SMEs: A vendors' perspective (Tongsuksai et al., 2021)                           | Conference Paper  | Scopus         | 2021 |
| 2  | Challenges of Cloud-ERP Adoptions in SMEs (Haddara et al., 2021)   | Conference Paper  | Scopus         | 2021 |
| 3  | Cloud-Based ERP Systems Implementation: Major Challenges and Critical Success Factors (Shatat and Shatat, 2021)  | Article           | Scopus         | 2021 |
| 4  | Cloud ERP in Malaysia: Benefits, challenges, and opportunities (Razzaq and Mohammed, 2020)   | Article           | Google Scholar | 2020 |
| 5  | Cloud ERP Systems Challenges and Benefits (Egbon, 2020)  | Article           | Google Scholar | 2020 |
| 6  | Understanding Cloud ERP Adoption Phenomenon: Large Organizational Perspective (Ahmed et al., 2020)   | Proceedings Paper | WOS            | 2020 |
| 7  | Implementation of cloud ERP in the SME: evidence from UAE (Alsharari et al., 2020)   | Article           | WOS            | 2020 |
| 8  | An empirical investigation of organizations' switching intention to cloud enterprise resource planning: a cost-benefit perspective (Chang and Hsu, 2019)         | Article           | Scopus         | 2019 |
| 9  | A Study on the Challenges of Implementing Cloud-Based ERP (Alharthi et al., 2019)  | Conference Paper  | Scopus         | 2019 |
| 10 | Cloud ERP Adoption Pitfalls and Challenges A Fishikawa Analysis in the Context of the Global Enterprises (Bhadra et al., 2019)                                   | Conference Paper  | Scopus         | 2019 |
| 11 | Difference Comparison of SAP, Oracle, and Microsoft Solutions Based on Cloud ERP Systems: A Review (Elbahri et al., 2019)  | Proceedings Paper | WOS            | 2019 |
| 12 | The main factors in analysing the deployment of Cloud ERP in order to create a competitive advantage (Costan and Pascu, 2019)                                    | Proceedings Paper | WOS            | 2019 |
| 13 | Creating Business Value from Cloud-Based ERP Systems in Small and Medium-Sized Enterprises (Hustad et al., 2019)   | Conference Paper  | Scopus         | 2019 |
| 14 | Reducing integration complexity of cloud-based ERP systems (Muslmani et al., 2018)   | Conference Paper  | Scopus         | 2018 |
| 15 | Critical Factors of Success in ERP cloud Projects under the Aspects of Processes, System and Technology in the Brazilian Business Context (Gheller et al., 2017) | Article           | WOS            | 2017 |
| 16 | An empirical study of technological factors affecting cloud enterprise resource planning systems adoption (Kinuthia and Chung, 2017)                             | Article           | Scopus         | 2017 |
| 17 | Data security issues in cloud-based Software-as-a-Service ERP (Saa et al., 2017)   | Conference Paper  | Scopus         | 2017 |
| 18 | Identification of challenges and their ranking in the implementation of cloud ERP: A comparative study for SMEs and large organizations (Gupta et al., 2017)     | Article           | Scopus         | 2017 |

| No | Study Title  | Pub. Type        | Source         | Year |
|----|--|------------------|----------------|------|
| 19 | An Analysis of the Perceived Benefits and Drawbacks of Cloud ERP Systems: A South African Study (Scholtz and Atukwase, 2016)   | Conference Paper | Scopus         | 2016 |
| 20 | Benefits and challenges of cloud ERP systems–A systematic literature review (Abd Elmonem et al., 2016)                         | Article          | Google Scholar | 2016 |
| 21 | Exploring the strategic alignment concern when switching toward cloud ERP (Mezghani, 2016)                                     | Conference Paper | Scopus         | 2016 |
| 22 | The effect of status quo bias on cloud system adoption (Fan et al., 2015)  | Article          | Scopus         | 2015 |
| 23 | Cloud ERP adoption opportunities and concerns: The role of organizational size (Johansson et al., 2015)                        | Conference Paper | Scopus         | 2015 |
| 24 | Implementation of cloud ERP: Moderating effect of compliance on the Organizational factors (Gupta and Misra, 2015)             | Conference Paper | Scopus         | 2015 |
| 25 | Cloud computing and ERP: A framework of promises and challenges (Zhong and Rohde, 2014)  | Conference Paper | Scopus         | 2014 |
| 26 | Cloud ERP: A new dilemma to modern organisations? (Alex Peng and Gala, 2014)   | Article          | Scopus         | 2014 |
| 27 | Switching toward cloud ERP: A Research model to explain intentions (Mezghani, 2014)  | Article          | Scopus         | 2014 |
| 28 | Cloud ERP query flow control simulation with quality restrictions and profit gaining criteria (Romanov and Varfolomeeva, 2013) | Article          | Scopus         | 2013 |
| 29 | Cloud ERP implementation challenges: A study based on ERP life cycle model (Iqbal et al., 2012)                                | Conference Paper | Scopus         | 2012 |
| 30 | ERP in the Cloud–Benefits and Challenges (Lenart, 2011)  | Article          | Google Scholar | 2011 |

## Statistical Analysis

In this section, the distribution of the source studies used in the analysis study according to years, databases, type of publication, publishers, citation numbers and countries has been subjected to statistical analysis from various aspects. The data obtained as a result of the analysis are presented through the graphic or table representation obtained from MS Excel.

## Number and rates of publications by years

The distribution chart of the studies carried out on the benefits and difficulties of the cloud ERP system by years is shown in Figure 6. When the distribution of a total of 30 selected studies between 2011 and 2021 is examined, the annual number of publications reached 3 since 2014, in parallel with the widespread use of Cloud ERP, this number increased to 4 in 2017, and it reached 1 in 2018.

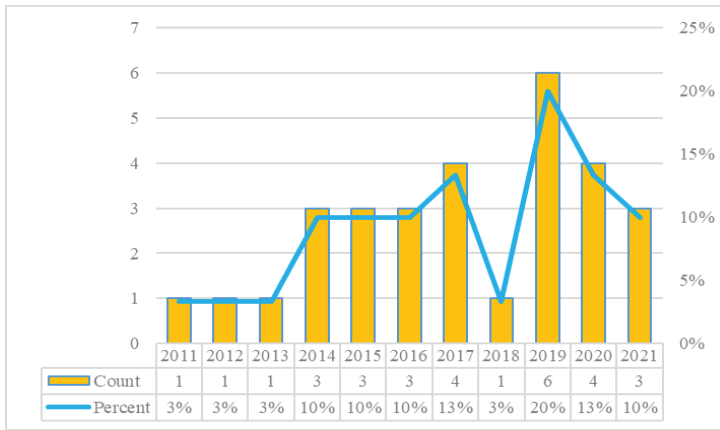


Figure 6. Number of publications by year.

It is observed that the highest increase was experienced with 6 units in 2019. In the same graph, when the percentages of the number of publications in the total are analysed, it is seen that it is at least (3%) and at most 20% in 2019, and at least 10% in recent years, excluding 2018. When analysed as a whole, it is observed that while the concept of Cloud computing and then ERP Cloud took place at a basic level (3%) between 2011 and 2013, which are considered the first years of its emergence, there was a rapid increase, and it remained popular except for 2018. It is noteworthy that the rate of 13 different publications in the last 3 years has been 43.33%.

### Distribution by database and publication type

The research was carried out through the Publish or Perish application, Scopus, Web of Science and Google Scholar databases. The obtained studies were subjected to pre-processing and analysis. The studies by the same author published in different databases on the same subject were singularized, taking into account the number of citations and other field characteristics, and 30 main sources were determined. Their distribution by database is Scopus (n=21, 70%), Web of Science (n=5, 17%) and Google Scholar (n=4, 13%). The distribution of these studies by type of publication is article (n=14, 47%), conference paper (n=13, 43%) and proceeding paper (n=3, 10%).

### Distribution by publishers

The distribution, number and ratio of studies by publishers are shown in Figure 7. Springer (n=5, 17%) has the most publications, IEEE (n=4, 13%) is in second place, and IACIS (n=3, 10%) is in third place. Elsevier shares the 4th place with Emerald and IGI Global publishers (n=2, 7%), while it shares the 5th place with the other publishers in the chart (n=1, 3%).

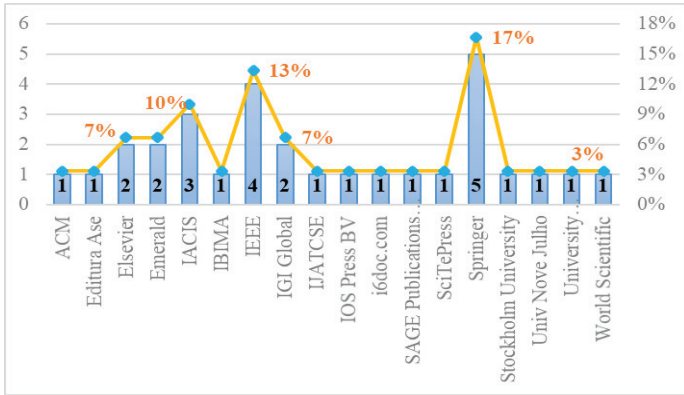


Figure 7. Number and rate of studies by publishers.

### Distribution by Number of Citations

The year in which the studies were published and the total number of citations they received are presented in Figure 8.

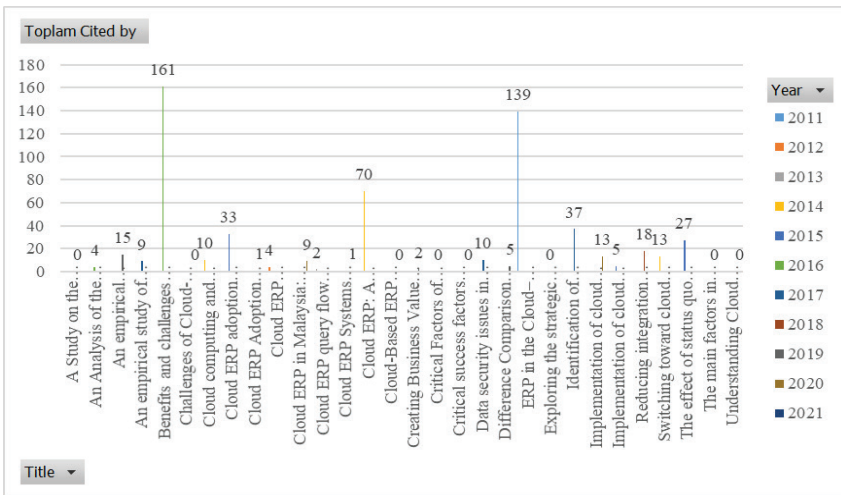


Figure 8. Number of citations per academic study.

When the graph is examined, the study named ‘Benefits and challenges of cloud ERP systems–A systematic literature review’ by (Abd Elmonem et al., 2016) took the first three places with a significant difference, with a total of 161 citations. The study named ‘ERP in the cloud–benefits and challenges’, published by (Lenart, 2011) in 2011, achieved a very high number compared to the others. The study named ‘Cloud ERP: A new dilemma to modern organisations?’, which was studied by (Alex Peng and Gala, 2014) in 2014, took the third

place with 70 citations. Due to the fact that some studies can be searched in both the Scopus and WOS databases, an approach that is the sum of the citations in the two databases could not be taken as the total citation sales. However, it is a fact that the total number of citations for this study will exceed the number specified here. Obtaining a DOI number for each publication may be a solution to avoid such confusion or duplication. It has been observed that 8 publications in total have not received any citations yet.

The number of publications produced on a yearly basis and the total number of citations received and their rates are shown in Table 5. According to the number of citations, there are 3 publications in 2016 (n=165, 28.06%), one publication in 2011 (n=139, 23.64%) and 6 publications in 2019 (n= 23, 3.91%). It is seen that 3 publications published in 2021 have not been cited yet.

Table 5  
*The number and rates of citations on a yearly basis*

| Pub.Year | Count | Cited by | Percent | Pub.Year | Count | Cited by | Percent |
|----------|-------|----------|---------|----------|-------|----------|---------|
| 2011     | 1     | 139      | 23.64%  | 2017     | 4     | 56       | 9.52%   |
| 2012     | 1     | 4        | 0.68%   | 2018     | 1     | 18       | 3.06%   |
| 2013     | 1     | 2        | 0.34%   | 2019     | 6     | 23       | 3.91%   |
| 2014     | 3     | 93       | 15.82%  | 2020     | 4     | 23       | 3.91%   |
| 2015     | 3     | 65       | 11.05%  | 2021     | 3     | 0        | 0.00%   |
| 2016     | 3     | 165      | 28.06%  |          |       |          |         |

### Distribution by Countries

When the distribution of studies by country is analysed, the United States (n=3, 10%) ranks first, while India, New Zealand, Norway, Saudi Arabia and Taiwan (n=2, 6.67%) rank second. There is a study from Bahrain, Brazil, Canada, Egypt, England, Greece, Iraq, Jordan, Kazakhstan, Poland, Romania, Russian Federation, South Africa, Spain, Sweden and the United Kingdom. When the data is analysed, it is seen that broadcasting countries have a similar distribution worldwide, with at least one country from each continent and slightly higher in economically rich countries. On the other hand, it was found interesting that countries such as Germany, France, Italy, China, Japan and Turkey, which are in the developed country category, are not included in this list. It is thought that this may be due to the fact that the study was conducted in English publications. In addition, considering that the study has limitations in terms of subject, it is difficult to reach a definite conclusion about whether cloud ERP comparison is a matter of preference for countries. There is a need for a more comprehensive study in all languages in order to reach a stronger decision on this issue.

### Visual Network Analysis and Mapping

The VOSviewer software was used in visual data network analysis and mapping studies. The article title, author keywords, and summary text words were used.

### Author keyword analysis

Keywords of 30 academic studies were analysed through the VOSviewer application. Corrections were made in 65 key areas determined before the analysis that would not change the essence of the word. For example, the word ‘enterprise resource planning’ was written as ERP, the plural word SMEs was edited as SME. They are combined according to whether the keywords are synonymous or similar. In the word analysis phase, a total of 10 keywords were determined, of which at least 2 were repetitive. These keywords and their frequency of use are shown in Table 6.

Table 6  
*Keyword frequency table*

| Keyword         | Frequency | Keyword                 | Frequency |
|-----------------|-----------|-------------------------|-----------|
| Cloud ERP       | 17        | Challenges              | 4         |
| Cloud computing | 12        | Implementation          | 3         |
| ERP             | 8         | Saas                    | 3         |
| SME             | 5         | Critical success factor | 2         |
| Adoption        | 4         | ERP systems             | 2         |

When the first three rows are examined in terms of usage frequency, the term ‘Cloud ERP’ is repeated 17 times, the term Cloud Computing 12 times, and the term ERP’ 8 times. On the other hand, the density map obtained through the program regarding the frequency of use of these keywords is shown in Figure 9.

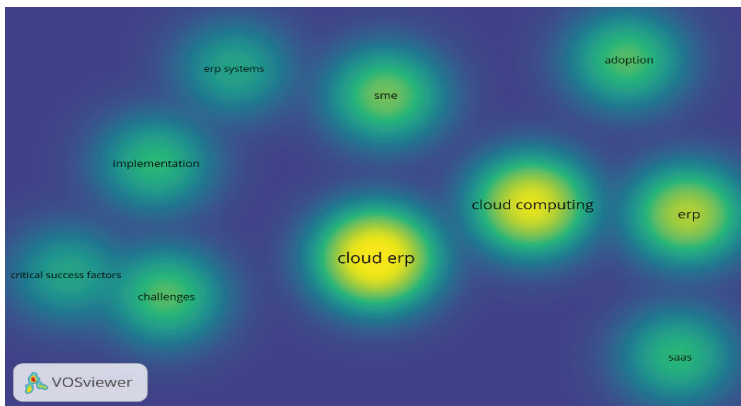


Figure 9. Keyword density map.

When the author keyword network is examined using the Vosviewer program, it is seen that the network constitutes the main centre of the relationship network on ‘cloud ERP’, ‘cloud computing’, ‘ERP’, ‘Adoption’ and ‘SME’.

It is related to the frequency of each word used in the formation of the word network connection and density clusters in the keywords. It shows the most repeated word clusters



in the keyword density map. According to the density map created through keywords, the density based on ‘cloud ERP’, ‘cloud computing’ and ‘ERP’ is observed. It is seen that the cloud, SaaS cloud service is clustered around ERP, and the subject of ‘cloud computing’ and ‘cloud ERP’ is highly dense and closely related. It can be referenced as a simple use for easy separation in user references.

The time map of author keywords based on text data is shown in Figure 10. The colouring of the words in the figure is according to the colour scale in the timeline. In other words, dark colours represent words followed by people who have been broadcasting in this field for years, and light colours represent new concepts.

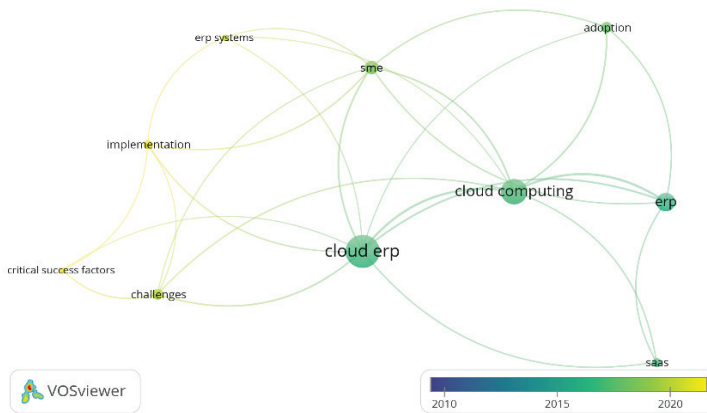


Figure 10. Time map of author keywords based on text data

The use of author keywords in publications from 2010 to the present (dark to light) is shown. In this timeline, ERP, cloud computing, cloud ERP in SME are listed as challenges and implementation, while ‘critical success factors’ come to the fore today.

### Abstract Keyword Analysis

In the VOSviewer application, word analysis was carried out on the summary texts of the academic studies used in the analysis. A total of 698 different words were identified in the summary texts of 30 different academic studies. The number of times each of these words was used in the text was examined. As a result of this examination, it was determined that there were 20 different words with at least 5 or more repetitions. The list of these words and their repetition numbers are shown in Table 7. Challenge, factor and SME (small and medium-sized enterprises) are the three most used words.

Table 7  
Abstract text word frequency table

| Keyword   | Frequency | Keyword                            | Frequency | Keyword                  | Frequency |
|-----------|-----------|------------------------------------|-----------|--------------------------|-----------|
| Challenge | 49        | Literature                         | 11        | Cloud ERP adoption       | 6         |
| Factor    | 23        | Risk                               | 10        | Research model           | 6         |
| SMEs      | 21        | Business                           | 9         | Use                      | 6         |
| Adoption  | 16        | Cloud enterprise resource planning | 9         | Cloud environment        | 5         |
| Concern   | 16        | Large organization                 | 9         | Cloud ERP implementation | 5         |
| Provider  | 14        | Information                        | 8         | Order                    | 5         |
| Data      | 12        | Security                           | 8         | -                        | -         |

A screenshot of the network map based on summary text data of the studies obtained is shown in Figure 11.

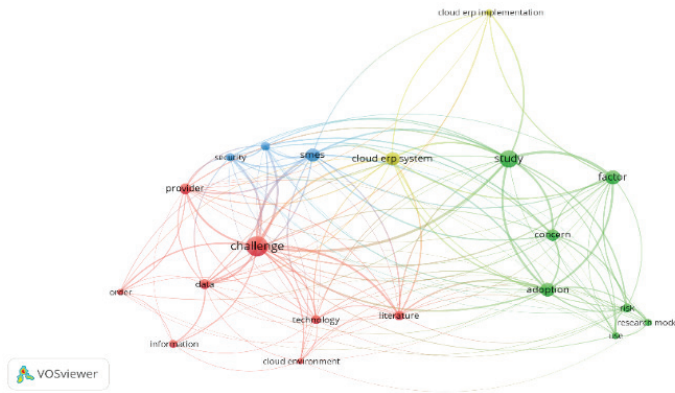


Figure 11. Abstract word network.

Challenge, factor, and SMEs are the most repetitive words, providing a network map of green, red, and blue words around these words. The strength of the relationship between words is effective in determining the colour class and proximity of the related term. The word ‘Challenge’ was the subject with the most connections, reached the highest frequency and stood out among the common clusters of 2.

The VOSviewer application also presents the usage intensities of the words in the texts in the form of mapping. The word density map made over the words in the abstract texts is shown in Figure 12. The reason for the brightness in the intensity is because that data is the most repetitive. The main purpose of this display is to see more clearly the areas where concentrations are experienced through word repetitions rather than the connection relationship between words.

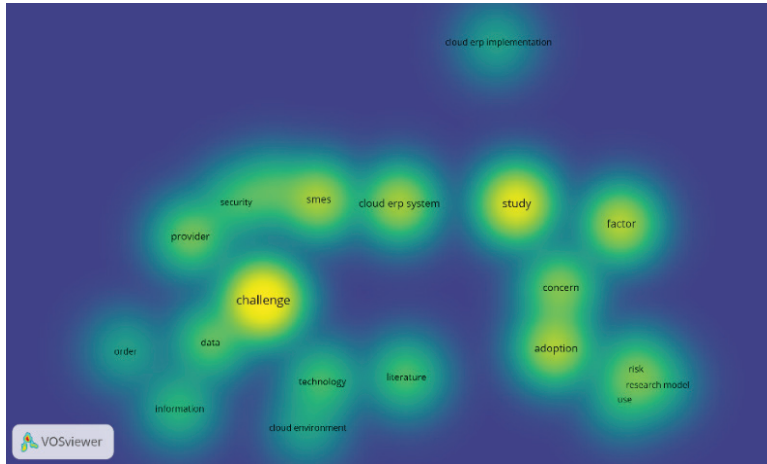


Figure 12. Abstract text word density map

When this density map is examined, it is seen that there is a concentration in the words difficulty, SME and factor due to the selection of resources compatible with the study subject. In SMEs and large organizations, it is observed that security, support, business and data areas are clustered around the challenge area. It is seen that there are concentrations around adaptation, interest, research model, risk on the part of Cloud ERP factors. Abstract text word usage time map is shown in Figure 13.

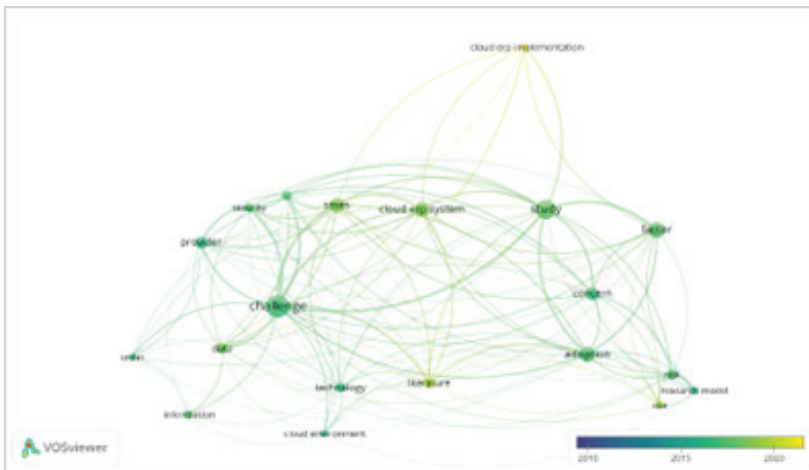


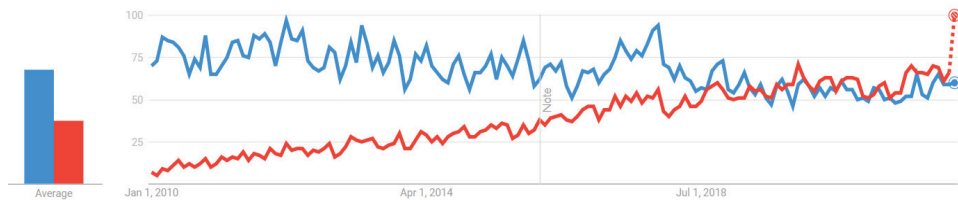
Figure 13. Time map of words based on abstract text data.

The words written in dark blue are the words in the previously published articles in this field, and the yellow words are the words belonging to the newly published articles. The words in the table in colours from green to yellow are mostly used in recent publications. Examples

of these words are ‘cloud ERP implementation’, ‘cloud ERP system’ and ‘literature’. Such time-based representations also show how the words in the studies show a trend from the past to the present, and in what direction the researches are concentrated.

## Google Trend Analysis

The search trends of the users for the words ‘ERP’ and ‘Cloud ERP’ on the Google internet search engine have been examined. The analysis results obtained through the Google Trend application are shown in Figure 14.



*Figure 14.* ERP vs cloud ERP trend analysis comparison chart.

The chart shows the search trend for the term “Cloud ERP” in red and the term “ERP” in blue. According to the results of this trend analysis, it is seen that the term ‘Cloud ERP’ has been in a continuous upward trend since it first came out, the search for the term ‘ERP’ caught on in 2018, then it had a similar trend for a while, and this increase continues to the present day. Although the popularity of ERP continues, it can be said that the term Cloud ERP stands out when it comes to ERP, especially after 2018. It is understood that this interest in Cloud ERP will continue to strengthen. ERP and Cloud ERP systems, which were 70:7 in 2010, surpassed ERP systems by 59:66 in June 2022.

## Summary and Conclusion

Enterprise resource planning is an effective tool that ensures the effective use and management of existing resources to achieve the goals of the organization. If this tool is understood and applied correctly, it both brings companies to the point they want and provides customer satisfaction (Saylam, 2016). It is a very useful system for businesses. In terms of application architecture, traditional ERP applications depend directly on on-premises platforms. Cloud ERP, on the other hand, is not dependent on on-premises platforms. It is in a remote place called the cloud in the internet environment. While this architectural structure offers many advantages, it also carries some risks and difficulties due to the fact that the technology is new and not fully understood. On the other hand, its popularity is increasing day by day thanks to the many benefits it provides to institutions. According to the August 2022 Gartner report,

53% of the product-focused market uses cloud ERP. It is predicted that this ratio will increase and reach 60% in 2024. Despite such a popular and widespread use of cloud ERP, it still needs to be understood in terms of risks, benefits and challenges. Bibliometric analysis, on the other hand, contributes to the understanding of the subject by working on the publications produced by individuals or institutions in a certain field, period and region.

In this study, the benefits and challenges of Cloud ERP are analysed. The Scopus, Web of Science and Google Scholar databases were used. After determining the publications suitable for the criteria through these databases, a bibliometric analysis study was carried out. Thus, it is aimed to make inferences about the benefits and difficulties of cloud ERP with related academic studies. A road map has been tried to be drawn for its current situation and usage trend. Text mining and word analysis studies were carried out using the VOSviewer program. Data and texts were visualized using scientific mapping models. Cloud ERP and ERP trend analysis was performed using the Google Trends application. The data obtained from the analysis studies were evaluated in the findings and discussion section. As a result, cloud ERP comes to the fore with cloud technologies, and the cloud ERP application system is becoming more widespread day by day. This is confirmed by the Gartner research reports. This growing interest and trend shows that the benefits of cloud ERP outweigh its challenges. As the areas of difficulty, the obscurities of data, provider, new technology and cloud environment were associated with the literature and lack of knowledge. Data security and ERP system implementation in SMEs remain up to date.

In this study, which is considered as a cross-section of the studies in the literature, the level of interest and important subject areas for the benefits and challenges of cloud ERP were determined. In parallel with the increasing importance and use of this subject, it has been determined that it is also the subject of academic studies. The study was conducted in the English language, in prestigious databases, in limited time and space. This should be taken into account in the evaluation of findings and results. Different studies can be done with more databases and less restrictions. On the other hand, the results of this study shed light on future research and businesses that have difficulties in deciding to use this technology. Using the results of this study, researchers can also work on solutions that facilitate cloud ERP's challenge areas. They can also set new study targets for existing and less studied topics derived from text mining. Thus, by contributing more to the literature on cloud ERP, which is increasingly popular, it can help to eliminate the concerns and problems of institutions in the transition to this technology.

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