Review

Integrating Analytics in Enterprise Systems: A Systematic Literature Review of Impacts and Innovations

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Abstract: Recent advancements in Enterprise Information Systems (EISs) have transitioned from primarily supporting operational and tactical processes to enabling strategic decision-making through integrated analytics. This systematic review critically examines global literature from 2010 to 2023, focusing on the factors influencing the adoption of analytical components in EISs and assessing their impact on strategic decision-making in organizations. Following the PRISMA 2020 guidelines, we meticulously selected and reviewed articles from the Scopus database, employing a robust taxonomy based on the technology–organization–environment (TOE) framework to categorize findings. Our methodology involved a thorough screening of 234 studies, leading to a final analysis of 45 peer-reviewed articles that met our stringent criteria. These studies collectively underscore a significant gap in organizational capabilities, notably in the business ecosystems surrounding EISs, which hampers the effective adoption and utilization of advanced analytics. The results highlight a distinct need for improved understanding and implementation strategies for integrated analytics within EISs to enhance strategic decision-making processes. This review identifies critical factors for integrating analytics into Enterprise Information Systems (EISs), emphasizing technological, organizational, and environmental dimensions. It highlights a significant gap in models guiding ERP systems with Business Intelligence (BI) capabilities and underscores the need for robust research to enhance strategic decision-making through analytics.

Keywords: enterprise system; ERP; CRM; SCM; enterprise information system; analytics; analytic embedded; data analytics; business analytics; business intelligence; big data analytics; adoption; use; TOE; TAM; DOI; UTAUT; TRA

1. Introduction

Enterprise Information Systems (EISs), such as Enterprise Resource Planning (ERP), are software packages that manage various business areas, including finance, accounting, inventory, human resources, procurement, sales, and production (Jenab et al. 2019). These systems enhance operational efficiency and decision-making by integrating processes and data into a single platform (Davenport and Harris 2007). Given their importance, ERP is the focus of this research. Modern enterprise systems like ERP, Customer Relationship Management (CRM), and Supply Chain Management (SCM) now integrate emerging technologies such as Business Intelligence and Analytics (BI&A) (Junior et al. 2019; Kyriakou et al. 2020). This literature review is essential to identify, evaluate, and interpret studies on the adoption of EISs with integrated BI&A due to the rapid technological advancements of the past decade. This will help identify knowledge gaps, understand adoption factors and frameworks, and guide future research.

The focus on ERP systems is justified, as they are the backbone of enterprise operations, integrating various business processes into a unified system. Unlike other tools for operation management, ERP systems offer a comprehensive solution that encompasses multiple functional areas, making them a critical subject for this review. Furthermore,
reviewing prior literature helps to identify existing research gaps, understand the factors influencing the adoption of these systems, and guide future research.

Additionally, diffusion and adoption theories, such as the Diffusion of Innovations (DOI) and the Technology Acceptance Model (TAM), are fundamental in understanding how new technologies spread and are accepted within organizations. This review delves deeper into these theories, examining their application to ERP and BI&A systems to provide a clear rationale for their relevance and importance in this context.

In today’s business landscape, profoundly shaped by rapid technological evolution and innovation, the integration of Enterprise Resource Planning (ERP) systems with Business Intelligence and Analytics (BI&A) has become pivotal in augmenting organizational performance and decision-making efficacy (Junior et al. 2019). This integration is instrumental in navigating the complexities of the modern business environment, where strategic agility and data-driven decision-making distinguish leaders from laggards.

Despite the acknowledged strategic value of these integrated technologies in fostering organizational competitiveness and operational efficiency (Ruivo et al. 2012b), challenges such as insufficient business maturity and underutilization persist. Addressing these challenges, this systematic literature review aims to dissect and enhance the understanding of the adoption dynamics and the consequent impacts of ERP and BI&A within diverse organizational contexts.

Leveraging the PRISMA 2020 framework, this review synthesizes insights from 234 scholarly articles, providing a comprehensive panorama of current research and identifying fertile grounds for future inquiry (Page et al. 2021). It draws attention to significant contributions in the domain, such as Chen et al.’s (2015) exposition on value creation through big data analytics in Supply Chain Management (Ruivo et al. 2012a) and exploration of ERP’s impacts on Iberian SMEs through theories such as Diffusion of Innovations and Resource-Based View (Ruivo et al. 2012b). This discussion is not merely academic; it reflects a broader trend toward leveraging advanced technological solutions for superior business process optimization and decision-making.

The review goes beyond mere adoption patterns, probing into the multifaceted impacts and challenges faced by organizations in assimilating ERP and BI&A. It critically examines prevailing theoretical frameworks like the Technological, Organizational, and Environmental (TOE) (Tornatzky and Fleischer 1990) and the Diffusion of Innovations (DOI) (Rogers 1995), unraveling their applicability and limitations in explaining the nuanced landscape of technology adoption in enterprises (Ruivo et al. 2012b). Firms also employ the BI&A system for the purpose of identifying and addressing market demands (LaValle et al. 2011).

Technology adoption in organizations is significantly influenced by size and industry, as noted by (Kyriakou et al. 2020). However, Johansson et al. (2012) and (Azhar 2021) highlight that many technologies are underutilized, raising the question of whether the accelerated pace of incremental innovations exceeds the adoption capacity of firms. (Junior et al. 2019) delve into the stages of adoption of ERP systems with analytics functionalities in the agricultural sector, demonstrating the versatility and cross-cutting impact of these technologies in various industrial sectors (Junior et al. 2019). Some of the critical factors for a successful adoption included executive support (Wang and Hwang 2012), user training (Johansson et al. 2012), and effective integration with existing systems (Bonner and Chae 2016).

By navigating through this intricate domain, this review endeavors to provide stakeholders with nuanced insights into the strategic utilization of ERP and BI&A systems, guiding informed decision-making and strategic planning. It addresses the palpable gap in understanding the transformative potential of these integrations, thereby steering the discourse towards a more informed and effective adoption and utilization of business analytics in enhancing organizational capabilities and strategic outcomes.

Identifying research gaps is crucial, as it highlights areas that require further exploration to advance the field. These gaps reveal the limitations of current knowledge and the need for additional studies to address unanswered questions. In this systematic literature
review, we aim to identify significant gaps in the integration of BI&A within enterprise systems (ESs). By recognizing these gaps, future research can focus on critical areas such as the deployment of SE with BI&A systems in small and medium-sized enterprises (SMEs), the role of artificial intelligence and machine learning in enhancing ERPBI systems, and the security and privacy implications of integrating new technologies with ERPBI systems. Addressing these questions can provide deeper insights into the successful implementation and utilization of SE with BI&A systems, ultimately enhancing their value and effectiveness across various organizational contexts.

2. Methods and Protocol

This systematic literature review ambitiously aimed to unravel the complexities surrounding the adoption of ERP systems enhanced with analytics capabilities. By meticulously examining academic publications, conference proceedings, theses, and other scholarly outputs, we endeavored to synthesize existing knowledge and frameworks that illuminate the path to successful analytics integration in enterprise environments (Munn et al. 2018). The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines provide a standardized approach for conducting and reporting systematic literature reviews. They ensure that reviews are comprehensive, transparent, and replicable by outlining steps such as defining objectives, searching for studies, selecting studies, extracting data, and analyzing results. Grounded in the PRISMA 2020 guidelines, our review process was designed to uphold the highest standards of methodological rigor, ensuring that our findings are both reliable and of practical relevance to practitioners and scholars alike (Page et al. 2021).

Our systematic review was underpinned by the Technology–Organization–Environment (TOE) framework, which informed our taxonomy and enabled a nuanced exploration of the technological advancements, organizational dynamics, and environmental factors influencing the adoption of analytics in ERP systems. This framework served as a lens through which we examined the multifaceted nature of analytics integration, allowing us to dissect the complex interactions between technology, organizational practices, and broader environmental influences. The TOE (Technology–Organization–Environment) framework is a model used to understand the adoption of new technologies by organizations. It considers three key aspects: technology (the technological innovations available), organization (attributes of the company such as size and resources), and environment (external factors like industry conditions, competition, and regulations). This framework is instrumental in analyzing the factors influencing technology adoption.

The cornerstone of our methodological framework was the delineation of three pivotal areas of inquiry. Firstly, we explored the diverse range of data analytics technologies being woven into the fabric of enterprise systems, aiming to pinpoint usage and adoption trends, coupled with the innovation of emerging technologies integrated or embedded that are forging the future landscape of ERP solutions. Secondly, our review critically assessed the organizational ramifications of adopting analytics within ERP systems. This included a deep dive into the catalysts for adoption and the critical role external stakeholders play in sculpting these processes. Lastly, we turn our attention to the various methodologies and research approaches that have been employed to unravel the value and application of analytics in business systems across different organizational contexts.

2.1. Search Framework and Taxonomy

The initiation of our systematic literature review embarked upon crafting a search framework and taxonomy designed to meticulously navigate and examine the vast terrain of literature surrounding the integration of analytics within Enterprise Resource Planning (ERP) systems (see Figure 1). This critical step was not merely procedural but foundational, setting the stage for a holistic examination that extends beyond mere technological aspects to encompass organizational and environmental dimensions—collectively known as the TOE framework.
Our endeavor began with the delineation of a structured taxonomy, an intellectual scaffold that aimed to categorize and dissect the myriad ways in which the most widely used enterprise systems—Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM) (Kyriakou et al. 2020)—are augmented by Business Intelligence & Analytics (BI&A). These systems were included due to their widespread adoption and critical role in business operations globally. This taxonomy was not just a methodological tool but a conceptual lens through which we sought to understand how the adoption of analytics influences organizational dynamics, shapes business processes, and catalyzes both incremental and radical innovations within enterprises. At the heart of our methodology was an intent to scrutinize the technological, organizational, and environmental factors that serve as both catalysts and barriers to the assimilation of analytics in enterprise systems. This detailed inquiry, guided by our carefully crafted taxonomy, was aimed at unraveling the nuanced interplay between these factors and their collective impact on a company’s agility and the maturity of its Business Intelligence capabilities (Bonner and Chae 2016).

An initial foray into the Scopus database with a focus on ERP systems yielded 94 articles, setting a preliminary stage for our review. Recognizing the need for a broader perspective that reflects the multifaceted nature of enterprise systems, we expanded our search to include literature on SCM and CRM. This expansion was not merely quantitative but strategic, enhancing our review’s depth and breadth by increasing our pool of articles to 234. These articles, carefully selected through a lens defined by our taxonomy, formed the bedrock of our review, enabling us to offer comprehensive insights into the adoption and impact of analytics within enterprise systems.

2.2. Search Terms

We categorized relevant literature into three distinct clusters, as outlined in our framework (Table 1). These clusters—Enterprise Information System, Analytics, and Adoption—served as the primary axes around which our search strategy revolved. Each cluster was carefully populated with terms closely related to our investigation’s core themes: from ‘ERP’, ‘CRM’, and ‘SCM’ under the Enterprise Information System cluster to ‘Analytic
embedded’, ‘Data Analytics’, and ‘Big Data Analytics’ under Analytics, and finally, encapsulating the Adoption cluster with terms like ‘Use’, ‘TOE’, ‘DOI’, ‘TAM’, and ‘UTAUT’. This structured approach to defining our search terms was instrumental in ensuring the comprehensiveness and precision of the literature we aimed to review.

Table 1. Clusters—Framework Research SLR—Keywords.

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Information System Information System</td>
<td>Analytics</td>
<td>Adoption</td>
</tr>
<tr>
<td>ERP</td>
<td>Analytics embedded</td>
<td>Use</td>
</tr>
<tr>
<td>CRM</td>
<td>Data Analytics</td>
<td>TOE</td>
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<tr>
<td>SCM</td>
<td>Business Analytics</td>
<td>DOI</td>
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<tr>
<td></td>
<td>Business Intelligence</td>
<td>TAM</td>
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<tr>
<td></td>
<td>Big Data Analytics</td>
<td>UTAUT</td>
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</table>

2.3. Search String

Armed with a clear understanding of our thematic clusters, we then embarked on crafting a search string that would adeptly navigate the vast seas of information. Utilizing Boolean operators, we interwove our meticulously selected search terms, creating a harmonious sequence that promised to unearth literature at the intersection of these three pivotal areas. This strategic amalgamation of terms was not just a technical exercise but a thoughtful endeavor to filter through the noise and home in on literature that precisely matched our review’s focus. By setting this sequence into motion within the Scopus database, we were not only able to capture the essence of our identified clusters but also to lay a solid foundation for a review that promises to shed new light on the integration of analytics within ERP systems, revealing insights that are both profound and actionable for organizations navigating this complex landscape (see Figure 2).

Figure 2. Search String—Scopus.

2.4. Database and Cut-Off Date

Our choice of the SCOPUS database as the primary source for our literature search was intentional, aligning with the specialized knowledge domain of our investigation. SCOPUS, renowned for its comprehensive coverage and quality of scholarly articles, offered the breadth and depth needed for an exhaustive review. We established 2 January 2024 as the cut-off date for our search. This decision ensured the inclusion of the most current research, capturing the evolving discourse on analytics within ERP systems up to this specific point in time.

2.5. Inclusion and Exclusion Criteria

The heart of our search strategy lay in the meticulously defined inclusion and exclusion criteria tailored to sieve through the vast database offerings. Our approach was twofold, focusing initially on titles and subsequently on abstracts to distill relevant articles for our review.

Inclusion Criteria: We concentrated on articles that melded the technological aspects of enterprise systems (ERP, SCM, CRM) with business analytics (BI&A, BD), emphasizing literature that delved into the organizational ramifications of adopting these integrated systems. The focus was on adoption frameworks, adoption factors, use, value, and impact studies related to the synergy between enterprise systems and business analytics.
Exclusion Criteria: Articles that veered into emerging technologies without direct relevance to our core investigation (RFID, IoT, ML, Blockchain) or those that were primarily concerned with operational efficiency or specific modules (HCM, Manufacturing, SCM) without addressing the analytical integration were systematically excluded. Moreover, literature that lacked a clear nexus between adoption frameworks and analytics was also omitted.

Our search spanned titles, abstracts, and keywords, prioritizing documents based on the number of citations to ensure the inclusion of impactful research. This rigorous selection process culminated in the retrieval of 234 articles, which were subjected to a two-stage review process—first by title and then by abstract—whittling down to 65 articles of prime relevance. Further refinement based on citation counts and availability reduced our corpus to 45 articles, each dissected for their contributions to the discourse on analytics and ERP systems (Figure 3).

Figure 3. Identification of studies via databases, following the PRISMA 2020 guidelines—from: (Page et al. 2021). For more information, visit: http://www.prisma-statement.org/, accessed on 2 January 2024. * Relevance of Scopus to the engineering and management field. ** Excluded articles focused on operational efficiency and process implementation. *** excluding articles on non-common business systems such as MRP, SMP, among others.
Our database, comprising 234 articles, became the substrate for a comprehensive analytical process employing a suite of sophisticated tools and techniques. This analytical phase was instrumental in distilling patterns, trends, and insights pivotal to understanding the current landscape of ERP and Business Intelligence & Analytics (BI&A) adoption.

Employing tools such as R Studio, Bibliometrix, VosViewer, and Microsoft Excel, we ventured beyond mere numerical analysis to perform an in-depth graphical exploration of the data. These tools were not arbitrarily chosen; each offered unique capabilities that, when combined, provided a holistic view of the research domain under investigation. R Studio and Bibliometrix facilitated advanced statistical and bibliometric analyses, allowing us to mine the data for underlying themes and connections. VosViewer added a spatial dimension to our analysis, enabling the visualization of networks and clusters within the literature, thereby highlighting relationships between key concepts, authors, and publications. Microsoft Excel supported our data organization and preliminary analyses, ensuring a structured approach to handling the information gleaned from the articles.

The criteria and methods guiding our analysis were rooted in the initial stages of our review process. By adhering to these predetermined parameters, our analysis remained focused and relevant, ensuring that the final set of articles selected for in-depth study was both representative and significant. This methodical approach culminated in a refined sample of 45 articles, each carefully chosen based on their contribution to the discourse on ERP and BI&A integration.

3. Analysis

This systematic review critically examines the global literature from 2010 to 2023, focusing on the factors influencing the adoption of analytical components in Enterprise Information Systems (EISs) and assessing their impact on strategic decision-making in organizations. The initial step involved identifying related articles by examining titles, abstracts, and keywords such as ‘ERP’, ‘Enterprise Resource Planning’, ‘Analytics’, and ‘Data Analytics’ to bridge ERP with the analytics domain. This allowed us to explore the confluence of these technologies. Next, we analyzed the relationship between ERP and analytics to understand how ERP systems, traditionally seen as operational backbones, are increasingly integrated with analytical tools. This integration enhances decision-making capabilities, streamlines operations, and drives organizational efficiency. We then examined the impacts of ERP and analytics adoption, identifying both positive outcomes like improved efficiency and challenges such as implementation hurdles and data management issues. Lastly, we explored adoption factors, identifying a range of influences from cost implications and technological complexities to organizational culture and business necessities. This comprehensive review provides insights into the multifaceted impact of ERP and analytics integration and highlights the need for effective strategies to facilitate their adoption.

3.1. Literature Review

The literature review embarked upon for our systematic analysis underscores the multifaceted challenges businesses encounter today, significantly influenced by a rapidly evolving business landscape, the imperative for efficiency improvements, and the complexity associated with integrating cutting-edge technologies (Fosso Wamba et al. 2018). Complexity, notably, emerges as a pivotal and adversely impacting factor on the adoption of enterprise systems integrated with analytics, as highlighted across various studies (Fosso Wamba et al. 2018; Johansson et al. 2012; Junior et al. 2019; Ruivo et al. 2012a, 2013; Yoon et al. 2017).

This complexity underscores the essential need for organizations to evaluate and enhance their capabilities, fostering the effective implementation of these transformative technologies (Hawking et al. 2008). Research indicates a discernible evolution in the maturity levels of BI solutions adoption within Australian companies, underscoring the universal necessity of analytical capabilities to bolster decision-making across industries and company sizes, thereby securing a competitive edge.
The domain of ERP adoption and utilization has captivated scholarly attention for decades (Fosso Wamba et al. 2018). Yet, calls persist for deeper exploration into the adoption of the latest ERP system generations, notably those post-2010 to 2012—a period marked by a significant publication peak, which the year 2023 surpassed. This resurgence post-pandemic highlights a shift toward the adoption of these technologies, spurred by the pandemic’s impact on business operations (see Figure 4).

![Distribution of Articles by Year of Publication](image)

**Figure 4.** Annual scientific production—state of the art ERP–BI—distribution of articles by year of publication.

The literature suggests an initial surge in ERP system-related research within academic journals starting in 1999, with a notable increase in 2006. Following a subsequent decline, a resurgence in interest coincides with the advent of emerging technologies in enterprise systems, leading to a significant peak in publications by 2023.

Our analysis reveals a strong interdependency between ERP systems and BI solutions, given BI’s reliance on data from transaction processing systems. This synergy presents an opportunity for ERP vendors like SAP, Oracle, and Microsoft to potentially dominate the BI market (Hawking et al. 2008). However, this interdependence also highlights a prevalent industry phenomenon—the underutilization of integrated BI solutions due to challenges such as technical complexity, scalability issues, and data quality concerns (Fosso Wamba et al. 2018; Junior et al. 2019; Ruivo et al. 2012b, 2013; Yoon et al. 2017).

Our literature review’s exploration into the dynamics of ERP and analytics adoption reveals a significant variance in publication outputs across different countries, underscoring the global interest and collaborative efforts in this research domain. As illustrated in the analysis (Figure 5), topics such as “supply chain management”, “big data analytics”, and “ERP” prominently feature across both author (left panel) and indexed keywords (right panel), indicating these areas’ centrality to the discourse on enterprise system enhancements and digital transformation. Several adoption factors can either complexify or facilitate the adoption of emerging technologies in enterprise systems (Hawking et al. 2008). These factors used in different research studies as dependent variables in the adoption of emerging technologies, such as (BI), can leverage a digital transformation in organizations (Fosso Wamba et al. 2018; Junior et al. 2019; Ruivo et al. 2012b, 2013; Yoon et al. 2017). If the factors manage to leverage the transformation, they can evaluate and enhance the capabilities of the organizations to visualize and integrate them into their business strategy.

However, researchers such as (Wang and Hwang 2012) and (Aldossari and Mukhtar 2019) mention the importance of comprehensively addressing research in other contexts. In their research studies, they do not offer a comparison with similar studies conducted in other countries or industries, which limits the understanding of how the findings can be applied in different contexts. This opens the possibilities for new contributions to knowledge, for example, on the specific challenges faced by Colombian companies in their process of adopting analytical platforms.
Keywords, with their focus on technological, organizational, and cultural contexts. This diversity underscores the potential for further research that specifically addresses the unique challenges faced by companies in emerging markets, such as Colombia, in adopting analytical technologies such as artificial intelligence (AI), Business Intelligence (BI), and Machine Learning (ML). These frameworks provide a structured lens through which to examine the multifaceted aspects of adopting and managing these technologies in different organizational and cultural contexts. This diversity underscores the potential for further research that specifically addresses the unique challenges faced by companies in emerging markets, such as Colombia, in adopting analytical technologies like BI as a service (SaaS) in companies of varying sizes (Rodrigues et al. 2016).

**Figure 5.** Top 10 author keywords and index keywords—SLR.

The examination of publication patterns by country, particularly in the context of Single-Country Publications (SCPs) and Cross-Country Collaborations (CCMs), highlights Portugal, the United States, and India as leading contributors, with notable participation from Malaysia, Australia, Sweden, Turkey, China, the United Arab Emirates, and Spain. This distribution not only reflects the geographical diversity of research contributions but also the extent of international collaboration in advancing the understanding of ERP and analytics integration (Figure 6). The varying focus across countries suggests a rich tapestry of research interests and adoption challenges, pointing to the broader applicability and relevance of these technologies in different organizational and cultural contexts. This diversity underscores the potential for further research that specifically addresses the unique challenges faced by companies in emerging markets, such as Colombia, in adopting analytical platforms. The insights from such studies could significantly enrich the global discourse, offering new perspectives on leveraging ERP and analytics for business transformation.

**Figure 6.** Publications by country, SCP, and CCM.

Furthermore, the review identifies several adoption frameworks that have been applied to study the integration of ERP systems and analytics, notably the Technology–Organization–Environment (TOE) framework and the Diffusion of Innovations (DOI) model by Rogers (Rogers 1995). These frameworks, with their focus on technological, organizational, and environmental factors and the process of innovation adoption, respectively, provide a structured lens through which to examine the multifaceted aspects of adopting emerging technologies like BI as a service (SaaS) in companies of varying sizes (Rodrigues et al. 2016).
3.2. Adoption Framework

The intricate process of adopting emerging technologies within organizations, particularly within specific sectors like banking, underscores the necessity for a nuanced understanding of the impact and efficiency these technologies bring (Nithya and Kiruthika 2021). The adoption framework becomes a critical lens through which the integration and effective utilization of technologies such as artificial intelligence (AI), Business Intelligence (BI), business analytics (BA), big data analytics (BDA), and machine learning (ML) can be assessed and strategized. This is especially relevant in today’s business environment, where technological adoption is not just a matter of operational enhancement but a strategic imperative for maintaining competitiveness.

The adoption of new technologies within a business context necessitates a well-structured strategy to ensure that investments yield the expected outcomes and align with organizational goals (Alaskar et al. 2021; Aldossari and Mukhtar 2019; AL-Shboul 2023; Chen et al. 2015; Hamed and Bohari 2022; Junior et al. 2019; Kyriakou et al. 2020; Lai et al. 2018; Ruivo et al. 2014; Wang and Hwang 2012). This is where adoption frameworks come into play, offering a comprehensive set of practices, strategies, and principles designed to guide organizations through the complexities of integrating and utilizing new technologies effectively.

As shown in Table 2, several frameworks have been identified as instrumental in this process, including the Technology–Organization–Environment (TOE) framework, the Diffusion of Innovations (DOI), the Technology Acceptance Model (TAM), the Resource-Based View (RBV), and the Unified Theory of Acceptance and Use of Technology (UTAUT). These frameworks provide a structured approach to understanding and navigating the multifaceted process of technology adoption.

### Table 2. Top 5 IT adoption frameworks.

<table>
<thead>
<tr>
<th>Framework Adoption</th>
<th>Articles</th>
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</thead>
<tbody>
<tr>
<td>TAM—Technology Acceptance Model</td>
<td>(Wang and Lien 2019; Yoon et al. 2017)</td>
</tr>
<tr>
<td>UAATUT—Unified Theory of Acceptance and Use of Technology</td>
<td>(Aldossari and Mukhtar 2019)</td>
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3.2.1. TOE Model (Technology–Organization–Environment)

The TOE (Technological, Organizational, and Environmental) framework emerges as one of the most prevalent in literature, particularly in the context of Enterprise Information Systems (EISs) with integrated BI&A components. It is applied across a range of business sizes, with a notable emphasis on small and medium-sized enterprises (SMEs) (Tornatzky and Fleischer 1990). This literature review evidences that it is one of the most widely used adoption frameworks, as we found 10 articles not only oriented to the adoption of enterprise information systems but also to integrated or embedded analytics components applied in all business sizes, with a greater presence of SMEs. This framework is extensively used to explore the adoption of various enterprise technologies, such as ERP systems, CRM systems, and BI systems, underscoring the need for further research, especially in the area of BA adoption and its influencing factors (Kyriakou et al. 2020).

This approach argues that the incorporation of innovative technological tools is influenced by various elements found in three distinct contexts: the technological domain, the organizational domain, and the environmental domain (Tornatzky and Klein 1982).
application of the TOE framework in diverse global settings, across various company sizes, and in cross-country comparisons predominantly utilizes quantitative analyses to test hypotheses related to technology adoption (Alaskar et al. 2021; Aldossari and Mukhtar 2019; AL-Shboul 2023; Chen et al. 2015; Hamed and Bohari 2022; Junior et al. 2019; Kyriakou et al. 2020; Lai et al. 2018; Ruivo et al. 2014; Wang and Hwang 2012). This includes significant findings, such as the positive impact of enterprise system adoption on the adoption degree of BA, highlighting the framework’s utility in dissecting the technological capabilities, organizational integration, and environmental factors influencing the adoption process (Kyriakou et al. 2020).

In the technology dimension, the capability, technical aspects, and functions of the technology are evaluated, along with its potential benefits and competitive advantages for the organization (Tornatzky and Fleischer 1990). The organizational dimension focuses on how the technology is integrated into the organization’s structure and processes, its impact on the corporate culture, and the management of internal change related to the technology adoption (Chen et al. 2015). Finally, the environmental dimension covers the application of technology in the industry, the availability of technology suppliers in the region, government regulations, and external factors such as market trends and business environment conditions.

3.2.2. DOI Model (Diffusion of Innovations)

The Diffusion of Innovations (DOI), proposed by Everett Rogers, serves as a foundational theory across multiple disciplines, including sociology, marketing, and information technology, to understand how innovations spread within communities and organizations (Johansson et al. 2012; Junior et al. 2019; Ruivo et al. 2012b, 2012c, 2013; Yoon et al. 2017). This theory posits that the adoption of an innovation is influenced by its inherent attributes: relative advantage, compatibility, complexity, trialability, and observability. Within the realm of information technology, these attributes play a crucial role in shaping an individual’s or organization’s decision to embrace or reject a new IT innovation (Yoon et al. 2017). The DOI’s enduring relevance in the literature underscores its utility in dissecting the adoption process of IT innovations, providing a nuanced understanding of how the characteristics of technological innovations impact their uptake.

3.2.3. TAM (Technology Acceptance Model)

Developed by Fred Davis in 1989, the TAM framework (Technology Acceptance Model) offers a theoretical lens to predict and understand the acceptance of new technologies by individual users (Wang and Lien 2019; Yoon et al. 2017). Centered around the concepts of Perceived Usefulness and Perceived Ease of Use, TAM suggests that an individual’s behavioral intention to use a technology is primarily influenced by these two perceptions. Perceived Usefulness refers to the degree to which a person believes that using a particular technology would enhance their job performance or efficiency (Davis 1989). Conversely, Perceived Ease of Use denotes the extent to which a person believes that using the technology would be free of effort (Yoon et al. 2017), which also increases the likelihood that the user will be willing to adopt it (Wang and Lien 2019). The widespread application of TAM in technology and information systems research highlights its effectiveness in capturing the user-centric aspects of technology adoption, emphasizing the importance of user perceptions in the adoption process.

Both the DOI and TAM frameworks contribute significantly to our understanding of technology adoption, albeit from different perspectives. The DOI model focuses on the innovation’s characteristics and the broader social system’s role in its diffusion, while TAM zeroes in on the individual user’s perceptions and attitudes towards the technology. These models, when applied to the study of Enterprise Information Systems (EISs) with integrated Business Intelligence & Analytics (BI&A) components, provide a comprehensive view of the factors that drive or hinder the adoption of these critical technological innovations. Through these lenses, we gain deeper insights into the mechanisms of technology acceptance and
diffusion, informing strategies for effective technology implementation and utilization in organizational contexts.

3.3. Data Analytics and Business Intelligence (BI&A) (Internal or Embedded—Integrated or Extended) in EISs

The intersection of data analytics and Business Intelligence (BI&A) with Enterprise Information Systems (EISs) represents a pivotal evolution in the way businesses leverage technology for strategic advantage. Since Hans Peter Luhn’s conceptualization of Business Intelligence (BI) in 1958, the field has undergone significant transformations, expanding from Decision Support Systems (DSS) in the 1960s and 1980s to becoming a cornerstone of strategic planning and trend analysis in various industries by the 21st century. The modern incarnation of BI, as popularized by Howard Dresner in 1989, underscores the importance of data in enhancing decision-making processes (Laudon and Laudon 2017). Today, BI is a widely recognized and widely used tool in a variety of industries, fundamental to senior management in strategic planning and long-term trend analysis (Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Bonner and Chae 2016; Hawking et al. 2008; Hung and Chen 2020; Ippolito et al. 2023; Junior et al. 2019; Ruivo et al. 2012c; Ruivo and Neto 2010; Sellitto and Hawking 2015; Trigo et al. 2015; Wang and Hwang 2012). By 2023, ERP systems, including CRM and SCM, had not only incorporated BI functions but had also made advanced analytics accessible across organizational levels, obviating the need for separate analytics solutions and democratizing Business Intelligence.

Embedded analytics within next-generation EISs encapsulates the seamless integration of analytical tools and capabilities directly into enterprise software platforms (see Figure 7). This advancement empowers users with real-time analytics and insights within their primary operational tools, enabling informed decision-making without the necessity of toggling between different applications (Davenport et al. 2010; Howson and Frank 2014). Conversely, external BI&A platforms have evolved to facilitate non-expert user engagement in data management and collaboration, supported by IT and AI, alongside intuitive, low-code automation tools that enhance analytic capabilities beyond enterprise systems to any organizational data source (Howson and Frank 2014). The delineation between internal (embedded) and external (extended or integrated) BI&A within EISs is crucial for understanding the architecture and functionality offered by modern enterprise systems (Figure 7). As illustrated, the trend in literature leans towards studies exploring integrated or extended external BI&A, reflecting a growing interest in leveraging external data and analytics frameworks to complement and enhance the intrinsic capabilities of EISs (Table 3).

![Figure 7](enterprise_systems.png)

**Figure 7.** Enterprise systems with embedded or external analytics—own elaboration.
Table 3. Internal (embedded) and external data and analytics frameworks.

<table>
<thead>
<tr>
<th>Category</th>
<th>Data and Analytics Frameworks</th>
<th>Articles</th>
</tr>
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</table>

Figure 7 illustrates the comparison between enterprise systems with embedded analytics and those with extended analytics. Embedded analytics refers to the integration of analytical tools directly within enterprise systems such as ERP, CRM, and SCM, allowing users to access analytics without leaving the primary system. Extended analytics, on the other hand, involves using external tools or platforms like Power BI or Tableau to perform advanced data analysis. This figure helps to understand the architectural and functional differences between these two approaches."

This bifurcation—internal (embedded) versus external (extended or integrated) BI&A (Table 3)—underscores a strategic dimension in the deployment of Business Intelligence within enterprise systems, offering insights into how organizations navigate the choices between embedding analytics into their core systems or integrating them with external platforms to maximize data-driven decision-making capabilities. Such an exploration not only reflects the current state of BI&A integration within EISs but also signals future directions for research and practice in harnessing the full potential of data analytics in enhancing business operations and strategic initiatives.

4. Results

The Systematic Literature Review (SLR) sheds light on the intricacies of integrating data analytics and Business Intelligence (BI&A) within Enterprise Information Systems (EISs), marking a pivotal advancement in both research and management practices. Through meticulous analysis, the SLR highlights the transformative role of next-generation ERP systems, especially those featuring embedded analytics, underscoring their significance as strategic assets in the competitive landscape of contemporary business.

A central revelation from the SLR is the essentiality of adopting next-generation ERP systems endowed with analytical capabilities. This strategic integration not only boosts operational efficiency but also acts as a linchpin for competitive advantage, enhancing decision-making processes across organizational echelons. The review meticulously develops a taxonomy that categorizes the crucial elements necessary for understanding the adoption and effective utilization of these technologically advanced ERP systems. This structured approach provides a roadmap for identifying the factors critical to the successful implementation and strategic application of these technologies.

For managers and decision-makers at all levels within organizations, the SLR offers invaluable insights into devising and implementing strategies centered around ERP and BI&A-enabled EISs. These insights are instrumental in elevating the analytics maturity levels within organizations, fostering a culture that prioritizes data-driven decision-making. The literature suggests strategic sequencing in technological adoption, advocating for the prioritization of ERP systems as the operational backbone of the company. This foundational step is deemed essential before the integration of supplementary systems like SCM or CRM, purported to streamline operations and enhance organizational efficiency comprehensively.
4.1. Integration of Data Analysis Technologies into Enterprise Systems

This review has highlighted significant advancements and contributions in the adoption and application of enterprise systems like Supply Chain Management (SCM) and big data analytics (Al-Sboul 2023; Kyriakou et al. 2020). However, a notable gap emerges in the delineation of Enterprise Resource Planning (ERP) systems enhanced with integrated or embedded analytics, which are critical enablers for competitive advantage through Business Intelligence (BI) technology (Baransel and Baransel 2012).

The literature underscores the immense potential BI technology holds for small and medium-sized enterprises (SMEs), aiding them in effectively managing operational costs and expanding market share. Despite this potential, a discernible lack of specific models supporting the seamless implementation of ERP systems with integrated BI capabilities has been identified. This absence of models results in inadequate adoption practices for state-of-the-art ERP systems, indicating that existing models for adoption may be inapplicable or absent altogether (Aldossari and Mukhtar 2019). This gap points towards overlooked factors crucial for the successful implementation of these technologies (Yoon et al. 2017).

Furthermore, the review suggests that while some studies acknowledge the inclusion of data analytics capabilities within the functionalities of various enterprise systems (Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Bonner and Chae 2016; Hawking et al. 2008; Hung and Chen 2020; Johansson et al. 2012; Junior et al. 2019; Ruivo et al. 2012c; Sellitto and Hawking 2015; Shamekhi et al. 2018; Wang and Lien 2019; Wang and Hwang 2012; Yoon et al. 2017), they fall short in differentiating between internal or embedded analytics and external BI&A capabilities. This distinction is vital, as embedded analytics within ERP systems can significantly enhance operational efficiency and strategic decision-making processes. The study by Aldossari S. and Mukhtar U., (Aldossari and Mukhtar 2019) emerges as one of the few that specifically addresses the concept of embedded or internal Business Intelligence components, highlighting a critical need for models that guide the successful implementation of ERP systems with integrated BI capabilities (Aldossari and Mukhtar 2019). The effectiveness of the structured search chain within the SLR brings to light the evolving landscape of “Next Gen (EIS + BI&A)”—the latest generation of business systems that increasingly feature both internal (embedded) and external components of BI&A (Table 4). This evolution underscores the necessity for a nuanced understanding and strategic implementation of these technologies to fully harness their potential in bolstering competitive advantage.

Table 4. Next Gen EIS + BI&A trends—analytics internal (embedded) or external.

<table>
<thead>
<tr>
<th>Category</th>
<th>EIS/Data Frameworks and Analytics Internal (Embedded) or External</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next Gen—ERP (EIS + BI&amp;A)</td>
<td>ERP + BI</td>
<td>(Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Bonner and Chae 2016; Hawking et al. 2008; Hung and Chen 2020; Ippolito et al. 2023; Junior et al. 2019; Ruivo et al. 2012c; Ruivo and Neto 2010; Sellitto and Hawking 2015; Trigo et al. 2015; Wang and Hwang 2012)</td>
</tr>
<tr>
<td></td>
<td>ERP + BA</td>
<td>(Bonner and Chae 2016; Kyriakou et al. 2020)</td>
</tr>
<tr>
<td></td>
<td>ERP + BDA</td>
<td>(Ippolito et al. 2023; Kyriakou et al. 2020)</td>
</tr>
</tbody>
</table>
Table 4. Cont.

<table>
<thead>
<tr>
<th>Category</th>
<th>EIS/Data Frameworks and Analytics Internal (Embedded) or External</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCM + BI</td>
<td>(Munim et al. 2023; Yiu et al. 2021; Raman et al. 2018; Sodero et al. 2019; Maggioni and Ricciardi 2012; Shafique et al. 2023)</td>
<td></td>
</tr>
<tr>
<td>SCM + BA</td>
<td>(Kyriakou et al. 2020; Raman et al. 2018; Sodero et al. 2019; AL-Shboul 2023)</td>
<td></td>
</tr>
<tr>
<td>SCM + BD</td>
<td>(Chen et al. 2015; Munim et al. 2023; Raman et al. 2018; Sodero et al. 2019)</td>
<td></td>
</tr>
<tr>
<td>SCM + BDA</td>
<td>(Chen et al. 2015; Kyriakou et al. 2020; Munim et al. 2023; Raman et al. 2018; Sodero et al. 2019; Lai et al. 2018; Alaskar et al. 2021; Hamed and Bohari 2022; Shah et al. 2023; Jum’a and Kilani 2022; Singh et al. 2021)</td>
<td></td>
</tr>
<tr>
<td>CRM + BI</td>
<td>(Hawking et al. 2008; Wang and Lien 2019; Trigo et al. 2015; Ruivo and Neto 2010; Nithya and Kiruthika 2021)</td>
<td></td>
</tr>
<tr>
<td>CRM + BA</td>
<td>(Kyriakou et al. 2020; Pesqueira 2022)</td>
<td></td>
</tr>
<tr>
<td>CRM + BDA</td>
<td>(Kyriakou et al. 2020)</td>
<td></td>
</tr>
<tr>
<td>PSM + BI</td>
<td>(Vallurupalli and Bose 2018)</td>
<td></td>
</tr>
</tbody>
</table>

In our systematic review, we embarked on a comprehensive examination of the interplay between various business technologies and the myriad problems and solutions they address within the domain of information management. Through a meticulous methodological approach, we sifted through a multitude of studies, honing in on pivotal technologies such as Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), and Business Intelligence (BI), among others. This exploration was structured around three primary categories of business systems, with a significant emphasis placed on ERP systems due to their central role in enterprise information systems (EISs) without direct association to BI&A elements. Our review unearthed nine articles (Bhadra et al. 2019; Fosso Wamba et al. 2018; Johansson et al. 2012; Rashid et al. 2010; Rodrigues et al. 2016; Ruivo et al. 2012b, 2013, 2014; Trigo et al. 2007) that specifically focus on ERP systems, shedding light on adoption factors, technological variables, and the outcomes of technological implementations (Junior et al. 2019).

Interestingly, while technologies like Business Intelligence (BI) and ERP frequently emerge in the discourse, a discernible gap exists in the literature regarding the distinction between embedded or integrated BI&A solutions (Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Bonner and Chae 2016; Hawking et al. 2008; Hung and Chen 2020; Ippolito et al. 2023; Junior et al. 2019; Ruivo et al. 2012c; Ruivo and Neto 2010; Sellitto and Hawking 2015; Trigo et al. 2015; Wang and Hwang 2012).

This observation points to a broader issue within the field of information management—namely, the challenge of navigating complex data management and decision-making scenarios, as pointed out by (Chen et al. 2015; Ruivo et al. 2012b). The prominence of BI and ERP in scholarly discussions underscores their criticality in formulating effective business strategies.

The issues unearthed through our review are diverse, though they frequently circle back to themes of information management and the imperative to refine decision-making processes. This is particularly crucial in the context of today’s data-centric business environment, as illustrated by studies such as the one conducted by C. H. Junior et al. (Junior et al. 2019). These challenges and the technologies that aim to address them play a fundamental role in shaping the strategies that businesses deploy to navigate the complexities of modern information management. Thus, our systematic review not only highlights the technological landscape of current business practices but also underscores the need for further exploration and clarification in the integration and application of BI&A within enterprise systems.
4.2. Impact of Analytics on Organizations

The exploration of Business Intelligence & Analytics (BI&A) within enterprise systems (ESs) reveals the essential capabilities and factors influencing the successful adoption and implementation of these technologies. This investigation delves into the dual perspectives of enterprises and their partners or implementers, uncovering the synergies and challenges inherent in integrating BI&A into dynamic business environments (see Exhibit 7). For enterprises, several key capabilities have emerged as pivotal. Analytic and Technology Capability stands out, underscoring the necessity for organizations to possess the technical prowess and analytical acumen required for leveraging big data analytics and BI (Alaskar et al. 2021; Johansson et al. 2012; Perçin 2023; Rashid et al. 2010; Ruivo et al. 2012b, 2012c; Shah et al. 2023). Strategic and Operational Management is another cornerstone (Aldossari and Mukhtar 2019; Hawking et al. 2008; Rashid et al. 2010; Vallurupalli and Bose 2018), emphasizing the importance of adaptability to market dynamics and operational efficiency (Alaskar et al. 2021; Johansson et al. 2012; Perçin 2023; Rashid et al. 2010; Ruivo et al. 2012b, 2012c; Shah et al. 2023). Collaboration and External Relations focus on the significance of building strong integrations with customers and suppliers, fostering a collaborative ecosystem conducive to Business Intelligence integration. Lastly, Organizational Efficiency and Development (Kiran et al. 2023; Maggioni and Ricciardi 2012; Wang and Lien 2019) highlight the ongoing need for continuous improvement and skills enhancement within the organizational framework.

Partners or implementers, on the other hand, bring distinct capabilities to the table. Strategic Capabilities in decision-making and an innovation-centric approach enable partners to guide enterprises through the strategic implementation of BI&A technologies (Aldossari and Mukhtar 2019; Lai et al. 2018; Wang and Hwang 2012). Development and Training Capabilities (Aldossari and Mukhtar 2019; Nithya and Kiruthika 2021; Trigo et al. 2015; Wang and Lien 2019; Wang and Hwang 2012) are crucial for ensuring that the workforce is well-equipped and knowledgeable about the new technologies. Innovation and Product Development Capabilities (Kiran et al. 2023; Maggioni and Ricciardi 2012; Wang and Lien 2019) focus on crafting and deploying adaptive solutions that meet the evolving needs of the enterprise. Market and Expansion Capabilities (Rodrigues et al. 2016; Trigo et al. 2015) emphasize the understanding of and adaptation to various market conditions, which are crucial for scaling and penetrating new segments.

## Table 5. Next Gen EIS adoption factors—adoption factors and their influence and significance in new-generation EIS organizations.

<table>
<thead>
<tr>
<th>Adoption Factors</th>
<th>Influence</th>
<th>Articles</th>
<th>Level of Significance</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>(Aldossari and Mukhtar 2019)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>(Fosso Wamba et al. 2018; Johansson et al. 2012; Ruivo et al. 2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>(Fosso Wamba et al. 2018; Johansson et al. 2012; Ruivo et al. 2013)</td>
</tr>
<tr>
<td>Complexity</td>
<td>Positive</td>
<td>(Bhadra et al. 2019; Hawking et al. 2008; Rashid et al. 2010; Rodrigues et al. 2016; Shah et al. 2023)</td>
<td>Not Significant</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>(Baransel and Baransel 2012; Kyriakou et al. 2020)</td>
<td>Significant</td>
<td>(Baransel and Baransel 2012)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>(Kyriakou et al. 2020)</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>(Rodrigues et al. 2016; Ruivo et al. 2012c, 2014)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Usability</td>
<td>Positive</td>
<td>(Bonner and Chae 2016; Raman et al. 2018; Rodrigues et al. 2016; Ruivo et al. 2012c, 2014)</td>
<td>Not Significant</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>All</td>
</tr>
<tr>
<td>Usability</td>
<td>Positive</td>
<td>(Bhadra et al. 2019; Hamed and Bohari 2022; Rodrigues et al. 2016)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Analytical Maturity</td>
<td>Positive</td>
<td>(AL-Shboul 2023; Junior et al. 2019; Yoon et al. 2017; Hamed and Bohari 2022)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Best practices</td>
<td></td>
<td></td>
<td>Not Significant</td>
<td>All</td>
</tr>
<tr>
<td>Security</td>
<td>Positive</td>
<td>(Hamed and Bohari 2022)</td>
<td>Significant</td>
<td>All</td>
</tr>
</tbody>
</table>
Table 5. **Cont.**

<table>
<thead>
<tr>
<th>Adoption Factors</th>
<th>Influence</th>
<th>Articles</th>
<th>Level of Significance</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>(Baransel and Baransel 2012; Shamekhi et al. 2018)</td>
<td>Not Significant</td>
<td>All</td>
</tr>
<tr>
<td>Innovation Culture</td>
<td>Positive</td>
<td>(Hung and Chen 2020)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Data Quality, Data Integrity, and Scalability</td>
<td>Positive</td>
<td>(Kyriakou et al. 2020)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>BI Implementation Scope Technological Capabilities</td>
<td>Positive</td>
<td>(Chen et al. 2015; Jum’a and Kilani 2022; Shafique et al. 2023; Wang and Lien 2019; Wang and Hwang 2012)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Organizational Readiness and FI</td>
<td>Positive</td>
<td>(Aldossari and Mukhtar 2019; Ruivo et al. 2012c, 2014)</td>
<td>Significant</td>
<td>All</td>
</tr>
<tr>
<td>Size of the Company</td>
<td>Positive</td>
<td>(Kyriakou et al. 2020; Wang and Lien 2019)</td>
<td>Not Significant</td>
<td>All</td>
</tr>
</tbody>
</table>
Interestingly, the review notes a relative lack of focus on external players, such as vendors or specific ERP systems, attributing this to the broader focus on factors affecting the adoption and use of ERP with BI&A across various units or value chains rather than the influence of specific vendors. However, a few articles (only four) shed light on the perspectives of consulting firms and technology providers, underscoring their role in facilitating BI&A adoption (Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Lai et al. 2018; Rodrigues et al. 2016).

An additional criticism related to business ecosystem actors, factors, and capabilities is that vendors interested in serving the market should pay attention to economic development and business culture and set reasonable expectations through effective communication (Wang and Hwang 2012).

Numerous studies have investigated the value of BI systems from an organizational perspective, finding that the successful adoption of these systems allows organizations to leverage large amounts of data to enhance strategic decision-making and operational processes (Tiwari et al. 2018; Wang et al. 2016). However, the benefits derived from the adoption of BI systems are not uniformly shared among firms (Stefanovic and Stefanovic 2009; Tiwari et al. 2018). Few studies have explored how BI technologies should fit the contingency factors inside and outside firms. Based on an event-study analysis of BI system adoption in the US manufacturing sector, it was found that the adoption of these systems does not have an immediate impact on the market value of firms. However, this impact is significantly enhanced in highly competitive industries or those characterized by shorter operating cycles and high munificence. This study contributes to the literature by employing contingency theory, linking BI system adoption with contingency factors associated with operating characteristics and contexts, and providing empirical evidence that fitting BI system adoption to these factors is critical to enhancing their business value, especially in dynamic and competitive industries.

4.3. Methodologies and Approaches in Business Systems Research and Analytics

The systematic review underscores a predominant preference for quantitative research methods, augmented by qualitative and mixed-method approaches, facilitating a multifaceted understanding of the adoption and impact of Business Intelligence & Analytics (BI&A) within enterprise systems (ESs) (Kaplan and Duchon 1988). This provides a clearer and more guiding line of inquiry in experimental design. Quantitative methods, featuring prominently in our findings, leverage surveys, simulations, case studies, and advanced statistical models like ordinal regression (Kyriakou et al. 2020) and structural equation modeling (SEM) (Jum’a and Kilani 2022) (Table 6). These approaches enable a rigorous examination of the variables influencing BI&A adoption and its subsequent effects on organizational performance. The inclusion of qualitative research, characterized by interviews, case studies, and literature reviews, enriches the analysis by providing in-depth insights into the experiences and perspectives of enterprises and implementers alike. This methodological diversity not only broadens the scope of inquiry but also enhances the robustness of the research outcomes.

The review reveals an intriguing application of less conventional methodologies, such as algorithm building, performance evaluation models, and fuzzy AHP techniques (Perçin 2023). This variety in research approaches signifies the field’s dynamic nature and the ongoing innovation in addressing the complexities of integrating BI&A technologies with enterprise systems. Conceptual studies also emerge as a significant category, aiming to clarify and define key concepts, thereby facilitating a deeper understanding of BI&A’s role within the business strategy and operational framework.

Analyzing various methods in business systems and analytics research is vital for a thorough understanding of the field. Combining quantitative methods, such as surveys, simulations, and statistical models, with qualitative approaches, like interviews and case studies, offers a comprehensive view of BI&A adoption and impact within enterprise systems (ESs). This methodological diversity enhances the robustness and reliability of findings by
providing both precise data and detailed insights. It also helps identify knowledge gaps and
directs future research, ensuring studies address current challenges and effectively advance
the field. By employing multiple approaches, researchers can achieve a more balanced and
nuanced understanding of complex dynamics in business systems and analytics.

Table 6. Methodologies and approaches in business systems research and analytics.

<table>
<thead>
<tr>
<th>Methodology Approach</th>
<th>Company Size</th>
<th>Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Method</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualitative</td>
<td></td>
<td>(Aldossari and Mukhtar 2019; Bonner and Chae 2016; Junior et al. 2019; Kyriakou et al. 2020; Raman et al. 2018; Rodrigues et al. 2016; Ruivo and Neto 2010; Singh et al. 2021)</td>
</tr>
<tr>
<td><strong>Collection and Analysis Methods</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interviews</td>
<td></td>
<td>(Aldossari and Mukhtar 2019; Baransel and Baransel 2012; Bonner and Chae 2016; Junior et al. 2019; Perçin 2023; Rodrigues et al. 2016; Ruivo and Neto 2010; Shamekhi et al. 2018; Sodero et al. 2019)</td>
</tr>
<tr>
<td>Experimental—Case Study</td>
<td></td>
<td>(Baransel and Baransel 2012; Hawking et al. 2008; Ippolito et al. 2023; Nithya and Kiruthika 2021; Sellitto and Hawking 2015; Shamekhi et al. 2018; Vallurupalli and Bose 2018; Wang and Hwang 2012)</td>
</tr>
<tr>
<td><strong>Events Studio</strong></td>
<td></td>
<td>(Pesqueira 2022; Yiu et al. 2021)</td>
</tr>
<tr>
<td>Literature Review</td>
<td></td>
<td>(Aldossari and Mukhtar 2019; Fosso Wamba et al. 2018; Jum’a and Kilani 2022; Maggioni and Ricciardi 2012; Munim et al. 2023; Naceur et al. 2021; Nithya and Kiruthika 2021; Pesqueira 2022; Rashid et al. 2010; Shah et al. 2023; Singh et al. 2021)</td>
</tr>
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</table>

Impact—SLR Company Size

An interesting observation from our systematic review is the impact of company size
on the adoption and implementation of BI&A components and platforms. The analysis sug-
gests a pronounced focus on small and medium-sized enterprises (SMEs), highlighting the
unique challenges and opportunities these entities face in leveraging BI&A for competitive
advantage (Table 7). The literature review reveals that there is a greater focus on SMEs,
with 27 articles, compared to 14 articles focused on large companies.

Further investigation into how company size influences the adoption of enterprise
systems reveals nuanced findings. For instance, the study by Trigo et al. (2015) suggests
that while the adoption of traditional systems like ERP, CRM, and SCM is not significantly
affected by company size, the adoption of BI&A technologies shows a positive correlation
with the scale of the enterprise. This insight points to the varying motivations and capacities
of companies of different sizes in integrating advanced analytics into their operations, from
enhancing business operations to achieving cost reductions. Other studies examining the
influence of business size through hypotheses and validations have shown similar results
(Bhadra et al. 2019; Kyriakou et al. 2020; Shafique et al. 2023; Trigo et al. 2015).
Table 7. Influence of size on the adoption of BI&A in SEs.

<table>
<thead>
<tr>
<th>Enterprise Information System</th>
<th>Company Size</th>
<th>Articles</th>
</tr>
</thead>
</table>

5. Discussion

The integration of BI&A technologies within the business environment has proven to be a fundamental pillar in solving complex problems and improving decision-making processes. Throughout this systematic review, we have identified how technologies such as ERP, SCM, CRM, and BI, among others, have been applied to address significant challenges in various organizational contexts.

The prevalence of Business Intelligence (BI) and Enterprise Resource Planning (ERP)-based solutions, as highlighted by (Chen et al. 2015; Ruivo et al. 2012a), underscores the value of data analytics and systems integration for efficient management. These studies show how the correct implementation of these technologies can result in tangible improvements in productivity and strategic decision-making.

The problems addressed by the analyzed studies reflect a wide range of challenges, from Supply Chain Management to internal process optimization. The diversity of proposed solutions, from theoretical frameworks to practical applications, illustrates the versatility of BI&A technologies in providing effective answers to these problems. Authors such as Junior et al. (2019) and Vallurupalli and Bose (2018) have contributed significantly to this body of knowledge, presenting case studies and conceptual frameworks that facilitate the understanding and application of these technologies.

The research highlights the critical importance of analytical and technological capacity, especially in the adoption of big data analysis and Business Intelligence (BI), for business competitiveness (Aldossari and Mukhtar 2019; Hawking et al. 2008; Rashid et al. 2010; Vallurupalli and Bose 2018). Companies that excel in these areas not only improve their decision-making but also adapt more quickly to constantly changing market environments. This adaptability is enhanced by advanced technological competencies, which are fundamental for interpreting and leveraging large volumes of data.

On the other hand, effective business management and strategy, which includes the ability to respond to demand and manage the supply chain flexibly, are equally essential (Alaskar et al. 2021; Hamed and Bohari 2022; Hawking et al. 2008; Ruivo et al. 2014; Wang and Lien 2019). The integration of strategic management with strong analytical capabilities allows companies not only to face current challenges but also to anticipate future market changes, ensuring an agile and well-informed response.

Our research aims to elucidate the factors influencing the adoption of enterprise systems with emerging technologies, fostering a collaborative capacity that enhances individual capabilities and provides a positive, cross-functional impact within organizations. Ineffective adoption of enterprise systems or poor integration within the business ecosystem can lead
to operational inefficiencies and a loss of competitiveness (George et al. 2020). A pertinent real-world example is the National Football League (NFL), which successfully applied analytics in its enterprise system to provide detailed data to Fantasy Football participants. By enhancing its Fantasy Football platform with unique data sets, the NFL demonstrated how sports organizations can leverage data analytics to boost user engagement and operational efficiency. This case offers valuable insights for other sports organizations aiming to exploit their data capabilities for similar benefits (Sellitto and Hawking 2015).

Understanding the critical factors and their interrelationships with the successful use of ERPBI (Enterprise Resource Planning and Business Intelligence) systems can help top management mitigate organizational losses. Effective utilization of these systems can lead to increased cash flow, controlled expenses, optimized headcount management, improved employee performance, streamlined supply chain operations, accurate tracking of key project financial performance, enhanced customer relationships, and better reporting systems (Hawking et al. 2006; Jenab et al. 2019; Khazaelp et al. 2015; Rashid et al. 2010). These elements collectively contribute to overall organizational performance, with management playing a pivotal role in overseeing, controlling, and supporting all significant areas (Aldossari and Mukhtar 2019).

However, the convergence of analytical capabilities and management strategies represents both a challenge and an opportunity for organizations. Success in this area requires not only investments in technology and training but also a cultural shift towards innovation and continuous learning (Kiran et al. 2023; Maggioni and Ricciardi 2012; Wang and Lien 2019). As companies strive to balance these capabilities, new paths for research open up, especially in how technological innovations affect strategic decisions in various business contexts.

The discussion on BI&A technologies and their impact reveals a clear pattern toward digitization and advanced analytics as the solutions of choice for contemporary business problems. This approach not only improves operational efficiency but also promotes a culture of innovation and adaptability within organizations. Research by Ruivo et al. (2013), for example, demonstrates how SMEs can leverage ERP to overcome structural constraints and improve their competitiveness in the marketplace.

6. Gap Identification

The areas mentioned in the Results section, which have not been explored, are significant because they address real challenges in the adoption of analytics technologies and business systems. In addition, they offer opportunities to improve competitiveness and decision-making in organizations. In addition, they provide a solid foundation for future research and strategy development in the area of enterprise systems and analytics maturity.

The focus on the integration of ERP with BI&A in the value chain is important to understand how these technologies can contribute to the efficiency and competitiveness of organizations. This approach considers the relevant players in the business ecosystem and highlights the need for effective collaboration models. Considering that the gaps between large and small companies are quite large, technology adoption maturity levels are lower in SMEs compared to large ones.

The research reveals difficulties in the adoption of embedded or integrated BI&A; this is relevant because it points to a real challenge faced by companies. This unexplored area is significant because it suggests that there are opportunities to improve BI&A adoption, which can have a positive impact on the decision-making and competitiveness of organizations.

Research in these areas can bring significant benefits to the field. For example, a focus on specific vendors and ERP systems can help organizations make informed decisions about technology adoption, which can result in better investment and improved business performance.

7. Research Gaps and Future Directions

Despite the progress observed, our review has also identified areas where research is still insufficient. There is a palpable need for studies that explore the implementation
of these technologies in underrepresented sectors and in diverse geographic contexts. In addition, future research could benefit from a more granular approach to measuring the return on investment of these technologies, thus providing a more robust framework for their economic justification and compatibility.

Key research questions for future exploration that could delve deeper into deployment in SMEs, the role of AI and machine learning, and security and privacy issues include:

- What are the unique challenges and opportunities of implementing SE (Systems Engineering) with BI&A (Business Intelligence and Analytics) systems in small and medium-sized enterprises (SMEs) compared to large corporations?
- How do advancements in artificial intelligence and machine learning enhance the capabilities and effectiveness of ERPBI systems?
- What are the security and privacy implications of integrating new technologies with ERPBI systems?

By addressing these questions, future research can provide deeper insights into the successful implementation and utilization of SE with BI&A systems, ultimately enhancing their value and effectiveness across various organizational contexts.

8. Conclusions

Our systematic review has revealed the critical importance of various business technologies in solving contemporary problems in information management. Although various innovative solutions have been proposed, the rapid evolution of technology and the business environment suggest the need for continued research. Future research should focus on the adaptability and scalability of technology solutions, especially in the context of SMEs.

This systematic review has highlighted the importance and impact of embedded and SE-integrated BI&A technologies in solving business problems. Through analysis of relevant literature, we have identified not only the practical applications of these technologies but also areas that require further research attention, such as implementation methodologies, ROI, resources, training, complexity, and compatibility of the technology and the adopting business. Moving forward, it is imperative that future studies continue to explore and validate new applications and methodologies, especially of emerging technologies, to maximize the potential of these technologies in the business environment.

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