ERP Adoption and Use in Production Research: An Archival Analysis and Future Research Directions

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Abstract. The enterprise resource planning (ERP) adoption and use phenomenon has attracted much of the attention of production researchers over the last two to three decades. Through a systematic literature review, the purpose of this paper is to conduct a detailed examination of the investigation of ERP adoption and use in production research, more specifically. The paper provides a synthetic view of the various research approaches and designs having been used and presents an overview of the studied: vendors/systems, ERP deployment types, implementation outcomes, benefits, critical success factors, risk factors and effects based on identified 61 articles. Further research directions are proposed including the urgent need for researchers to examine ERP implementation with regards to IoT, big data analytics, machine learning and blockchain. The contribution of this study lies in the provided taxonomy, the detailed description of classifications, the adopted methodology, and the identification of research gaps.

Keywords: ERP · Adoption and use · Literature review · Research agenda

1 Introduction

Running a business today is more and more difficult, especially with the evolving environment, the constant search for efficiency, and the more and more complex integration of sophisticated technologies. To manage a company effectively, the implementation of an Enterprise Resource Planning (ERP) system seems to be a logical and straightforward solution, provided it is wisely used. However, despite the promise of a high operational and strategic impact (if a sound business process analysis is performed), it remains challenging to easily familiarize with the use of ERPs (in order to manage computerised data exchanges) and to integrate software packages within them. As a result, ERPs have gradually become an important focus for a number of academic and corporate investigations over the past two to three decades. The existing literature on this subject has attributed several qualifiers to ERPs: the 'most strategic and most valuable tool with which to develop and improve a firm's competitiveness'

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(p. 94) [1]; the 'single biggest information technology (IT) investment an organisation can make' (p. 1037) [2]; a 'link through the entire supply chain aimed at best industry and management practices' (p. 537) [3]; the 'most widely accepted choices to obtain competitive advantage' (p. 397) [4]; and even the 'most difficult system development projects' (p. 1236) [5]. The rationale behind such statements is that ERPs have thoroughly transformed modern-day businesses. Not only have they improved coordination and task efficiency [6] while standardising the flow of management information [1], they also have been able to provide a total integrated solution for the organisation's information-processing requests [2] and to facilitate inter-firm relationships [7].

According to [8], the global ERP market is expected to reach $41.69 billion by 2020, with manufacturing & services being the highest revenue generating segment. Also, forecasts indicate that new business functions and on-premise deployments will be the highest income generating segments shortly. North America is also forecast to be the highest revenue generating geographic region. According to Panorama's annual independent analysis of the titans of the ERP market from October 2015 to November 2016 [9], the distribution industry represents 35% of the ERP market, followed by the manufacturing industry (29%) and the education sector (23%). They are mostly used by organisations with at least $50 M in annual revenue. A total of 17% of the companies tend to implement ERPs to improve business performance, 14% to ensure compliance, 14% to make employees' jobs easier, and 13% to better integrate systems across locations. An important number of organisations (67%) implement on-premise ERPs, 27% implement them on demand (SaaS), and only 6% implement cloud-based ERPs. This limited implementation of cloud-based ERP solutions is mainly due to the perceived risk of data losses (72%) and security breaches (12%). 70% of organisations are reported to have customised 26–50% of the software code in their ERPs. 27% hired consultants to manage implementation, 22% to provide organisational change management support, and 19% to conduct unbiased software selection. While more than 70% of organisations focused on organisational change management, about 75% improved all their business processes. Despite the overall excitement and interest in ERPs at all levels, little effort has been done to organise the large bulk of ERP literature in a way that can facilitate research and enable a better understanding of the role of ERP systems in production. Thus, the purpose of this study is to provide an overview of our current body of literature on ERPs and to propose a structured classification framework that accurately depicts the state of ERP adoption and use research in production. The research objectives are set as follows:

1. Develop a classification framework to categorise the articles dealing with ERP adoption and use in production research;
2. Use the classification framework to classify and summarise all relevant articles;
3. Propose future research directions where the implementation and deployment of ERPs are likely to have significant impacts.

In the following section, we present the research materials and implemented research method. The results are then presented in a subsequent section. Finally, the results are discussed while we present their implications for research and practice, and provide future research directions.

2 Methodology

The methodological approach adopted for this study is a systematic literature review. The review process was developed based on those used by [10] on Big Data, [11, 12] on ERP-related topics. The review process consisted of three steps: (i) developing a classification framework; (ii) conducting the literature review; and (iii) classifying and analysing the relevant journal articles. This classification framework focuses on journal articles dealing with topics related to the adoption and use of ERP in supply chain, production, and manufacturing. Specifically, seven dimensions related to ERP were used to build the framework: (i) research approach; (ii) system vendor; (iii) deployment type; (iv) implementation outcome; (v) benefits; (vi) risk factors and effects; and (vii) critical success factors. In this study, research approach refers to the *plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation* [13]. System vendor refers to the enterprise that manufactures or sells ERP systems or software. Deployment type refers to the hosting option chosen by a company using ERP functionalities to streamline operations. Implementation outcome refers to the effects of deliberate and purposive actions to implement ERP systems [14]. Benefits refers to the added value an organization expects or perceives after an ERP investment. Risk factors and effects refers to factors that create uncertainty in the ERP environment, the effects they may have on the organisation and the decisions made thereafter. Critical success factors refer to the key areas that management needs to focus on to achieve ERP performance goals. A broad literature search was conducted during the month of October 2017 looking for research articles having used the terms *ERP* or '*Enterprise Resource Planning*' in their body. This search was restricted to the International Journal of Production Research because the authors considered it to be highly representative of the research conducted on ERPs in the field of production. Given the journal's fame and age, it is one of the oldest and most cited journals in the domain. At the end of the search, a total of 321 articles were selected, the abstracts and references of which were downloaded into EndNote reference management software while their full texts were downloaded into a computer for sorting, leading to the identification of 61 relevant articles for this study. Articles deemed irrelevant were discarded; and this was the case when ERP was not the main theme of the article or when it was cited superficially. The 61 articles were then classified into the seven dimensions of the framework. The classification process was rigorous but rather subjective. However, each author individually pegged each article into the framework dimensions, while disagreements were discussed during work sessions. Classification disagreements were resolved through votes. After justification, the authors voted on disagreements and the highest vote won. If there was a tie, the final decision was made by the principal investigator.

3 Results

Figure 1 and Table 1 show that publications on ERP adoption and use in production research only started in 1999 with 1 article. In 2002, 5 publications on the topic were recorded, accounting for 8% of the total number of articles reviewed in this study. After

a slight decrease in 2003 and 2004, an increase in publication volume was observed in 2005, with 7 articles published in the domain. The highest number of articles was recorded in 2007 (9 articles), which dropped significantly until 2012, where it stood at 8 articles. Since, then, the number of publications in the domain has dropped to 1 article by the end of 2016.

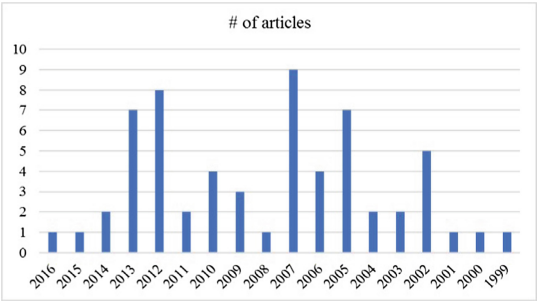

Fig. 1. Year of publication

As shown in Table 1, 28% (17 of 61 articles) of publications on ERP adoption and use relied on a using mixed methods design. 21% of the articles (13) were conceptual while 20% (12 articles) adopted a non-conventional approach (e.g., ethnography, living laboratory…). Authors of 11% of articles (7) used case studies, 8% (5 articles) used literature reviews and experiments, and only 3% (2 articles) approached the topic using surveys.

Table 2 reveals that 74% (45 articles) of the reviewed articles do not focus on any specific ERP, as they only address general issues in relation to ERP and production. However, 15% (9 articles) focus on SAP systems, and 3% (2 articles) focus on Oracle ERPs. Also, 8% (5 articles) of the publications focus on several ERPs for reasons such as comparison or integration. Of the 16 articles that addressed specific ERPs, 13 of them (21% of the total number of articles reviewed) focused on ERPs deployed on premises (Table 3). Two articles (3% of the total number of articles reviewed) dealt with software as a service (SaaS) ERPs, and only one (2% of the total number of articles reviewed) was about cloud-based ERP systems.

ERP benefits were classified (Table 4) according to the acknowledged framework developed by [74]. The analysis revealed that, operational ERP benefits are the most represented (28%) in production research than any of the other benefits. The most prominent operational benefits are cost reduction (8%), productivity improvement (8%) and customer service improvement (7%). Managerial benefits are the second most important category, accounting for 19% of the total number of identified ERP benefits, the most represented benefits being improved decision making and planning (8%) and performance improvement (8%). Strategic benefits (8%), IT infrastructure benefits (4%) and organisational benefits (4%) benefits were the least represented categories.

Table 1. Classification by research approach

Research approaches	Articles	# of articles	%
Mixed methods (e.g. survey + case study)	[15] survey + simulation model; [16]; [17]; [18]; [19]; [20]; [21]; [22] survey + SEM; [23] survey + SEM; [24] Theoretical model & case study; [25] Theoretical model & case study; [26] Formal method + case study; [5] Model + illustrative example; [27] Framework + case study; [28] Framework + case study; [29] Framework + simulation study; [30] Model + case study	17	28%
Conceptual	[31]; [32]; [33]; [34]; [35]; [36]; [37]; [38]; [39]; [40]; [41]; [42]; [43]	13	21%
Others (e.g., ethnography, living laboratory)	[44] literature review + interviews; [45] 'collaborative project between academia and industry'; [46] 'performance evaluation model' + empirical analysis; [47] Algorithm creation + real data test; [48] New framework + numerical example + extensive analysis; [49] Discusses the limitations of SCOR analysis + case study; [50] Ontology and semantic integration in SAP ERP; [51] Fuzzy AHP methodology + case study; [52] Guidelines + case studies as examples; [53] Algorithm creation + case study; [54] Field study; [55] Two-stages approach: development of model & numerical simulation	12	20%
Case study	[56]; [57]; [58]; [59]; [60]; [61]; [4]	7	11%
Review	[62]; [63]; [64]; [65]; [66]	5	8%
Experiment	[67] model + simulation experiment; [68] model + simulation experiment; [69] model + simulation experiment; [70]; [71] simulation experiment	5	8%
Survey	[72]; [73]	2	3%
	Total	61	100%

Note: The texts correspond to the elements referred to in the citation. Each article and corresponding texts are separated by a semicolon. Only articles that need precision have texts next to them

The well acknowledged risk factors and effects framework from [75] was used to analyse our pool of research outlets. Articles were classified in terms of both identified risk factors (Table 5) and risk effects (Table 6). Table 7 regroups risk effects into 'macro' risk classes. The main ERP risk factors that were identified include inadequate change management (8%), inadequate selection (7%), low top management

Table 2. Classification by ERP vendor/system

ERP vendor/system	Articles	# of articles	%
Generic (N/A)	[31]; [24]; [32]; [15]; [16]; [43]; [62]; [67]; [18]; [44]; [63]; [34]; [64]; [68]; [56]; [29]; [35]; [45]; [36]; [37]; [26]; [20]; [65]; [69]; [46]; [71]; [21]; [47]; [48]; [66]; [49]; [39]; [40]; [41]; [22]; [51]; [52]; [70]; [42]; [72]; [60]; [61]; [27]; [28]; [23]	45	74%
SAP	[25] SAP R/3; [38] SAP R/3; [50]; [58]; [53]; [5] SAP R/3; [59]; [55]; [30] SAP[2]	9	15%
Several	[19] SAP R/3, Mfg-PRO, BAAN; [4] Microsoft Navision, SAP, Infor ERP system, Exact Globe ERP; [73] BOPSE, SAP; [54]; [17] SAP, Oracle, Baan, SSA, QAD/MFG PRO, JD Edwards	5	8%
Oracle	[33] Oracle database, RDBMS, Developer/2000; [57]; Oracle AIM	2	3%
	Total	61	100%

Note: The texts correspond to the elements referred to in the citation. Each article and corresponding texts are separated by a semicolon. Only articles that need precision have texts next to them.

involvement (7%), inadequate BPR (7%), ineffective consulting service (5%), and inadequate IT system use (5%). The corresponding risk effects include budget exceeds (10%), poor business performance (8%), time exceeds (7%), project stop (5%), and low degree of integration and flexibility (5%). The classification by macro-level risk classes revealed that process failure, interaction failure and correspondence failure each make up 11% of the risk effects, while expectation failure accounted for 8%.

Table 3. Classification by deployment type

ERP deployment type	Articles	# of articles	%
On-premise	[17]; [25]; [56]; [19]; [57]; [58]; [59]; [28]; [53]; [5]; [30]; [55]; [4]	13	81%
SaaS	[33] P: 2610–2611: 'client/server structures', 'software application'; [27] P: 145/146: 'ERPoutsourced process'	2	13%
Cloud-ERP	[36] p5126: 'web-based ERP component'	1	6%
	Total	16	100%

Note: The texts correspond to the elements referred to in the citation. Each article and corresponding texts are separated by a semicolon. Only articles that need precision have texts next to them

Table 4. Classification by benefits

Benefits	Sub benefits	Articles	# of articles	%
Operational	Cost reduction	[67]; [69]; [48]; [72]; [5]	5	14%
	Cycle time reduction	[24]	1	3%
	Productivity improvement	[57]; [45]; [19]; [5]; [4]	5	14%
	Quality improvement	[19]; [16]	2	5%
	Customer services improvement	[43]; [67]; [45]; [57]	4	11%
Managerial	Better resource management	[43]; [16]	2	5%
	Improved decision making and planning	[56]; [35]; [45]; [47]; [4]	5	14%
	Performance improvement	[20]; [39]; [22]; [5]; [16]	5	14%
	Support business growth	[4]	1	3%
	Build business innovations	[22]	1	3%
Strategic	Build cost leadership	[19]	1	3%
	Build external linkages (customers and suppliers)	[38]	1	3%
IT infrastructure	Build business flexibility for current and future changes	[22]	1	3%
	Increased IT infrastructure capability	[47]	1	3%
Organizational	Support organizational changes	[17] 1	1	3%
	Empowerment	[5]	1	3%
	Total		37	100%

Table 8 classifies the selected articles by critical success factors based on the factors identified by [44, 46]. 23% of the articles identify business process reengineering (BPR), system integration, and minimum software customization as critical success factors for ERP implementation projects. System flexibility and expansibility, and cross-department and cross-region application, are also regarded as critical success factors in 10% and 8% of articles respectively. The following factors was identified by exactly 7% of the reviewed articles: change management program and culture; compatibility between application structure and database; the professional capacity of consulting companies; project management; service quality level of consulting companies; support of top management; and training quality improvement.

Table 5. Classification by risk factors

Risk factors	Articles	# of articles	%
Inadequate change management	[16]; [34]; [45]; [51]; [72]	5	13%
Inadequate selection	[16]; [44]; [5]	4	10%
Low top management involvement	[44]; [34]; [46]; [72]	4	10%
Inadequate BPR	[17]; [45]; [46]; [5]	4	10%
Ineffective consulting service	[56]; [19]; [5]	3	8%
Inadequate IT system use	[16]; [44]; [46]	3	8%
Poor team skills	[16]; [44]	2	5%
Ineffective communication system	[44]; [46]	2	5%
Inadequate training and instruction	[56]; [21]	2	5%
Complex architecture and high number of implementation modules	[34]; [45]	2	5%
Inadequate IT system maintainability	[44]; [56]	2	5%
Low key user involvement	[72]	1	3%
Bad managerial conduct	[44]	1	3%
Ineffective project management techniques	[44]	1	3%
Inadequate legacy system management	[16]	1	3%
Poor leadership	[44]	1	3%
Inadequate IT supplier stability and performances	[16]	1	3%
	Total	39	100%

Table 6. Classification by risk effects

Risk effects	Articles	# of articles	%
Budget exceed	[16]; [44]; [56]; [45]; [71]; [21];	6	24%
Poor business performance	[17]; [19]; [46]; [48]; [22]	5	20%
Time exceed	[44]; [56]; [45]; [21]	4	16%
Project stop	[16]; [45]; [4]	3	12%
Low degree of integration and flexibility	[48]; [40]; [51]	3	12%
Bad financial/economic performance organisation	[40, 48]	2	8%
Low organisation and process fitting	[48]	1	4%
Low strategic goals fitting	[48]	1	4%
	Total	25	100%

Table 7. Classification by risk effect macro-classes

Risk effects – Macro-Classes	Articles	# of articles	%
Process failure	[16]; [44]; [56]; [45]; [71]; [21]; [4]	7	27%
Interaction failure	[17]; [19]; [46]; [48]; [22]; [40]; [51]	7	27%
Correspondence failure	[17]; [19]; [46]; [48]; [22]; [40]; [51]	7	27%
Expectation failure	[17]; [19]; [46]; [48]; [22]	5	19%
	Total	26	100%

Table 8. Classification by critical success factors

CSF	Articles	# of articles	%
BPR, integration, and minimum customization	[31]; [16]; [17]; [44]; [34]; [64]; [36]; [46]; [57]; [66]. [49]; [39]; [51]; [52]	14	15%
System flexibility & expansibility	[24]; [17]; [36]; [46]; [66]; [39]	6	7%
Cross-department & cross-region application	[16]; [67]; [64]; [20]; [46]	5	5%
Change management program and culture	[24]; [16]; [44]; [28]	4	4%
Compatibility between application structure & database	[16]; [67]; [34]; [46]	4	4%
Professional capacity of consulting company	[31]; [16]; [46]; [72]	4	4%
Project management	[31]; [16]; [44]; [38]	4	4%
Service quality level of consulting company	[16]; [46]; [5]; [76]	4	4%
Support of top management	[16]; [44]; [46]; [72]	4	4%
Training quality improvement	[34]; [56]; [46]; [39]	4	4%
Adjustment of the internal organisation structure	[46]; [66]; [54]	3	3%
Software development, testing, and troubleshooting	[44]; [5]; [25]	3	3%
Cost of implementation	[56]; [47]; [72]	3	3%
Information quality	[65]; [5]; [76]	3	3%
Business plan and vision	[16]; [44]	2	2%
Communication with consulting company	[46]; [5]	2	2%
Development of ERP implementation strategies	[64]; [46]	2	2%
Implementation rationality checking	[24]; [46]	2	2%

(*continued*)

Table 8. (*continued*)

CSF	Articles	# of articles	%
IT system quality of the supplier	[46]; [65]	2	2%
Project champion	[16]; [44]	2	2%
System capability	[17]; [46]	2	2%
Technology alignment with business processes and needs	[34]; [45]	2	2%
Choice of software & vendor	[19]; [76]	2	2%
Monitoring and evaluation of performance	[44]	1	1%
Improvement of personnel cooperation and adaptation	[46]	1	1%
Objective management	[46]	1	1%
Teamwork and composition	[72]	1	1%
Implementation time and ROI	[56]	1	1%
Proper resource allocation	[45]	1	1%
System usefulness	[65]	1	1%
Capacity of internal IT personnel	[54]	1	1%
	Total	91	100%

4 Discussion

The first direct observation that can be made from this literature review is that journal publications on ERP adoption and use started in production research by 1999 and became very popular in 2007. Following a rather constant decrease during the four subsequent years, another peak of publications occurred in 2012 and 2013. Given that this study is based on a single journal, it is possible that this contradictory development in the results is due to number of publications accepted by the journal each year. With the proliferation of articles on ERP, many journals became more critical about the articles they accept on the topic to avoid redundancies.

Most of the studies on the topic were conducted using a mixed-methods approach. This research design has the benefit of being able to address confirmatory and exploratory research questions simultaneously and provide stronger inference than a single method [77]. The application of this approach in the study of ERP adoption and use in production research, has helped to develop a deep understanding and to inductively generate new theoretical insights on the subject. The identified articles having relied on such approach opted for a combination of surveys with simulations, case studies and structural equation models (SEM). Others combined frameworks and models with simulations, illustrative examples and case studies. Conceptual papers were the second most represented category. Such studies typically aimed at focusing on identifying and defining ideas related to the topic, thus helping the readers to better understand the principles or generalizations regarding different aspects of ERP

adoption and use. A number of papers relying on less 'conventional' approaches such as algorithm creation, performance evaluation models, and fuzzy AHP methodology, were also identified.

Most of the literature that was reviewed did not focus on specific ERP vendors or systems. This may be attributed to the fact that most papers concentrated on factors affecting the adoption and use of ERP and its integration with production units irrespective of the vendor. However, among the articles dealing with specific ERPs, SAP ERPs were the most popular systems under investigation. There were also several publications on different ERP types, especially in the area of the integration of multiple ERPs into companies' production processes. Nowadays, organisations tend to prefer ERP systems to be deployed on-premise or on-demand (SaaS). In this review, most of the ERPs that were studied relied on on-premise deployment even though on-demand solutions have become trendy and very cost-effective compared to on-premise solutions. Data security and customization have remained major concerns regarding the implementation of on-demand solutions [78, 79]. Therefore, the choice to integrate production processes through either on-premise or cloud-based ERPs has remained a matter of business priorities between high levels of customization and security (on-premises) or low operational cost (SaaS) [80].

Most of the reviewed papers did not focus on the implementation outcomes of ERPs in production, addressing only other aspects such as requirements, selection, adoption, integration, and planning. However, all the publications that provided information on ERP implementation clearly indicated positive outcomes in terms of implementation. The main implication that can be drawn from such result is that there is to date no research on failed ERP projects in production. Research efforts in this area need to be encouraged and welcome as they could provide important insights about the other side of the ERP implementation coin.

Our results fully corroborate with [81] who found that the benefits of ERP adoption and use in production are mostly operational and managerial, and that there were no significant benefits in terms of IT infrastructure and organisation. The main operational benefits include product improvement, cost reduction, and customer service improvement. ERPs are very instrumental in Product Lifecycle Management (PLM), providing operational benefits as indicated above [82]. There are also managerial benefits such as performance improvement and improved decision-making planning. ERP vendors today have started adding business intelligence (BI) capabilities to their ERP systems to meet the needs of companies who seek to make the most of their data [83]. This adds substantial value to ERPs since this allows the access of information on production processes directly from ERP modules and provides performance insights in real time [84].

When analysing the risk factors and effects of ERP adoption and use, six main risk factors were recurrently observed: inadequate change management, inadequate ERP selection, low top management involvement, inadequate Business Process Reengineering (BPR), ineffective consulting service, and inadequate IT system use. These factors lead mostly to process, interaction and correspondence failures. The main effects of these risks on a company range from budget exceed, poor business performance and time exceed to project stop and low degree of integration and flexibility. Further studies could be carried out based on these results to more clearly identify the existence of dependencies between these factors [75]. In this study, the most

Table 9. Future research questions for ERP studies

ERP research streams	Relevant theories	Future research questions for ERP in production research
Strategy, culture, leadership, and organization	Resource based theory [89], Competitive strategy [90], dynamic capability theory [91]	How can organizations ensure business alignment, ERP and strategic analytics in the emerging data economy?
		Which ERP architecture will lead to the competitive advantage in the IoT landscape?
		How can organizations develop capabilities in IoT, big data, machine learning and blockchain to leverage digital transformation?
		How can dynamic analytics capabilities be developed using big data to address uncertainty?
Information systems and technology management	Transaction cost theory [92, 93]	What are the key issues related to the design of various interfaces between ERP and IoT-enabled connected devices?
		What is the impact of ERP on lean operations and quality management?
		How can organizations better use insights from ERP and relevant analytics to achieve operational excellence?
		What is the impact of ERP and analytics in various sectors (e.g., healthcare, retail industry, and manufacturing)?
Data quality, cloud infrastructure, privacy and security, blockchain	IT quality theory [94], IS success theory [95, 96], Sociomateriality of IT [97]	What factors influence governance, security, and privacy in the next generation ERP?
		How can a firm leverage ERP to generate, acquire, transform and integrate big data?
		How can a firm leverage a cloud-based platform to produce data and business value?
		How ERP can be used to develop data-driven innovations?
		Should firms continue with the dominant onpremise ERP strategy or move toward ERP as SaaS or a cloud-based ERP system?
Overarching value	IT business value [98], business value of analytics [99]	How do ERP-integrated analytics, machine learning and blockchain influence each other to enhance competitive advantage?
		How do organizations deal with ERP implementation to diversify themselves?
		How do organizations capitalize on ERP to extract value?
		What factors influence ERP implementation at different stages?

represented critical success factors (CSF) are BPR, integration and minimum customization, and system flexibility and expansibility. Indeed, BPR, system integration, and customization are well-known CSFs in ERP implementation [85, 86]. However, system flexibility and expansibility do not appear in a majority of ERP CSF frameworks. This highlights their rather ignored but particular importance in the specific context of production processes.

5 Conclusion and Future Research Directions

There remains a number of limitations that need to be taken into consideration. One is that the study is based solely on articles from the International Journal of Production Research. Our results thus provide a representative but imprecise depiction of ERP adoption and use research in the production field. Furthermore, despite the rigorous sorting of identified papers, their selection and classification remains subjective to some extent. The authors have done their best at mitigating the risks and biases that such relative subjectivity could engender.

Overall, this systematic review offers a clear overview of the current body of knowledge on ERP adoption and use in production. Firstly, this research contributes to research and management perspectives, emphasizing the importance of ERP adoption and use in production and enabling a better understanding of the role and impact of ERPs in production. Secondly, the study presents a general taxonomy for ERP adoption and use and identifies key elements that are relevant to production research. Finally, managers at all level are offered critical insights for the formulation and execution of ERP implementation strategies during operations. The proposed classification framework can be used by companies to address issues ranging from the selection of the right ERP system and the right ERP deployment type to the planning of risk management strategies. The research findings show that managers can implement ERP systems for production operations and have successful outcomes. This research work can eventually help managers to better grasp the most relevant benefits of ERP adoption and use, the related CSFs, and the associated risks to be overcome in the area of production.

Moreover, it is in the interest of managers and researchers to recognise the contribution of ERP systems in production and to assess changes in operational performance at both the modular and the system levels [87]. In fact, present-day ERP system can catalyse the application of lean production practices [88]. Some even suggest that managers should first adopt an ERP as the backbone of company operations before deploying any other enterprise systems (ES), such as SCM systems [81]. Thus, further research is needed on the adoption of modern ERPs to meet their operational requirements in other areas.

One of the major contributions of this paper is to set out a systematic review which results can be used by managers to improve ERP adoption and use in production environments. It shows the current state of research on the topic, proposing other research angles for future studies. Organizations could enjoy several operational and managerial benefits through the successful adoption and use of ERPs for production. They could leverage the information ecosystem created by ERPs to improve their

products and reduce cost through supply chain optimization and improved customer services. This study also identified many aspects of ERP adoption and use that can be explored in the area of production and beyond. For example, the development of a comprehensive conceptual framework is needed to fully and efficiently capture the business value that can be derived from the adoption and use of ERPs. Future research may also consider developing explanatory and predictive theories related to BPR, ERP deployment, performance, and decision-making process.

The contribution of this study lies in that it establishes a taxonomy of publications on ERPs in the domain of production, provides a detailed description of core aspects in this regard, and sets out an efficient methodology to be followed. Besides, it identified research gaps and proposed research questions. The review and developed taxonomy should serve as a starting point for the development of more up-to-date and improved insights on the topic. Legacy issues or areas having had limited attention, such as IoT, big data, machine learning and blockchain, are clearly identified and should be the focus of future research. Furthermore, the research perspectives highlighted in Table 9 can be extended and used in the development of a research agenda for future studies in this domain. We conclude by emphasizing the urgent need for more research efforts on ERP deployment types and implementation outcomes, as organisations need such information to replicate best practices and avoid pitfalls. This will be very useful for managers seeking to optimize organisational performance, competitive advantage, and business results during implementation.

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