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A systemic framework for Enterprise Resource Planning systems: A bibliometric networking analysis

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Abstract

Enterprise Resource Planning (ERP) systems have been considered by numerous organizations as a key part of their strategy to support the optimization of their processes and enhancement of their business performance. However, managing business processes through ERP systems and their integration with other systems and data sources is complicated. Part of this difficulty comes from the lack that managers, executives, and implementers have of an integrated and holistic view of ERP systems. This article presents a systemic framework for ERP systems based on many publications as a data sources. It derives from a bibliometric network analysis previously made based on a systematic literature review on ERP major concerns. The methodology used to do the systematic literature review was PRISMA 2020, and the software used to do the bibliometric networking analysis was VOSViewer. The bibliometric analysis was based on the network built based on the previous systematic review and on the clusters that emerged from it. Fifty-nine terms with the highest occurrence were chosen to support six clusters that were found. The data obtained from the bibliometric map, specifically the meaning of each identified cluster, was analysed. These clusters were used as the pillars of the systemic framework proposal. The clusters were used as core areas of the ERP systems field, respectively: (1) infrastructure & technology, (2) leadership & people, (3) processes & performance, (4) implementation & adoption, (5) supplier & implementer, and (6) enterprise & application architecture. The six different clusters and their main relationships were analysed and discussed.

Keywords: enterprise resource planning system; ERP concerns; ERP trends and perspective; ERP systems challenges; ERP evolution; business process management; critical success factors in ERP; ERP adoption; emerging ERP; bibliometric analysis; VOSViewer.

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1. Introduction

Technological innovation allows Enterprise Resource Planning (ERP) systems to optimize business processes and their integration with other systems. ERP has characteristics that facilitate the optimization of business process management and increases the competitiveness of organizations. For some years now, research has indicated that the successful adoption of ERP systems to support business strategy can help organizations achieve superior financial performance [1]. ERP systems are designed to be comprehensive, covering most of different functions and processes that a company uses to run its operations. This complexity is necessary to provide the necessary level of functionality and support for the various business processes involved in running a company. The complexity of ERP implementation also arises from the fact that much information that supports business comes from different sources or other systems. This requires a high level of technical sophistication and knowledge to ensure that ERP can effectively integrate and manage all this different data, such as company's financial, supply chain or human resources systems. Managers, executives, and implementers have difficulty obtaining an integrated and holistic view of ERP systems. Students, teachers, and researchers have a similar problem. Using many publications as data sources, this article presents a systemic framework for ERP systems. From an academic and practical perspective, it is important to have a framework that could help to better understand main ERP areas and their relationship.

There have been numerous publications on ERP systems. Martins and Belfo recently made a systematic literature review of major concerns about ERP systems [2]. Based on that study, a bibliometric networking analysis was made to explore and study the 126 eligible scientific publications found of a decade of research (2011-2021) that were reviewed by these authors [2]. This networking analysis enabled to unpack some evolutionary nuances of this field, while shedding light on its emerging areas [3], [4]. Scientific repositories, such as Scopus or Web of Science, were previously used to get most important scientific research publications in different thematic and interdisciplinary contexts about ERP systems. This study identified main ERP areas and how they apply and relate to each other. The main areas were identified through a bibliometric map based on the most important publications on ERP systems in a decade of research (2011-2021) [2]. The previous analysis of these publications allowed to perceive trends, observe patterns and understand the structure of the existing literature. These data also helped to have a global view of the literature, the existing gaps and observe its variants [5]–[8]. This article presents the terms with the highest number of occurrences and VOSViewer software grouped these terms into six clusters, each one with a particular meaning. The article has five more sections. The next section presents the used methodology. The third section presents the obtained results. The fourth section is dedicated to bibliometric networking analysis and its discussion. The fifth section proposes a systemic framework to understand the different areas and their main relationships. The conclusion of the results, some limitations of the study and possible future research is presented in the last section.

2. Methodology

The bibliometric networking analysis is based on the 126 publications eligible from the systematic literature review made by Martins and Belfo [2]. VOSViewer (version 1.6.18) was the software used to create the bibliometric map [9]–[12]. This program made it possible to work with the data collected and offered a set of mapping and clustering techniques essential for the analysis. VOSViewer allows to use all kinds of data collected in scientific repositories, for example, citations, or titles, and create and visualize their bibliometric maps. This tool allows text mining in English language. To create a bibliometric map, the program distinguishes: identification of noun phrases, selection of the most relevant noun phrases, mapping and grouping of terms, visualization of mapping and grouping results [9]–[13].

Table 1. Configuration in VOSviewer.

Fields	Title and abstract fields; Ignore structured abstract labels; Ignore copyright statements
Counting method	Full counting
Threshold	Minimum number of occurrences of a term: 6. Of the 2815 terms, 138 meet the threshold

The 126 eligible publications that were used covered different study methods, types of documents and disciplines. The study methods used are case study, descriptive, design science, experiment, literature review, survey and theoretical. Journal article and book chapter are the type of eligible documents, and the main disciplines that have been selected were information systems, organization and management and computer science [2]. For this bibliometric analysis, data were extracted directly from repositories in “ris” format [4], [10], [11]. The used data included title and abstract of the publications. Some repositories didn’t have enough data to allow to work on the software. An example of this problem happens at IEEE and EBSCO repositories, where it was necessary to edit the .ris file and include the abstract of each of the articles housed there. Once the files were corrected, they were uploaded in the software VOSViewer. After preparing the “ris” files, the data was selected and configured in the tool, according to Table 1.

After creating the bibliometric map and obtaining the necessary data to develop a systemic framework, the objective was to create a taxonomy of the areas of ERP systems. Then, the authors worked on the meaning of each area and their relationships. Each identified cluster of the created bibliometric network was used as an area of the proposed systematic framework and has a practical and comprehensive specific explanation of the ERP field and relates to some of the other areas.

3. Results

The 126 publications were obtained from scientific repositories and underwent a rigorous and selective process according to PRISMA 2020 methodology [14]. The selection of eligible articles was done manually, without recourse to automated tools, such as machine learning. Publications have characteristics that define them and help us to understand what the major concerns about ERP are, or the most studied phases of their life cycle. Table 2 presents the main characteristics of the eligible publications.

Table 2. Key characteristics of publications.

Repositories	ACM, EBSCO, IEEE, Sage, Scopus, Taylor and Francis, WoS
Life cycle	Implementation, operation, decision, selection and planning, maintenance, retirement
Document Type	Book chapter, journal article
Disciplines	Information technology, decision sciences, engineering, management, accounting, business
Date of publications	01-01-2011 to 31-10-2021
Study methods	Case study, descriptive, design science, experiment, literature review, survey, theoretical

There are different bibliometric analysis techniques, performance analysis, which explores research contributions, and science mapping, which deals with the relationships between researched constituents, and network analysis, which enriches bibliometric studies through network metrics, clustering, and visualization [4], [8], [10]–[12]. The most used measures are the number of publications and citations per year. Network metrics provide different measures of centrality, benefiting bibliometric analysis, but also making it increasingly complex. Among the different measures explored, the degree of centrality was the measure used, as we analysed the number of occurrences of terms in publications within the network. Clustering was the technique used to make the bibliometric analysis, aiming to create clusters and to help analysing how ERP areas emerge and relate. For this, it was necessary to use exploratory factor analysis. For the creation of cluster processes, it was necessary to follow some procedures and guidelines. First, it was necessary to define the objectives and the scope to be studied and then select the bibliometric analysis techniques. Based on the definition of objectives, we analysed the search terms to be used, identified the databases and publications to be analysed, applied the previously defined clustering technique, filtered the data in VOSviewer and eliminated the search terms and data that entered erroneously. It was important to collect data and identify which terms were most appropriate and which made sense for our bibliometric analysis. Through VOSviewer we obtained our bibliometric analysis and the results report [2], [5], [11], [12], [15], [16].

VOSviewer uses an algorithm based on natural language processing and only supports texts written in English. The identification of terms is based on five stages [10]–[13], [17]: (1) removal of copyright statements: often the titles and abstracts include the copyright statement, but VOSviewer removes them; (2) sentence detection: the sentence algorithm is applied based on the Apache OpenNLP library, with the characteristic of dividing text data into sentences; (3) part-of-speech tagging: each of the words are associated with the part of speech. This algorithm is provided by the

Apache OpenNLP library; (4) noun phrase identification: the software defines non-phrases as sequences of one or more words within the sentence. VOSviewer includes only the longest sentences and does not include propositions; (5) noun phrase unification: non-alphanumeric characters are removed, and VOSviewer converting uppercase characters to lowercase and plural noun phrases to singular. This study used the title and the abstract of each selected publication. Through the clusters, we were able to understand how sentences can be organized and understand their interrelationship. The methodology applied in this article was exclusively made through the results obtained with VOSViewer. The VOSViewer was configured based on the data collected from the eligible studies.

The authors created a file called "thesaurus.txt" to unify terms whose meanings were the same. There were two unifications: "CSF" or "CSFs" were replaced by "Critical Success Factors" and "smes" was replaced by "sme" (small and medium-sized enterprise). After optimizing the obtained data, we got 2812 terms and 147 meet the threshold. Finally, the authors filtered the collected data and removed the terms that were considered not relevant or too generalist. Table 3 presents the fifty-nine chosen terms.

Table 3. Selected terms used in VOSviewer.

Number of terms	59
Selected terms	accounting benefit, agility, alternative, application, big data, BIM, business intelligence, business process management, case study, change, concept, consultant, contribution, country, critical success factor, decision, decision maker, effectiveness, efficiency, enterprise, enterprise resource, erp implementation, erp project, execution system, financial performance, identification, implementation process, information technology, integration, internet, IoT, knowledge, leadership, management accounting, management control, manufacturing, order, problem, product, production, real time, relationship, researcher, retailer, RFID, risk, routine, rule, service, smart factory, sme, successful implementation, supplier, tco, technology, theory, time, top management support, workaround

The first bibliometric map that was created had seven clusters. Because the seventh cluster had just a few terms, it was decided to reduce the number of clusters to six. This was done by adjusting the value of the clustering resolution [11]. The final bibliometric map with six clusters is shown at Fig. 1. Based on the data obtained, it was possible to create the bibliometric map. Fig. 1 presents the bibliometric map that was created with the six clusters, each one identified by a different colour. The larger the node, the greater the number of occurrences of the term.

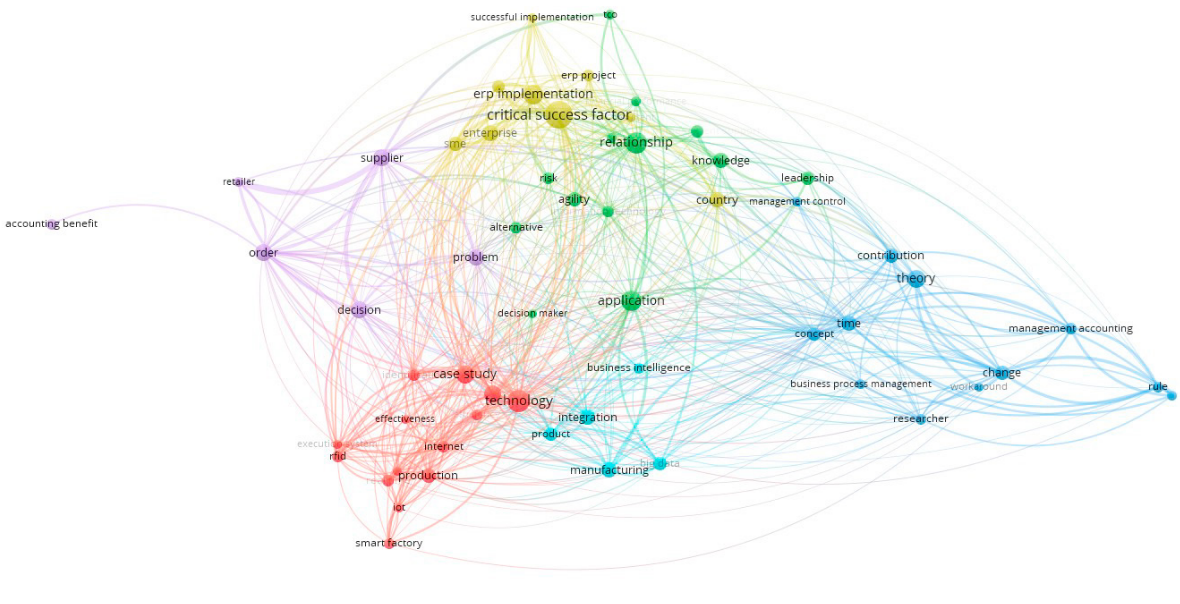

Fig. 1. Bibliometric map.

Table 4 presents the terms and the number of occurrences and relevance per cluster. The clusters were positioned by ascending order and their terms in descending order of their number of occurrences.

Table 4. Terms, number of occurrences and relevance per cluster.

Cluster	Color	Terms	Occurrence	Relevance
1	Red	technology	37	0.2879
		case study	24	0.3194
		service	21	0.3852
		production	16	0.6873
		internet	11	0.5399
		RFID	11	0.7185
		identification	10	0.4806
		real time	10	0.8724
		efficiency	9	0.536
		smart factory	9	1.0652
		BIM	6	0.7612
		effectiveness	6	0.8235
		execution system	6	0.8124
		IoT	6	1.0972
2	Green	relationship	35	0.5655
		application	32	0.4778
		knowledge	17	1.0007
		agility	16	1.2403
		leadership	14	1.5072
		top management support	12	1.7124
		risk	11	1.7586
		alternative	10	0.8667
		information technology	10	0.7744
		financial performance	8	0.9367
		tco	8	1.7787
		enterprise resource	7	0.5635
		decision maker	6	0.6181
3	Blue	theory	24	1.5758
		time	17	0.6702
		change	16	1.5953
		contribution	15	0.8431
		concept	14	0.4481
		management accounting	11	1.919
		researcher	9	0.8268
		rule	9	2.8598
		business process management	8	1.4047
		management control	8	0.5936
		routine	8	2.96
		workaround	6	2.922
4	Yellow	critical success factor	58	0.6897
		erp implementation	30	1.1192
		enterprise	20	0.7489
		country	18	0.5005
		sme	16	0.6642
		implementation process	12	0.7687
		erp project	10	0.6636
		consultant	7	0.6153
		successful implementation	6	1.0599
5	Pink	decision	22	1.0571
		supplier	22	1.5198
		order	21	0.4305
		problem	19	0.6457
		accounting benefit	9	1.7772
		retailer	7	2.2051
6	Light blue	integration	18	0.486
		manufacturing	18	0.5274
		big data	14	0.6185
		product	13	0.4588
		business intelligence	9	0.638

4. Bibliometric analysis and discussion

The defined network metrics allowed the analysis of the importance of the selected terms of the 126 publications. There are multiple relationships between terms in different publications. These terms are interrelated, and six clusters were created that indicate terms used in different areas. The bibliometric network also allowed to understand the most widespread terms, worked on and used by the authors, and the terms that are clearly emerging.

The proposed clusters allowed to identify the most important terms about enterprise resource planning systems that are identified by the academic community. This analysis is dependent on the 126 publications that were obtained from the systematic literature review that was previously done. A different publication selection process could create different clusters with different terms and different relations between them. Anyway, the 126 publications selected represent a very significant number and the systematic review was based on a very long period (2011-2021). The graphical interface of VOSviewer software allowed the creation of the network visualization. The visualization of the bibliometric map obtained from the software was in accordance with the previously defined procedures and guidelines.

The cluster 1 is represented by the red colour at Fig. 1. The terms with the most occurrences are “technology”, “case study” and “service”, and the most relevant terms are “IoT” (Internet of Things), “smart factory” and “real time”. This cluster is basically related to infrastructure and technology issues. A significant number of the publications that support this cluster correspond to the study and development of new or improved infrastructures and technologies that can automate and leverage the implementation and adoption of ERP systems. Some case studies allow the analysis of the development of infrastructures and technologies, and the way companies use them to create business value. Using the Internet in ERP has opened a range of business opportunities for companies, including the ability to access anywhere, the ability to reach new global markets and improve customer service. ERP providers are moving away from pre-built interfaces and formulas to construct highly linked systems that drive production-line-level operations while giving business decision-makers the data they need in real-time. This is done to get ready for Industry 4.0. Technologies like radio frequency identification (RFID) make it easier to integrate manufacturing execution systems (MES) with ERP systems. For instance, each car in manufacturing of automobiles will contain an RFID chip that will track and record the progression of raw materials through to finished items. Smart devices and smart factories are becoming mainstream for businesses, especially industrial companies seeking to comply with Industry 4.0, i.e., the digitization of manufacturing, driven by disruptive trends including increased data and connectivity, analytics, human-machine interaction, and improvements in robotics. This cluster is centred on the importance of how technologies can improve the optimization of business processes and the critical factors and elements related to a smart factory. The data collection and share in real time is a preponderant factor for the competitiveness of organizations [18].

The cluster 2 is represented by the green colour at Fig. 1. At that figure, it can be seen the terms with more occurrences at this cluster, respectively, “relationship”, “application” and “knowledge”. The most relevant terms of this cluster are “TCO” (total cost of ownership), “risk” and “top management support”. ERP projects basically deal with knowledge management and the relationship between people, technology, and processes. Projects must involve specialized people, such as IT administrators and users that understand how to optimize, implement and integrate different business processes. And, not less important, the top management support is critical to the success of ERP projects. Furthermore, most important decisions about ERP projects include not only the business knowledge to support the elicitation of ERP requirements, but also the balancing of those benefits to the organization with their implementation risk and cost. Another important aspect concerns the ERP implementation strategy, which includes the decision on the ERP modules that should be considered in each implementation phase. The term application can refer to a standalone or legacy system or ERP application. An ERP application generally refers to one of several applications or modules within an ERP software system. As the enterprise application integration is based on ensuring consistent information across different information systems and database architectures, that concept will be considered as part of another cluster. The strategy of companies should guarantee the success of implementation of new modules or systems, the configuration or the personalization of installed modules or systems. The top decision-makers must balance the benefits, cost and risks associated with each option within a certain ERP system context, because it may guarantee a better competitiveness of the company and increase the efficiency of its business processes [19]–[21].

Cluster 3 is identified by the blue colour at Fig. 1. The terms "theory”, “time”, and “change” appear with the highest number of occurrences at this cluster. The terms with the highest relevance are “routine”, “workaround” and “rule”. The terms “business process management” and “routine” also appear as part of this cluster. This cluster aggregates concerns around the study of business processes and efficiency. Nowadays, the change and optimization of business processes in different business areas is anchored in information systems, especially in ERP systems. Different theories present new ways of working and managing processes, supporting the creation of new routines and rules that make business processes more efficient. The publications that support this cluster correspond to studies where their authors theorize about new business models and the resources that are needed to manage in companies. Business models have been developed from empirical data gathered through extensive research. Business models must follow pragmatic and empirical guidelines and procedures to coordinate company resources and processes to achieve objectives efficiently and effectively. Business models can then be based on interdependent relationships between business partners to build networks of partnerships that allow the development of new products. ERP systems play a crucial role in collecting, storing, and using business data. The focus of this cluster is to value and improve the role of the ERP system for the organization, trying to understand how the business processes, practices and work routines and the established information content can be tuned with the support of the ERP system in order to maximize the achievement of higher levels of organizational performance [22]–[26].

The cluster 4 is identified by the yellow colour at Fig. 1. The terms with the highest number of occurrences are "critical success factor", "erp implementation" and "enterprise" and the terms with more relevance are "erp implementation", "successful implementation" and "implementation process". This group is basically related to the implementation of ERP systems, some of these specific to SME. The degree of success of an ERP implementation depends on the perspective of who measures it. It can be measured using two approaches. On the one hand, objective financial measures such as company costs and profit figures can be used. On the other hand, self-reported subjective measures of ERP success can also be used [27]. A significant number of publications that support this cluster focus their attention on the different agents involved in the implementation process, for example, end users. End users bring their essential business knowledge to the project, enabling better implementation. In addition, it is very important to get user satisfaction, so the adoption of the ERP system is maximized. And while successful implementation is very important, ERP adoption, a different matter, is no less vital. Implementation is the hands-on process of putting the technology in place. Adoption, on the other hand, is the full acceptance and continued use of the solution by its users. In fact, it is not just an implementation issue, it's also an adoption issue. Finally, the discussion around Critical Success Factors (CSF) over the past decade is another valued issue at this cluster. New factors that are more in tune with the current reality of emerging organizations are investigated and deepened. Recent studies suggest for new factors that should be considered important in the adoption of ERP. Those publications highlight important factors, as the selecting an ERP system that meet the requirements of the organization, the awareness, or the involvement of collaborators during the whole process of implementation and post-implementation phases. The risks inherent in the adoption of ERP systems are also addressed, through the assessment of project management, its execution and the relationship and communication between IT teams and end users [28]–[32].

The cluster 5 is represented by the pink colour at Fig. 1. The terms with highest number of occurrences in this cluster are "decision", "supplier" and "order" and the most relevant terms are "retailer", "accounting benefit" and "supplier". This cluster is mainly focused on the selection, support, and maintenance of the ERP system. It is important to understand how suppliers can solve business problems through the ERP system. The offer in the market is varied and extensive, and it is important for organizations to make good choices of ERP providers, which must adapt as best as possible to their needs. The decision and the selection of a supplier or an implementer is a complex process that should balance the ERP solution and the provider characteristics. Providers have been suggesting new solutions through ERP implementations that seek to improve organizational efficiency, each with a specific technical complexity, a certain time required and with a total cost of ownership. Solutions for different business models within a specific product and the characteristics, qualities, limitations, and opportunities of ERP adoption are discussed. In addition, the promises and risks surrounding a vendor selection, their technical and functional capacity to implement and support the solution, as well as the end users, must also be valued. It is therefore important to identify the different tangible and intangible factors around a decision about an ERP implementation and a provider selection. On one hand, understand the ERP solution usability, privacy, and security offered. On the other hand, the researchers underline factors for evaluating and selecting suppliers and their impacts on implementation and adoption [33], [34].

Cluster 6 is represented by the light blue colour. Its terms with the highest number of occurrences are "integration", "manufacturing" and "big data". The terms with more relevance are "business intelligence", "big data" and "manufacturing". The success of ERP depends on ensuring good management of organizational resources, integration of data and systems and sharing of knowledge among professionals. This requires a holistic view on processes, an end-to-end (E2E) perspective. E2E process improvement is a matter of building and improving processes across the value chain and embedding flow into company structures, collaborative processes, and daily routines. It is about connecting and automating processes across people, systems, and devices, usually known as process orchestration. The management of these conflicting approaches to success within large-scale organizations is known as Enterprise Architecture (EA). An important part of EA is called application architecture, the framework with all the software modules and components, internal and external systems, and the interactions among them that constitute an application, linking core services, such as middleware and databases. A well-structured application architecture includes big data tools and supports an effective implementation of a business intelligence strategy. Holistically defined processes ensure agility and a positive and beneficial effect on organizations. Organizations must create and develop a very strong organizational culture that promotes the development of knowledge and the sharing of information and knowledge among users. This organizational culture is one of the essential factors for the successful adoption of ERP systems, duly integrated with other complementary systems, very common at the shop floor level. Organizations need to continuously invest in the adoption, implementation, and integration between different systems. Decision-making processes can be improved using it tools. It is essential to evaluate the different tools so that we can select and buy the software that meets the requirements of organizations. These tools are strategic and increase the competitiveness of companies and their integration is essential to boost business. It is important to understand how technological and applicational innovation aims to optimize and make the work more efficient and guarantee the competitiveness [35]–[42].

5. A systemic framework for Enterprise Resource Planning systems

The previous bibliometric analysis identified six clusters of ERP major concerns [2]. These clusters were used as the pillars of a systemic framework proposal for Enterprise Resource Planning systems. Each cluster was used as an area of the field of Enterprise Resource Planning systems, identified with the main concepts around it. The proposed framework provides a cohesive picture of the subject and field of ERP systems for academia and industry.

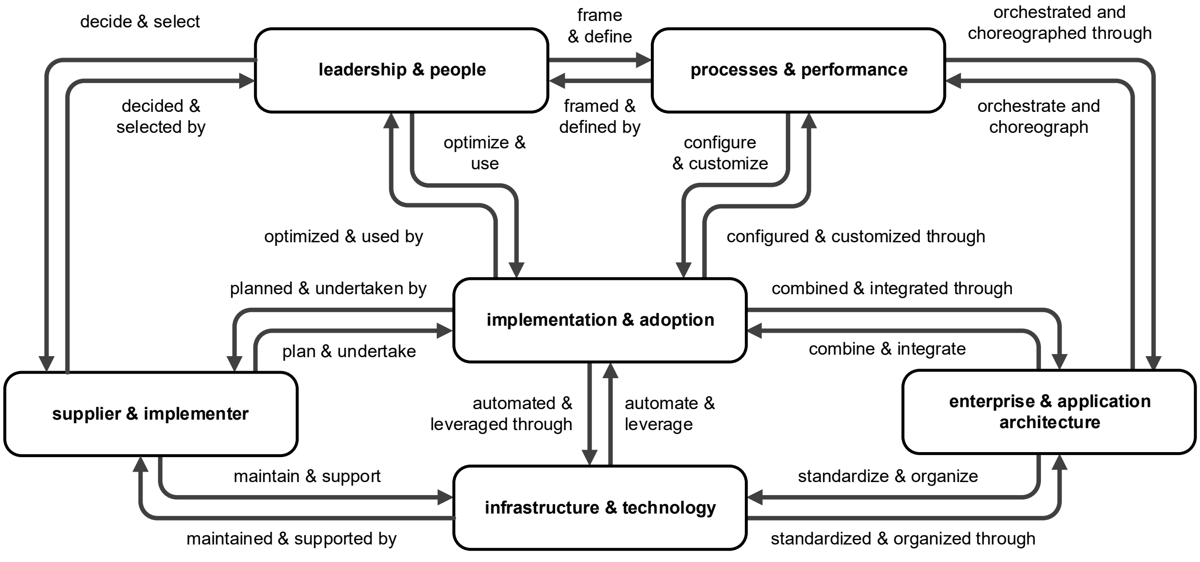

Fig. 2. Systemic Framework for ERP systems.

Using the six identified clusters, the proposed framework has six main areas for the field: (1) infrastructure & technology, (2) leadership & people, (3) processes & performance, (4) implementation & adoption, (5) supplier & implementer, and (6) enterprise & application architecture. Fig. 2 presents the proposed systemic framework with these six areas and their main relations. The main relations between these six areas were identified from the main links visible in the bibliometric map and were deeply analysed and articulated in the previous session. Other relationships may exist, but this framework represents the ten most important ones.

The infrastructure and technology area is the foundation and is represented at the bottom of the framework. This area covers basic physical and organizational structures and facilities that are necessary to support the operation of the ERP system. This may include general infrastructures, as buildings, power supplies and air conditioning, or specific information and communication technologies (ICT) infrastructures, as hardware, applications, and networking. The infrastructure and technology area relates to three other areas.

Infrastructure and technology automate and leverage implementation and adoption. According to experts, hyper-automation is unavoidable and irreversible. Everything that is automatable and ought to be automated will be. Organizations with ERP installed and being used as a digital data transmission fabric will profit from this trend.

Infrastructure and technology are maintained and supported by suppliers and implementers. Implementation and adoption are also planned and undertaken by suppliers and implementers. For example, deciding whether to install cloud ERP or on-premises ERP is a crucial decision. Historically, businesses have prioritized specific Golden Triangle aspects when providing IT services (People first, Processes second and Technology third). Today, everything has undergone a revolution thanks to internet and cloud services, and partners have entered the picture. Organizations can create value without necessarily turning into a technology firm thanks to third-party partners and suppliers.

Infrastructure and technology are standardized and organized across enterprise and application architecture. Implementation and adoption are also combined and integrated through the enterprise and application architecture. Organizations standardize and organize their IT infrastructure through enterprise architecture (EA) process to align it with their corporate objectives. To improve the compatibility of IT components and to integrate applications and data across the enterprise, organizations create enterprise architecture, and specifically, application architecture standards.

The area of implementation and adoption is positioned at the core of the framework. Processes and business performance goals help configure and customize the implementation and adoption. ERP configuration and customization are two methods for adjusting an ERP system to business needs and processes. It is essential to have a thorough grasp of objectives, challenges, and expectations of the organization before customizing or configuring an ERP system. Depending on requirements, the need may be to customize (modifying the source code or adding new code) or to configure (adjusting the settings and options to match preferences and processes) the ERP system, or both.

The leadership and people area and the processes and performance area are two key areas and are represented at the top of the framework. Leadership and people frame and define processes and performance, uses, and optimizes the implementation and adoption and decides and selects the suppliers and implementers. Project team is a key success factor for a successful ERP project. Additionally, organizational culture, embracing learning and growth, participatory decision-making, power sharing, comprehensive and cross-functional communication, and tolerance for risk and conflict, influences the effectiveness of ERP adoption. The success of an implementation and adoption, processes and performance management or third-party partners and suppliers' relationship is also much influenced by the strategic and tactical actions that senior management can take to impact and promote the desired culture and business operation.

Finally, processes and business performance are orchestrated and choreographed through the enterprise architecture and application architecture. Two facets of managing business processes are referred to as orchestration and choreography, respectively. From one party's perspective, orchestration is always a form of control. Contrasted with choreography, which is more collaborative and gives each side a chance to explain their role in the interaction, this is different. The message sequences between various parties and sources are tracked by choreography.

6. Conclusion

The main objective of this article was to present a systemic framework for Enterprise Resource Planning systems based on a bibliometric analysis in the context of a systematic literature review on major concerns about ERP previously made. Based on 126 eligible publications, it was possible to obtain important results on the publications of the last decade (2011-2021) and develop a systemic framework. Through the information obtained from these publications, the relevant terms were organized into six clusters. These clusters reveal the most important areas addressed in the most important studies on ERP systems. Terms with the highest number of occurrences were critical success factors, technology, relationship, and the most relevant terms are routine, workaround, rule. There is clearly a preference at the academia to study the implementation of ERP, having as focus the critical success factors through case studies, where they can show the impact, opportunities, and challenges of implementation. For this reason, this area is represented at the centre of the proposed framework.

This systemic framework provides a cohesive picture of the subject and field of ERP systems. It enhances most important areas and relations between these areas. The framework reveals a distinct dynamic between six different areas and can be very comprehensive. The ERP system must be understood from a global perspective and an integrated vision. This proposed framework has practical implications for academia and industry. Through this framework, it is possible to understand how ERP systems work and relate to their environment, namely with other diverse information systems. From an academic point of view, it helps to deepen even more some organizational and technical aspects inherent to the different enterprise components and how this dynamic can be optimised. The framework serves as a forum for talking about problems in the field of ERP systems. How does a case study relate to the framework when it is being used and discussed for the field? Therefore, the systemic framework seeks to be a means of fostering and developing a broad perspective on ERP systems, independent of subject or problem. From the point of view of organizations, this framework will help managers, executives, and implementers to have of an integrated and holistic view of ERP systems. It will help them to manage business processes through the ERP system and its integration with other systems and data sources. It may help to frame the investment in information systems, so they may help increase performance and better integrate with different other applications in an optimized and cohesive enterprise architecture vision that guarantees the collection and processing of data across different areas of activity, thereby benefiting the business processes and organizational performance. It may also help companies to define their strategies concerning the ERP implementation, better aligning business with technology. New business models emerge, which requires greater care in the implementation of ERP systems, making it clear that there are different factors for a successful implementation of ERP systems. The choice of ERP supplier and implementer remains fundamental, as a wrong choice of supplier can have immeasurable costs for the company in terms of financial, technical, or human resources.

This article was limited by data previously obtained in the systematic literature review on major concerns about ERP [2]. This article offers a global and systematic perspective on the studies that have already been published, analysing, and understanding the most relevant terms that elucidate what has been the focus of researchers in recent decades. Through a bibliometric analysis it was possible to propose a systemic framework, explaining the dynamics of different areas of ERP systems.

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