



Emerging Technologies in the Accounting Field: A Systematic Literature Review

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ABSTRACT: The rapid adoption of emerging technologies has increased the complexity of accounting information systems, making effective interaction between professionals and digital tools essential for organizational performance. In this context, technologies such as artificial intelligence, blockchain, big data analytics, robotic process automation, and electronic invoicing are transforming accounting processes and decision-making practices. This study analyzes the role of emerging technologies in the accounting field and their implications for professional practice and organizational outcomes through a systematic literature review. Relevant studies were identified and analyzed using established systematic review protocols and major academic databases.

The results indicate that emerging technologies are primarily applied in auditing, financial reporting, management accounting, fraud detection, and tax compliance systems, contributing to improvements in efficiency, accuracy, transparency, and real-time information processing. These advancements positively influence organizational performance while also raising challenges related to data security, ethical considerations, regulatory frameworks, and professional competencies. The review further identifies research gaps concerning empirical validation and the long-term impact of emerging technologies on accounting practices and organizational performance.

Keywords: Emerging technologies, Accounting, Digital transformation, Electronic invoicing

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1. Introduction

The Fourth Industrial Revolution, characterized by the rapid development of digital and intelligent technologies, has profoundly transformed organizational processes across multiple sectors, including the accounting field. Technologies such as artificial intelligence, blockchain, big data analytics, robotic process automation, cloud computing, and electronic invoicing have reshaped accounting information systems, changing how financial data are recorded, processed, analyzed, and reported. These technological advances have increased the complexity of accounting environments while enabling organizations to improve efficiency, transparency, and decision-making capabilities [1]. In the accounting context, emerging technologies play a strategic role in modernizing accounting processes by automating routine tasks, reducing human error, and enabling real-time financial information. The digitalization of accounting practices, particularly through electronic invoicing and automated tax management systems, has contributed to strengthening fiscal control mechanisms and improving the quality of financial information. However, the adoption of these technologies has not been homogeneous across organizations, and

significant challenges continue to limit their effective implementation.

Despite the potential benefits associated with emerging technologies, many organizations face barriers related to technological infrastructure, implementation costs, data security concerns, regulatory uncertainty, and the availability of specialized skills among accounting professionals. In addition to these structural challenges, resistance to change and limited understanding of advanced digital tools may hinder technology adoption within the accounting profession. These limitations highlight the need for a systematic analysis that provides a comprehensive understanding of the role of emerging technologies in accounting.

In response to this context, this study conducts a systematic literature review to analyze emerging technologies in the accounting field, their main areas of application, and the benefits and challenges associated with their adoption. Based on the analysis of peer-reviewed scientific articles, the following research questions are addressed: (1) What emerging technologies are most frequently studied in the accounting literature? (2) In which accounting areas are these technologies primarily applied? (3) What benefits and challenges are associated with the adoption of emerging technologies in accounting? (4) What is the role of electronic invoicing in the digital transformation of accounting processes?

To achieve these objectives, Section 2 presents a theoretical overview of the main concepts related to emerging technologies and digital transformation in accounting. Section 3 develops the discussion of the results in light of the existing literature. Section 4 provides a synopsis of the main research outcomes. Section 5 presents the conclusions of the study, while Section 6 addresses the limitations, theoretical and practical implications, and directions for future research.

2. Theoretical Overview of the Main Concepts

The rapid development of digital technologies associated with the Fourth Industrial Revolution has generated profound changes in the accounting field, giving rise to new theoretical and practical approaches to accounting processes and information systems. Digital transformation in accounting refers to the integration of advanced technologies into traditional accounting functions, leading to changes in how financial information is generated, processed, analyzed, and used for decision-making. This transformation has expanded the role of accounting from a primarily record-keeping function to a more strategic and analytical discipline.

2.1. Emerging Technologies in the Accounting Field

Emerging technologies are defined as innovations that are still in a phase of development or early adoption but have the potential to significantly transform industries and professional practices. In the accounting field, the literature highlights several key emerging technologies, including artificial intelligence, blockchain, big data analytics, robotic process automation, cloud computing, and electronic invoicing. These technologies enable higher levels of automation, data integration, and analytical capability within accounting information systems [2]. Artificial intelligence and machine learning applications support tasks such as anomaly detection, predictive analytics, risk assessment, and audit planning, enhancing both efficiency and accuracy. Blockchain technology has been associated with improvements in data integrity, transparency, and traceability, particularly in financial reporting and auditing contexts. Big data analytics allows accountants to process large volumes of structured and unstructured data, facilitating real-time reporting and more informed managerial decisions. Robotic process automation focuses on automating repetitive and rule-based accounting tasks, while cloud computing provides scalable and flexible platforms for accounting systems. Electronic invoicing plays a critical role in the digitalization of transactional processes by enabling standardized, automated, and real-time exchange of financial information between organizations and regulatory authorities [3].

2.2. Digital Transformation and Accounting Information Systems

Accounting information systems represent the technological backbone of modern accounting practice. The integration of emerging technologies into these systems has increased their complexity while simultaneously enhancing their functionality and strategic value. Digital transformation in accounting information systems enables real-time data processing, continuous auditing, and improved internal controls. From a theoretical perspective, this transformation aligns with information systems and innovation adoption theories, which emphasize the role of technological capabilities in improving

organizational performance. The adoption of digital accounting systems also affects the roles and competencies required of accounting professionals. As routine tasks become automated, accountants are increasingly expected to develop analytical, technological, and strategic skills. This shift has implications for accounting education, professional standards, and organizational structures [4].

2.3. Electronic Invoicing as a Driver of Accounting Digitalization

Electronic invoicing has emerged as a key component of accounting digitalization, particularly in the context of tax compliance and financial transparency. From a theoretical standpoint, electronic invoicing can be viewed as an enabling technology that facilitates process standardization, data accuracy, and interoperability between organizations and regulatory bodies. Its implementation supports the automation of transactional accounting processes and reduces manual intervention, thereby minimizing errors and increasing efficiency [5]. The literature also highlights the role of electronic invoicing in strengthening fiscal control mechanisms and improving the availability of real-time financial data. However, challenges related to regulatory diversity, technological infrastructure, and organizational readiness continue to influence its adoption and effectiveness across different contexts [6].

2.4. Challenges and Implications of Emerging Technologies in Accounting

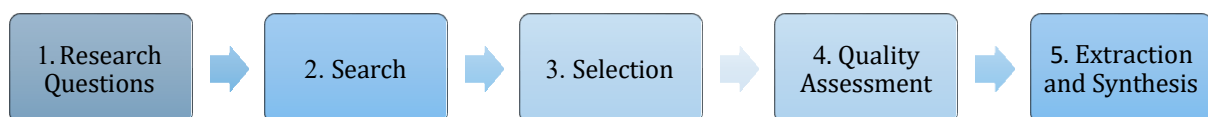
While emerging technologies offer significant opportunities for innovation and performance improvement, their adoption also presents theoretical and practical challenges. Issues related to data security, privacy, ethical use of artificial intelligence, regulatory adaptation, and resistance to change are frequently discussed in the literature. These challenges underscore the importance of a comprehensive theoretical understanding of technology adoption in accounting, considering not only technical factors but also organizational, institutional, and human dimensions [7]. In this context, a systematic examination of existing research is essential to synthesize current knowledge, identify conceptual gaps, and provide a foundation for future empirical studies. This theoretical overview supports the need for the systematic literature review conducted in this study and frames the analysis of emerging technologies within the accounting field [8].

3. Methodology

This study adopts a rigorous and structured approach based on the Systematic Literature Review (SLR) methodology, which is widely applied in accounting, information systems, and management research to consolidate scientific evidence, identify research trends, detect gaps, and propose future research directions [9]. The SLR methodology ensures transparency, replicability, and methodological rigor in the synthesis of existing knowledge. To support the management and selection of studies, the Rayyan web-based tool was employed, which is specifically designed to facilitate the systematic screening of scientific literature. Following the removal of duplicate records, all retrieved articles were imported into Rayyan, where a blinded review process was conducted. This process enabled the independent and consistent application of predefined inclusion and exclusion criteria, reducing selection bias and strengthening the reliability and objectivity of the review process. The main purpose of this systematic literature review is to analyze the role of emerging technologies in the accounting field, with particular attention to their applications, benefits, challenges, and implications for accounting processes, decision-making, and organizational performance, including the growing relevance of electronic invoicing as a key driver of digital transformation in accounting. The development of the systematic literature review was carried out through five main stages, which provide a structured and transparent methodological framework ensuring rigor and reproducibility. These stages are illustrated in Figure 1 and described in detail in the following subsections.

Figure 1

Phases of the methodological process for the development of the review



3.1 Research Questions

The objective of this study is to analyze the findings derived from a systematic review of the scientific literature on emerging technologies in the accounting field and their implications for accounting practices and organizational performance. To structure the analysis and establish the state of the art, the following research questions were formulated:

- **RQ1:** What emerging technologies are most frequently addressed in the accounting literature?
- **RQ2:** In which accounting areas are emerging technologies primarily applied?
- **RQ3:** What benefits and challenges are associated with the adoption of emerging technologies in accounting processes?
- **RQ4:** What role does electronic invoicing play in the digital transformation of accounting systems?

The structuring of these research questions was guided by the PIPOH framework, a widely recognized approach for formulating research questions in systematic reviews, as it allows the integration of key elements such as population, intervention, outcomes, professionals, and context. The definitions of these elements are presented in Table 1.

Table 1

Defining analysis categories using the PIPOH framework

Criterion	Description
Population	Organizations and entities that have adopted or are adopting emerging technologies in accounting processes.
Intervention	Implementation and use of emerging technologies in accounting, including automation, artificial intelligence, blockchain, big data, cloud computing, and electronic invoicing.
Results	Studies analyzing efficiency, accuracy, transparency, decision-making, and challenges associated with technological adoption in accounting.
Professionals	Accounting professionals, auditors, financial managers, and researchers in accounting and information systems.
Context	Organizational, financial, and regulatory environments where digital accounting technologies are implemented.

3.2 Search Strategy

In this phase, search criteria were defined to identify relevant studies within the scope of the systematic literature review. The main objective was to ensure comprehensive coverage of the scientific literature addressing emerging technologies in the accounting field, while guaranteeing the inclusion of relevant, recent, and scientifically validated documents. Key terms related to emerging technologies, digital transformation, accounting, and electronic invoicing were identified, along with their synonyms and related concepts. These terms were used to construct the search string presented below:

("Emerging technologies" OR "digital transformation" OR "artificial intelligence" OR "blockchain" OR "big data" OR "robotic process automation" OR "cloud computing" OR "electronic invoicing")
AND
("accounting" OR "accounting information systems" OR "auditing" OR "financial reporting")

The search was conducted in recognized academic databases, including Scopus, Web of Science, ScienceDirect, and IEEE Xplore. These databases were selected due to their extensive coverage of high-quality research in accounting, business management, and information systems.

3.3 Study Selection

All studies included in this review were examined in detail, considering elements such as title, keywords, abstract, introduction, theoretical background, methodology, results, and conclusions. Predefined inclusion and exclusion criteria were established to ensure the relevance and quality of the selected studies.

Inclusion Criteria (I):

- **I1:** Peer-reviewed journal articles published between 2010 and 2024.
- **I2:** Full-text articles available for analysis.
- **I3:** Studies explicitly addressing emerging technologies in accounting contexts.
- **I4:** Articles written in English or Spanish.

Exclusion Criteria (E):

- **E1:** Conference papers, technical reports, editorials, and book chapters.
- **E2:** Studies not directly related to accounting or accounting information systems.
- **E3:** Articles focusing exclusively on technical aspects without accounting implications.
- **E4:** Duplicate publications across databases.

The selection process of primary sources was carried out in three phases. The first phase involved the elimination of duplicate records. In the second phase, titles and abstracts were reviewed to assess their relevance. Finally, in the third phase, the full text of the remaining articles was examined to determine their suitability for inclusion. As a result of the initial search conducted in the selected databases, 280 studies were identified. After applying the predefined inclusion and exclusion criteria and completing the full-text review, the final number of documents selected for analysis was 45 scientific articles. The distribution of the initial set of primary studies retrieved from each database is presented in Table 3.

Table 3

Number of primary studies retrieved by database

Databases	Amount
ACM Digital Library	60
IEEE Xplore	10
Scopus	150
ScienceDirect	60
Total	280

3.4 Quality Assessment

The quality assessment process for the selected documents considered seven fundamental criteria: the origin and credibility of the sources, relevance of the content to emerging technologies in the accounting field, impact of the study, clarity of the research objectives, contextualization of the study within accounting and regulatory environments, objectivity of the methodological design, and scientific rigor in data analysis. These criteria are aligned with the three core pillars of quality management planning, organization, and control as proposed [10].

Furthermore, the evaluation process involved the complete reading and systematic analysis of the 45 selected studies. This process included the verification of full-text availability, the exclusion of duplicate and non-accessible articles, and the rigorous application of the predefined inclusion and exclusion criteria. The quality assessment procedure and the resulting classification of the studies are summarized in Table 4.

3.5 Data Extraction and Results Synthesis

This section presents the findings derived from the systematic analysis of the 250 selected articles. Key data extracted from each study included publication year, journal, research objectives, methodological approach, type of emerging technology analyzed, accounting area of application, reported benefits, challenges, and future research directions. The extracted evidence was synthesized using a qualitative thematic analysis, allowing the identification of dominant research trends, recurring themes, and conceptual patterns. The studies were grouped into thematic categories aligned with the research questions, facilitating a comprehensive understanding of how emerging technologies—particularly

electronic invoicing are transforming accounting processes, enhancing decision-making, and reshaping the accounting profession. This synthesis provides a solid foundation for the discussion of results and the conclusions presented in the following sections.

4. Discussion

The results of this systematic literature review confirm that emerging technologies are playing a transformative role in the accounting field by reshaping both technical processes and the strategic function of accounting within organizations. The evidence analyzed reveals a growing convergence between accounting practices and advanced digital technologies, supporting the notion that digital transformation involves not only the adoption of new tools but also structural changes in management models and professional competencies. Consistent with prior research, the findings indicate that technologies such as artificial intelligence, blockchain, big data analytics, and robotic process automation have become central drivers of accounting innovation. These technologies enable the automation of repetitive tasks, improve the quality and timeliness of financial information, and strengthen control and auditing mechanisms. In particular, the literature highlights that automation and advanced data analytics significantly contribute to operational efficiency and error reduction, which are critical factors for enhancing organizational performance. Electronic invoicing emerges as one of the most mature and widely implemented applications of accounting digitalization, especially in regulatory environments where its adoption is mandated or strongly encouraged. The reviewed studies agree that electronic invoicing not only facilitates tax compliance but also acts as a catalyst for the modernization of accounting information systems by promoting data standardization, transaction traceability, and integration with governmental and corporate digital platforms. However, the evidence suggests that its strategic impact remains underexplored, as most studies focus primarily on regulatory and operational aspects rather than on value creation or performance outcomes.

From a critical perspective, the review reveals that despite the widely reported benefits, the adoption of emerging technologies in accounting continues to face significant challenges. Limited technological infrastructure, high implementation and maintenance costs, and concerns related to data security and privacy remain major barriers, particularly for small and medium-sized enterprises. In addition, the lack of advanced digital skills among accounting professionals constrains organizations' ability to fully exploit the potential of these technologies. Another relevant issue identified in the discussion is the limited availability of robust empirical evidence regarding the long-term effects of emerging technologies on accounting and organizational performance. While many studies emphasize potential benefits, relatively few provide quantitative assessments or longitudinal analyses that establish clear causal relationships. This gap highlights the need for more rigorous empirical research designs that incorporate comparative approaches and performance metrics. Finally, the findings of this review suggest that the impact of emerging technologies in accounting is strongly influenced by institutional and regulatory contexts. Differences in regulatory frameworks, levels of digital maturity, and public policies significantly affect technology adoption processes. In this regard, the discussion underscores the importance of conducting comparative and cross-country studies to better understand how contextual factors shape the digital transformation of accounting.

5. Synopsis of the Main Research Outcomes

This section provides a structured synthesis of the main outcomes derived from the systematic literature review on emerging technologies in the accounting field. Based on the analysis of the 45 selected studies, the findings are organized around the research questions, highlighting dominant technologies, areas of application, reported benefits, and persistent challenges. The synthesis offers an integrated perspective on how technological innovation is reshaping accounting practices and contributing to digital transformation.

5.1 Dominant Emerging Technologies in Accounting

The reviewed literature reveals a strong focus on several emerging technologies that are transforming accounting processes. Artificial intelligence and machine learning are widely studied due to their potential to automate routine accounting tasks, support fraud detection, and enhance predictive analytics [7]. Blockchain technology is frequently associated with improvements in data integrity, transparency, and auditability, particularly in financial reporting and assurance services. Big data analytics and cloud computing are also prominently featured, enabling real-time data processing, scalability, and improved accessibility of accounting information. Additionally, robotic process automation (RPA) has gained

attention for its ability to streamline repetitive accounting activities, such as accounts payable, reconciliations, and reporting. Across the reviewed studies, electronic invoicing emerges as a critical component of accounting digitalization, particularly in tax compliance and transactional efficiency [11].

5.2 Areas of Application in the Accounting Field

The findings indicate that emerging technologies are primarily applied in key accounting areas, including financial accounting, management accounting, auditing, and tax management. Electronic invoicing is especially prominent in tax-related processes, where it facilitates automated reporting, enhances regulatory compliance, and improves transaction traceability. In auditing, technologies such as artificial intelligence and data analytics support continuous auditing models and risk-based audit planning. In management accounting, digital tools enable advanced cost analysis, performance measurement, and decision support. Overall, the integration of emerging technologies contributes to more agile, accurate, and transparent accounting systems[12].

5.3 Benefits of Adopting Emerging Technologies

Literature consistently reports several benefits associated with the adoption of emerging technologies in accounting. These include increased operational efficiency, reduced human error, improved data accuracy, and enhanced timeliness of financial information. Electronic invoicing, in particular, is associated with improved tax control, reduced administrative burdens, and increased transparency in financial transactions [13]. Additionally, the adoption of digital technologies supports better strategic decision-making by providing real-time insights and predictive capabilities. Many studies also highlight the role of emerging technologies in enhancing organizational competitiveness by enabling cost reductions, process optimization, and innovation in accounting services [14].

5.4 Challenges and Research Gaps

Despite the positive outcomes identified, the review reveals several challenges that limit the effective adoption of emerging technologies in accounting. Commonly reported barriers include high implementation costs, data security and privacy concerns, regulatory uncertainty, and a lack of digital competencies among accounting professionals[15]. The literature also reveals notable research gaps. Empirical evidence on the long-term impact of emerging technologies on accounting performance remains limited, and few studies provide quantitative assessments of the benefits of electronic invoicing beyond compliance-related outcomes. Moreover, there is a need for comparative and cross-country studies to better understand the influence of regulatory environments on technology adoption in accounting [15].

Another significant challenge identified in recent studies concerns organizational resistance to change and cultural barriers within accounting departments. The transition from traditional accounting systems to digitally integrated platforms often requires substantial modifications in workflows, internal controls, and professional roles. Resistance may stem from uncertainty regarding job displacement, lack of familiarity with advanced technologies, or insufficient managerial support for digital transformation initiatives. This organizational inertia can delay or undermine technology implementation, even when technical infrastructure is available, highlighting the importance of change management strategies and leadership commitment in successful digital adoption [16].

Furthermore, ethical and governance-related concerns are increasingly prominent in the literature, particularly regarding artificial intelligence and automated decision-making systems. Issues such as algorithmic bias, explainability of AI-driven outputs, accountability in automated processes, and transparency of blockchain-based transactions present complex regulatory and professional dilemmas. The absence of standardized ethical frameworks and clear regulatory guidelines creates ambiguity for organizations seeking to implement these technologies responsibly. As a result, future research should explore governance models that ensure responsible innovation while safeguarding data integrity and stakeholder trust [17]. Interoperability and system integration challenges also represent a critical limitation for the effective deployment of emerging technologies in accounting environments. Many organizations operate legacy systems that are not easily compatible with advanced digital tools, requiring costly upgrades or complete system overhauls. The integration of AI, RPA, blockchain, and electronic invoicing platforms into existing accounting information systems often involves technical complexity, data

migration risks, and potential disruptions to ongoing operations. This structural constraint is particularly acute in small and medium-sized enterprises, which may lack the financial and technical capacity to implement comprehensive digital transformation strategies [18].

Another critical issue identified in recent literature relates to regulatory uncertainty and the uneven pace of normative adaptation in response to technological innovation. In many countries, accounting and tax regulatory frameworks do not evolve at the same speed as emerging technologies, creating ambiguity in their practical implementation. This regulatory gap may delay technological investments and generate legal risks for organizations adopting advanced digital solutions without clear guidelines. Recent studies emphasize that the lack of international harmonization in digital accounting and tax standards constitutes a significant obstacle to the global implementation of technologies such as blockchain and electronic invoicing, particularly in multinational enterprises [19].

Additionally, a significant gap persists between the digital competencies required in modern accounting environments and the current academic and professional training of accountants. Technological transformation demands that accounting professionals develop skills in data analytics, algorithmic understanding, automated systems management, and technological risk assessment. However, several studies indicate that traditional accounting curricula still insufficiently incorporate content related to artificial intelligence, advanced analytics, and robotic process automation [20]

Finally, the literature demonstrates a methodological gap in current research designs. A considerable proportion of studies rely on conceptual analyses, case studies, or exploratory qualitative approaches, while large-scale quantitative investigations and longitudinal analyses remain scarce. This methodological imbalance limits the ability to generalize findings and to establish causal relationships between technology adoption and measurable performance outcomes. Future research should prioritize multi-method approaches, cross-industry datasets, and longitudinal performance metrics to build a more robust empirical foundation for understanding the long-term strategic impact of emerging technologies in accounting [21].

Table 4

Quality assessment in search and selection processes

Main term	Search results	Duplicate files	Excluded Files	Relevant files	Databases
Emerging technologies in accounting	10	0	5	5	IEEE Xplorer
Digital transformation	60	5	40	15	ACM Digital Library
Accounting & Information Systems	150	50	90	10	Scopus
Electronic invoicing	60	10	35	15	Science Direct
Total	280	65	179	45	

Figure 1

Overview of the article filtering process

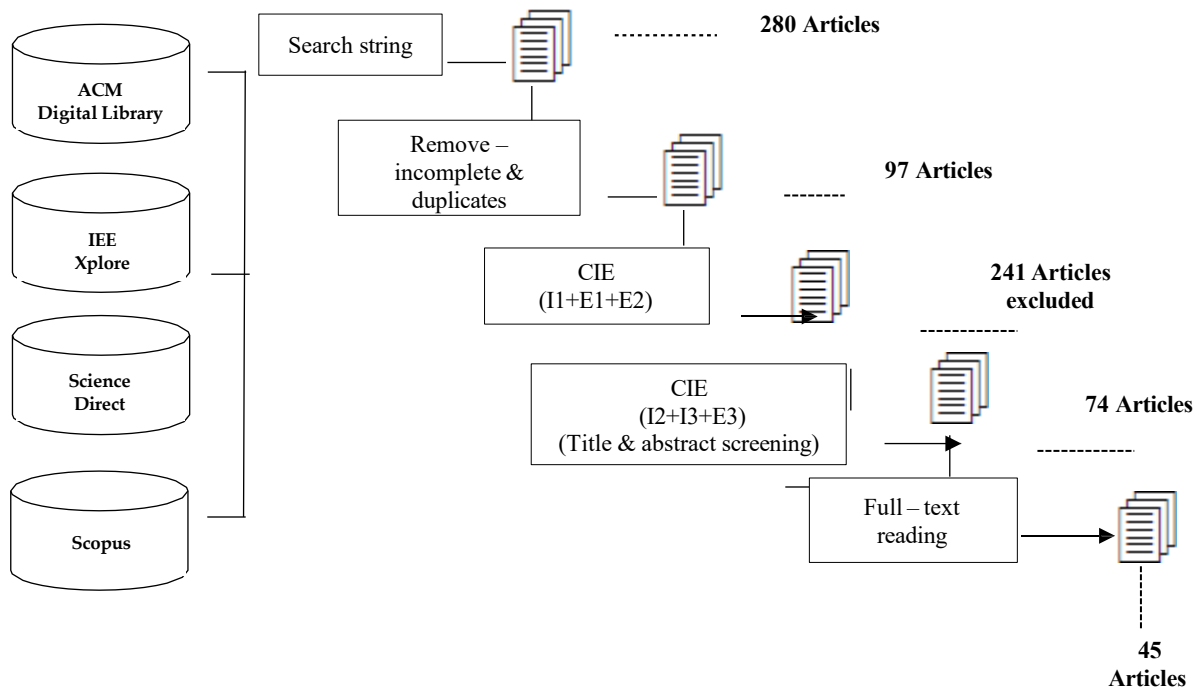


Figure 1 complements the information presented in Table 4 by providing a visual and sequential representation of the study identification, screening, and selection process applied in this systematic literature review. It illustrates each stage of the procedure, from the initial number of records retrieved from the academic databases to the final set of articles included for analysis, thereby facilitating a clear understanding of how the inclusion and exclusion criteria were systematically applied and how the final sample was progressively refined.

5.5 Dominant Emerging Technologies in Accounting

The accounting literature consistently highlights that technologies such as artificial intelligence (AI), machine learning, blockchain, big data analytics, robotic process automation (RPA), and cloud computing dominate recent research agendas due to their transformative capacity in accounting functions [22]. AI and machine learning are widely studied for their ability to automate data-intensive tasks, improve anomaly detection, and support predictive financial analysis, thereby enabling accountants to focus on strategic decision-making rather than routine data processing. Blockchain is recognized for enhancing data integrity and transparency, particularly in auditing and reporting systems, while big data analytics and cloud computing facilitate real-time processing of large datasets and scalability of accounting platforms [23]. Through these technologies, traditional bookkeeping evolves into data-driven and strategic accounting, enabling faster and more accurate financial insights, risk identification, and compliance support. These adoption trends align with the broader shifts toward digital transformation in accounting, where firms increasingly integrate emerging technologies to sustain competitive advantage [24].

Beyond operational automation, artificial intelligence is progressively being integrated into intelligent decision-support systems capable of analyzing complex financial patterns and generating scenario-based forecasts [25]. Recent studies emphasize that AI-powered tools enhance risk management processes, improve fraud detection accuracy, and strengthen internal control mechanisms by identifying irregularities that may not be detectable through traditional auditing techniques. This

technological evolution reflects a transition from reactive accounting practices to proactive and predictive financial management models, reinforcing the strategic relevance of digital capabilities within accounting departments [26].

Similarly, blockchain technology is expanding its scope beyond cryptocurrency applications to enterprise-level accounting and assurance frameworks. Its decentralized ledger structure enables immutable transaction records, thereby increasing trust, traceability, and audit efficiency[27]. Researchers argue that blockchain has the potential to transform external auditing by facilitating real-time verification of transactions and reducing reliance on manual reconciliations. This shift contributes to enhanced transparency and reduced information asymmetry among stakeholders, strengthening corporate governance and accountability mechanisms [28].

Robotic process automation (RPA) also plays a important role in optimizing repetitive and rule-based accounting activities, such as invoice processing, reconciliations, payroll management, and compliance reporting [29]. By reducing manual intervention, RPA minimizes operational errors and accelerates transaction cycles, generating cost efficiencies and productivity gains. When integrated with AI and analytics platforms, RPA contributes to the development of hybrid intelligent automation systems capable of learning from historical data and continuously improving process performance [30].

Finally, cloud computing serves as the infrastructural backbone enabling the integration and interoperability of these emerging technologies. Cloud-based accounting systems allow organizations to centralize financial information, support remote collaboration, and ensure scalability across multinational operations[31]. The literature suggests that cloud adoption enhances organizational agility and resilience, particularly in dynamic regulatory environments where rapid system updates and secure data exchange are essential. Consequently, the convergence of AI, blockchain, analytics, RPA, and cloud computing represents a holistic digital ecosystem that is redefining the architecture of modern accounting information systems [32].

5.6 Areas of Application in Accounting Practice

Emerging technologies are applied across several key areas of accounting practice, reflecting both operational and strategic imperatives. In auditing, artificial intelligence and data analytics enable continuous monitoring and risk-based audit planning, significantly reducing the time and manual effort required to evaluate large volumes of financial data [33]. These tools also improve fraud detection by identifying patterns that might elude traditional audit procedures. In financial accounting and reporting, technologies such as cloud computing and big data analytics support real-time reporting, collaboration across geographically dispersed teams, and enhanced accuracy of financial statements. Management accounting benefits from advanced analytics and automation to perform complex cost analyses, performance measurement, and scenario forecasting [34]. In tax management, the adoption of electronic invoicing systems enhances regulatory compliance, automates tax reporting, and increases transaction traceability, particularly in jurisdictions where e-invoicing is mandated or incentivized. These diversified applications highlight the move from manual, siloed accounting practices to integrated, technology-enabled processes that drive organizational performance and operational efficiency [35].

Beyond the traditionally recognized accounting functions, emerging technologies are increasingly integrated into internal control systems and corporate governance mechanisms. Intelligent systems powered by artificial intelligence contribute to real-time monitoring of internal controls, enabling early detection of irregularities and enhancing transparency in financial management. These technological integrations strengthen accountability frameworks and support more robust risk management structures within organizations, particularly in highly regulated industries [36].

Another growing area of application is sustainability and integrated reporting. Advanced analytics and digital platforms facilitate the collection, processing, and disclosure of environmental, social, and governance (ESG) data. As stakeholders demand greater transparency regarding non-financial performance indicators, accounting systems supported by emerging technologies are expanding beyond purely financial metrics. This evolution positions accounting as a central function in corporate sustainability strategies and long-term value creation [37]. Emerging technologies are also reshaping shared service centers and multinational accounting operations. Cloud-based infrastructures and robotic process automation enable centralized accounting processes across multiple subsidiaries and jurisdictions, improving standardization and operational consistency. This technological centralization enhances scalability while reducing administrative costs, especially for global enterprises operating in complex regulatory environments [38].

Finally, digital platforms are fostering greater interoperability between accounting systems and other enterprise information systems, such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. This integration promotes seamless data flows, reduces duplication of information, and supports holistic decision-making processes. As a result, accounting functions become more embedded within organizational strategy, contributing not only to compliance but also to performance optimization and competitive positioning [39].

Beyond automation and transparency, emerging technologies are increasingly contributing to the strategic repositioning of the accounting function within organizations. Recent studies indicate that the integration of advanced analytics and AI-driven systems enables accountants to move from transactional data processing toward high-value advisory roles, supporting scenario planning, performance optimization, and strategic risk assessment. This evolution strengthens the analytical dimension of accounting and enhances its contribution to evidence-based managerial decision-making in dynamic and data-intensive environments [40].

Another significant development involves the incorporation of process mining and intelligent workflow systems into accounting information infrastructures. These tools allow organizations to map, monitor, and optimize financial processes in real time, identifying inefficiencies, bottlenecks, and compliance deviations. By combining automation with continuous monitoring capabilities, organizations can improve internal controls and reinforce governance structures, leading to more resilient and adaptable accounting systems capable of responding to regulatory and operational changes [41]. Finally, the convergence of emerging technologies within integrated digital ecosystems is reshaping the architecture of modern accounting information systems. Rather than operating as isolated tools, AI, blockchain, analytics platforms, RPA, and cloud infrastructures increasingly function as interconnected components within enterprise-wide systems. This interoperability enhances data consistency, facilitates cross-functional collaboration, and strengthens stakeholder trust through improved transparency and traceability. Consequently, dominant emerging technologies are not only transforming accounting processes but also redefining the strategic role of accounting in sustaining organizational competitiveness and long-term value creation [42].

5.7 Benefits, Challenges, and the Transformative Role of Electronic Invocan

The adoption of emerging technologies has generated multiple benefits for accounting processes, including increased operational efficiency, reduced human error, improved data accuracy, and enhanced transparency throughout financial operations [43]. These benefits contribute to more informed decision-making, higher compliance with regulatory requirements, and strengthened competitive positions for organizations that effectively integrate technological solutions. However, significant challenges remain, such as high implementation costs, data security and privacy concerns,

regulatory uncertainty, and a persistent skills gap among accounting professionals that hinders seamless technology integration[44]. Electronic invoicing, in particular, plays a transformative role in the digitalization of accounting systems by standardizing transactional data, facilitating interoperability between business and tax authorities, and improving fiscal reporting mechanisms at the firm and national levels. E-invoicing adoption also demonstrates spillover effects within supply networks, suggesting that its impact extends beyond individual firms to broader economic ecosystems, especially in contexts where tax compliance and digital tax reforms are emphasized. Nonetheless, while electronic invoicing enhances compliance and operational control, its broader strategic implications for long-term organizational performance and value creation remain underexplored, indicating an important direction for future research [45].

Beyond the operational benefits widely documented, recent studies indicate that the adoption of artificial intelligence and advanced analytics in accounting significantly enhances the predictive capacity of financial systems, strengthening strategic planning and risk management processes. The integration of machine learning algorithms facilitates early detection of anomalies, fraud patterns, and budget deviations, thereby increasing organizational resilience in uncertain and highly regulated environments. However, these advancements also raise concerns related to algorithmic explainability and professional accountability in automated decision-making contexts [40].

From an organizational perspective, automation through Robotic Process Automation (RPA) has demonstrated positive impacts on administrative cost reduction and operational efficiency, particularly in repetitive processes such as reconciliations, accounts payable, and financial reporting. Nevertheless, recent literature emphasizes that successful RPA implementation requires process redesign, clear technological governance frameworks, and continuous professional training, as resistance to change remains one of the primary barriers to its strategic consolidation [46].

Regarding electronic invoicing, recent research shows that its mandatory adoption in several countries has significantly strengthened fiscal control mechanisms and transaction traceability, reducing tax evasion and increasing transparency within supply chains. Furthermore, the digitalization of tax documents enhances interoperability between businesses and tax authorities, promoting more integrated and efficient digital ecosystems. However, challenges persist concerning international regulatory harmonization and technological adaptation, particularly among small and medium-sized enterprises [47]. Additionally, recent literature suggests that accounting digitalization, including electronic invoicing, generates indirect effects on corporate competitiveness by facilitating access to financing, improving financial information quality, and reducing information asymmetries between firms and financial institutions. These systemic effects demonstrate that accounting digital transformation impacts not only internal processes but also strengthens trust in markets and national tax systems. However, the full realization of these benefits depends largely on the level of digital maturity within the institutional environment [48].

Finally, although existing evidence confirms that emerging technologies and electronic invoicing contribute to efficiency, transparency, and control, the literature consistently highlights significant gaps regarding their long-term strategic impact on organizational performance and sustainable value creation. There is a clear need for longitudinal and comparative studies that measure financial and non-financial indicators before and after technological adoption, as well as multilevel analyses integrating regulatory, cultural, and sectoral variables. Such approaches would enable a shift from an operational-efficiency perspective toward a broader understanding of the strategic value of accounting digitalization [49].

6. Conclusions

This study has presented a systematic literature review aimed at analyzing the role of interface metaphors in Industry 4.0 environments and their relationship with business competitiveness. Through a rigorous and structured review process, 45 high-quality scientific articles were selected from an initial pool of 280 studies retrieved from major academic databases. The adopted methodology ensured transparency, reproducibility, and scientific rigor, allowing a comprehensive synthesis of the current state of research in this field. The findings highlight that interface metaphors play a significant role in facilitating user interaction with complex Industry 4.0 systems. By translating abstract or technologically advanced processes into familiar and intuitive representations, interface metaphors contribute to improved usability, reduced cognitive load, and enhanced learning and decision-making capabilities. These aspects are particularly relevant in industrial and organizational contexts, where the effective use of digital technologies is closely linked to operational efficiency and performance.

Moreover, the review reveals that interface metaphors are increasingly applied across a wide range of Industry 4.0 technologies, including cyber-physical systems, industrial dashboards, data visualization platforms, and decision-support systems. Their use supports technology adoption and user acceptance, which in turn positively influences organizational performance, innovation capacity, and competitive advantage. As such, interface metaphors should not be regarded merely as design elements, but as strategic tools that can enhance the alignment between technological systems and business objectives. Despite the growing body of research, this review also identifies gaps in the literature, particularly regarding empirical validation of the long-term impact of interface metaphors on business competitiveness and organizational outcomes. Many studies focus on usability and user experience, while fewer provide quantitative evidence linking interface design decisions to measurable competitive or financial results. In conclusion, this systematic literature review underscores the importance of interface metaphors as a key factor in the successful implementation of Industry 4.0 technologies. By improving interaction, comprehension, and decision-making, interface metaphors contribute to both technological effectiveness and business competitiveness. Future research should further explore this relationship through longitudinal studies, cross-industry analyses, and empirical evaluations that integrate technical, human, and organizational perspectives.

7. Limitations, Implications, and Further Directions of Research

Despite the rigorous methodological approach adopted in this systematic literature review, some limitations should be acknowledged. First, the study is constrained by the selection of academic databases and the predefined search strings. Although major and highly reputable databases were consulted, relevant studies published in other sources or indexed in less common repositories may not have been included. Second, the review focused exclusively on peer-reviewed journal articles written in English and Spanish, which may have excluded valuable insights from gray literature, technical reports, or studies published in other languages. Third, while the review provides a comprehensive qualitative synthesis, it does not include a meta-analysis due to the heterogeneity of research designs, contexts, and outcome measures across the selected studies. From a theoretical perspective, the findings of this review contribute to the consolidation of interface metaphors as a relevant concept within the broader framework of Industry 4.0 and digital transformation. The study reinforces the idea that interface metaphors should be analyzed not only from a usability or human-computer interaction standpoint, but also in relation to organizational performance and business competitiveness. This integrative perspective offers a valuable foundation for future theoretical models that link interface design, technology adoption, and strategic outcomes in digital

and industrial environments.

In terms of practical implications, the results provide useful insights for practitioners, system designers, and managers involved in the implementation of Industry 4.0 technologies. The evidence suggests that the deliberate and context-aware use of interface metaphors can enhance user understanding, reduce complexity, and support more effective decision-making processes. Organizations seeking to improve the performance and acceptance of advanced digital systems should therefore consider interface metaphors as a strategic design element rather than a purely aesthetic feature. Regarding future research directions, several opportunities emerge from this review. Further empirical studies are needed to quantitatively assess the direct impact of interface metaphors on business competitiveness, productivity, and financial performance. Longitudinal and cross-sector studies could provide deeper insights into how interface metaphors influence technology adoption and organizational outcomes over time. Additionally, future research could explore the role of interface metaphors in emerging areas such as artificial intelligence-driven accounting systems, electronic invoicing platforms, and data-intensive decision-support tools. Expanding the methodological approaches to include experimental designs, case studies, and mixed-methods research would also strengthen the empirical foundation of this field. Overall, addressing these limitations and pursuing the proposed research avenues will contribute to a more robust understanding of the strategic role of interface metaphors in Industry 4.0 environments and their relevance for business competitiveness and organizational success.

References

- [1] L. N. Beltrán-Rodríguez, J. M. Larrahondo, and D. Cobos, "Tecnologías emergentes para disposición de relaves: oportunidades en Colombia," *Boletín Ciencias la Tierra*, no. 44, pp. 5–20, 2018, doi: 10.15446/rbct.n44.66617.
- [2] M. Lopera-Pérez, M. E. Cardona Zapata, and M. J. Gallego Orozco, "Laboratorio de medio ambiente «e-lab»: ODS 4 y 6 a través de tecnologías emergentes," *Enseñanza las Ciencias. Rev. Investig. y Exp. didácticas*, vol. 40, no. 3, pp. 165–183, Jul. 2022, doi: 10.5565/rev/ensciencias.3331.
- [3] L. Vasconez and J. Vásconez, "Tecnologías emergentes aplicadas a la educación Tecnologías emergentes aplicadas a la educación," *Dominio las Ciencias*, vol. 9, no. 4, pp. 668–780, 2023, [Online]. Available: <http://dominiodelasciencias.com/ojs/index.php/es/index>
- [4] A. J. Camargo Pérez and J. A. Munar Ladino, "Habilidades del pensamiento computacional en docentes en formación de la universidad La Gran Colombia," *Rev. Científica UISRAEL*, vol. 8, no. 2, pp. 135–149, May 2021, doi: 10.35290/rcui.v8n2.2021.441.
- [5] E. Invoicing, "Facturación Electrónica y su Impacto Económico en las Imprentas Autorizadas por el Servicio de Rentas Internas (SRI) de Manta," *Rev. Científica Salud y Desarro. Hum.*, vol. 5, no. 1, pp. 151–171, 2024, [Online]. Available: <https://doi.org/10.61368/r.s.d.h.v5i1.83>
- [6] P. Andrea *et al.*, "Análisis del impacto en la implementación de la facturación electrónica en el sector automotriz en la ciudad de Florencia , Caquetá Analysis of the impact on the implementation of electronic invoicing in the automotive sector in the city of Florencia , Ca," *Rev. Científica Empres. DEBE-HABER*, vol. 1, pp. 25–40, 2023, [Online]. Available: <https://debe-haber.ccpaqp.org.pe/index.php/rcedh/article/view/14/17>

- [7] E. Norman, "La inteligencia artificial en la educación: una herramienta valiosa para los tutores virtuales universitarios y profesores universitarios," *Rev. Semest. Espec. en Educ. y E-Learning*, vol. 17, no. 1, pp. 17(32)-1-9, 2023, [Online]. Available: <https://orcid.org/0000-0003-4069-0918>
- [8] D. Calderon, "Educación Contable en la Era Digital : Retos y Estrategias para la Formación Universitaria Post - Pandemia," *Rev. Colomb. Contab.*, vol. 13, pp. 109-128, 2025, [Online]. Available: <https://ojs.asfacop.org.co/index.php/asfacop/article/view/333/305>
- [9] D. Blanco, E. Rubio, M. Marín, and B. De Agustina, "Propuesta metodológica para revisión sistemática en el ámbito de la ingeniería basada en PRISMA," *XXIII Congr. Nac. Ing. Mecánica*, vol. 1, no. June, pp. 1-12, 2020, [Online]. Available: https://www.researchgate.net/profile/David_Blanco_Gomez/publication/348705198_Propuesta_metodologica_para_revision_sistemica_en_elambito_de_la_ingenieria_basada_en_PRISMA/links/600bf215a6fdccdc8736b1e/Propuesta-metodologica-para-revision-sistemica-e
- [10] D. S. Cruz Pérez, V. Ojalvo Mitran, Y. D. Valdés Bencomo, and L. E. Velastegui López, "Planeación y Planificación estratégica en comunicación educativa. Un estudio de caso en el contexto comunitario," *AlfaPublicaciones*, vol. 3, no. 2.1, pp. 113-137, May 2021, doi: 10.33262/ap.v3i2.1.53.
- [11] D. Nuñez, V. Vargas, F. Vasquez, W. Andrade, and F. Espinoza, "Educación STEM: Una revisión de enfoques interdisciplinarios y mejores prácticas para fomentar habilidades en ciencia, tecnología, ingeniería y matemáticas," *Cienc. Lat. Rev. Científica Multidiscip.*, vol. 7, no. 2, pp. 2023-2045, Apr. 2023, doi: 10.37811/cl_rcm.v7i2.5453.
- [12] D. Ramos and J. Jiménez, "Pensamiento Algorítmico una Propuesta Metodológica en la Profesión Contable," *Ciencias Soc. y Económicas*, pp. 262-270, 2019, [Online]. Available: <https://doi.org/10.32645/9789942914620>
- [13] C. K. K. Chung and M. Á. Alegre Brítez, "Reflexiones sobre la Educación Contable en Latinoamérica durante el periodo 2015-2022," *revistamultidisciplinar.com*, vol. 6, no. 3, p. e202430, Sep. 2024, doi: 10.23882/rmd.24245.
- [14] S. Heredia and B. J. Gaia Amorós, "Tecnologías Digitales. Desarrollo de aplicación de realidad aumentada como herramienta de visualización de vulnerabilidad sísmica edilicia," *Rev. Tecnol. y Cienc.*, no. 50, pp. 1-17, May 2024, doi: 10.33414/rtyc.50.1-17.2024.
- [15] D. B. Haubrich and C. Froehlich, "Benefícios e Desafios do Home Office em Empresas de Tecnologia da Informação," *Rev. Gestão Conex.*, vol. 9, no. 1, pp. 167-184, 2020, doi: 10.13071/regec.2317-5087.2020.9.1.27901.167-184.
- [16] A. Chaudhuri, N. Subramanian, and M. Dora, "Circular economy and digital capabilities of SMEs for providing value to customers: Combined resource-based view and ambidexterity perspective," *J. Bus. Res.*, vol. 142, pp. 32-44, Mar. 2022, doi: 10.1016/j.jbusres.2021.12.039.
- [17] H. Parra Acosta, J. López Loya, E. González Carrillo, L. Moriel Corral, A. D. Vázquez Aguirre, and N. C. González Zambada, "Las tecnologías del aprendizaje y del conocimiento (TAC) y la formación integral y humanista del médico," *Investig. en Educ. Médica*, no. 31, pp. 72-81, Jul. 2019, doi:

10.22201/facmed.20075057e.2019.31.18128.

- [18] C. Gallent Torres, A. Zapata González, and J. L. Ortego Hernando, "El impacto de la inteligencia artificial generativa en educación superior: una mirada desde la ética y la integridad académica," *Reli. - Rev. Electrónica Investig. y Evaluación Educ.*, vol. 29, no. 2, Dec. 2023, doi: 10.30827/relieve.v29i2.29134.
- [19] D. A. Luengo Molero and M. de los Á. Cruz Tamayo, "La gamificación para el desarrollo sostenible: estrategia para acortar brechas digitales y propiciar espacios inclusivos," *Rev. Científica UISRAEL*, vol. 9, no. 3, pp. 175–195, Sep. 2022, doi: 10.35290/rcui.v9n3.2022.642.
- [20] K. Watty, J. McKay, and L. Ngo, "Innovators or inhibitors? Accounting faculty resistance to new educational technologies in higher education," *J. Account. Educ.*, vol. 36, pp. 1–15, Sep. 2016, doi: 10.1016/j.jaccedu.2016.03.003.
- [21] J. Kokina and T. H. Davenport, "The Emergence of Artificial Intelligence: How Automation is Changing Auditing," *J. Emerg. Technol. Account.*, vol. 14, no. 1, pp. 115–122, Mar. 2017, doi: 10.2308/jeta-51730.
- [22] R. Ortega Ryberg, "Inteligencia Artificial Generativa: presente y futuro," *Rev. Sist.*, no. 172, pp. 12–16, Oct. 2024, doi: 10.29236/sistemas.n172a2.
- [23] D. X. Ramos and J. Jiménez, "Machine learning as a teaching strategy education: A review," *EAI Endorsed Trans. Scalable Inf. Syst.*, vol. 1, pp. 1–11, 2024, doi: 10.4108/eetsis.5703.
- [24] D. Alfonso, M. Mac, S. Computacionales, and K. M. Zu, "LAS TECNOLOGÍAS DE LA INFORMACIÓN EN LA ENSEÑANZA APRENDIZAJE PARA UNA EDUCACIÓN INCLUSIVA," *Rev. Científica penta ciencias*, vol. 4, no. 6, pp. 190–203, 2022, [Online]. Available: <https://www.redalyc.org/journal/2654/265478502014/265478502014.pdf>
- [25] I. Briceño-Álvarez, W. Hernández Arroyo, and A. Murillo-González, "Tecnología educativa en ascenso: La integración de Inteligencia Artificial en la enseñanza de la escuela de Bibliotecología y Ciencias de la Información de la Universidad de Costa Rica," *Informatio*, vol. 30, no. 1, Feb. 2025, doi: 10.35643/Info.30.1.1.
- [26] M. R. Quiroz Martinez, "Inteligencia Artificial Generativa (IA Gen) en la Transformación Digital de la Educación Superior una Revisión Sistemática de Literatura," *Cienc. Lat. Rev. Científica Multidiscip.*, vol. 9, no. 2, pp. 6339–6378, May 2025, doi: 10.37811/cl_rcm.v9i2.17370.
- [27] C. Cazoni and C. N. Ciocoiu, "Digital Transformation of Management Processes : A Comprehensive Review of Key Factors," *Sciendo*, 2024, doi: 10.2478/picbe-2024-0276.
- [28] T. Huynh-The *et al.*, "Blockchain for the metaverse: A Review," *Futur. Gener. Comput. Syst.*, vol. 143, pp. 401–419, Jun. 2023, doi: 10.1016/j.future.2023.02.008.
- [29] D. A. da Silva Costa, H. S. Mamede, and M. M. da Silva, "Robotic Process Automation (RPA) adoption: a systematic literature review," *Eng. Manag. Prod. Serv.*, vol. 14, no. 2, pp. 1–12, 2022, doi: 10.2478/emj-2022-0012.
- [30] F. A. Ramos Zaga, "Implicancias transformadoras de la Cuarta Revolución Industrial en el mercado laboral," *Newman Bus. Rev.*, vol. 9, no. 2, pp. 40–71, 2023, doi: 10.22451/3002.nbr2023.vol9.2.10087.

- [31] J. Kamlofsky, "Computación en la Nube: Fundamentos, Críticas y Desafíos," *Rev. Abierta Informática Apl.*, vol. 6, no. 2, pp. 3–30, Dec. 2022, doi: 10.59471/raia20222.
- [32] D. Ayuso del Puerto and P. Gutiérrez Esteban, "La Inteligencia Artificial como recurso educativo durante la formación inicial del profesorado," *RIED-Revista Iberoam. Educ. a Distancia*, vol. 25, no. 2, Apr. 2022, doi: 10.5944/ried.25.2.32332.
- [33] A. K. Tiwari, Z. R. Marak, J. Paul, and A. P. Deshpande, "Determinants of electronic invoicing technology adoption: Toward managing business information system transformation," *J. Innov. Knowl.*, vol. 8, no. 3, p. 100366, Jul. 2023, doi: 10.1016/j.jik.2023.100366.
- [34] A. Badmus, "FROM GUT FEELING TO ALGORITHMIC THINKING : AI-DRIVEN DECISION-," *J. AI, Data Sci. Eng.*, vol. 1, no. 2, pp. 1–15, 2024, [Online]. Available: <https://ijbds.com/index.php/journal/article/view/19/13>
- [35] A. Mon, R. H. Del Giorgio, C. Figuerola, and M. Querel, "La Usabilidad en el Desarrollo de Software para la Industria 4.0," *Departamento de Ingeniería e Investigaciones Tecnológicas* -, vol. 1903, pp. 1–12, 2021. [Online]. Available: https://indicetics.unlam.edu.ar/it/pdf/articulos/V_Conferencia_Iberoamericana_Interaccion_Humano_Computadora_2019.pdf
- [36] R. Almadadha, "Blockchain Technology in Financial Accounting: Enhancing Transparency, Security, and ESG Reporting," *Blockchains*, vol. 2, no. 3, pp. 312–333, Sep. 2024, doi: 10.3390/blockchains2030015.
- [37] L. E. M. Cevallos, L. M. Chamba-Rueda, and M. Pardo-Cueva, "Tecnologías de la Información y Comunicación en la Educación Superior: Un enfoque en las asignaturas Administración y Auditoría de la UTPL," *Rev. Ibérica Sist. e Tecnol. Informação*, no. E59, pp. 114–128, 2023, [Online]. Available: https://www.proquest.com/scholarly-journals/tecnologías-de-la-información-y-comunicación-en/docview/2858728774/se-2?accountid=44468%0Ahttps://media.proquest.com/media/hms/PFT/1/WABgU?_a=ChgyMDI0MDUyNzAyMjgyNzY1OT0to5ODY3MDESBTQ3Mjc5GgpPTkVfU0VBUkNIIg8xODYuM
- [38] H. Noviany, Y. Nurkhasanah, and S. Marlina, "Blockchain, Automation, and AI in Accounting: Challenges, Opportunities, and Global Perspectives," *Summa J. Account. Tax*, vol. 3, no. 1, pp. 25–40, Jan. 2025, doi: 10.61978/summa.v3i1.944.
- [39] L. Ramírez and M. Cortés, *Tecnologías emergentes, un compendio de desarrollos tecnológicos.*, Primera ed. Puerto Vallarta, Jalisco, México, 2020. [Online]. Available: <https://editorial.udg.mx/gpd-tecnologias-emergentes-9786075479903.html>
- [40] D. Kocsis, "A conceptual foundation of design and implementation research in accounting information systems," *Int. J. Account. Inf. Syst.*, vol. 34, p. 100420, Sep. 2019, doi: 10.1016/j.accinf.2019.06.003.
- [41] G. A. Zaragoza Alvarado, "Implementación de herramientas de la IA generativa que favorecen el aprendizaje de significativo en la EMS," *Rev. Soc. Front.*, vol. 4, no. 5, p. e45495, Oct. 2024, doi: 10.59814/resofro.2024.4(5)495.
- [42] M. J. Abdolmohammadi, S. M. DeSimone, T.-S. Hsieh, and Z. Wang, "Factors associated with internal audit function involvement with XBRL implementation in public companies: An international study," *Int. J. Account. Inf. Syst.*, vol. 25, pp. 45–

- 56, May 2017, doi: 10.1016/j.accinf.2017.03.002.
- [43] L. Y. Díaz Guecha and R. A. Márquez Delgado, "Tecnologías del Aprendizaje y el Conocimiento como estrategias en la formación de los docentes de la Escuela Normal Superior de Cúcuta, Colombia," *Ánfora*, vol. 27, pp. 17–40, 2020, doi: 10.30854/anf.v27.n48.2020.667.
 - [44] D. S. López Bustos, M. V. Gualli Gomez, T. L. Pilamunga Benavides, E. P. Paucar Viñan, M. T. Vacacela Buñay, and W. Y. Pompilio Daniel, "Integración de tecnologías multimedia en la enseñanza de la comprensión lectora: Un enfoque interactivo para la educación básica," *Cienc. Lat. Rev. Científica Multidiscip.*, vol. 9, no. 1, pp. 70–89, Jan. 2025, doi: 10.37811/cl_rcm.v9i1.15491.
 - [45] H. E. Inegbedion, "Acceptance of electronic tax system and the contribution of SMEs to tax revenue through the mediation of tax compliance," *J. Innov. Entrep.*, vol. 14, no. 1, 2025, doi: 10.1186/s13731-025-00582-w.
 - [46] D. Smith, "Secure pseudonymisation for privacy-preserving probabilistic record linkage," *J. Inf. Secur. Appl.*, vol. 34, pp. 271–279, Jun. 2017, doi: 10.1016/j.jisa.2017.01.002.
 - [47] M. Di Maio, V. Leone Sciabolazza, and V. Molini, *Migration In Libya : A Spatial Network Analysis*. World Bank, Washington, DC, 2020. doi: 10.1596/1813-9450-9110.
 - [48] S. Colombo, M. P. López, and N. Vera, "Tecnologías emergentes, poderes en competencia y regiones en disputa: América latina y el 5G en la contienda tecnológica entre China y Estados Unidos," *Estud. Int. Rev. relações Int. da PUC Minas*, vol. 9, no. 1, pp. 94–111, 2021, doi: 10.5752/p.2317-773x.2021v9n1p94-111.
 - [49] D. Appelbaum, A. Kogan, M. Vasarhelyi, and Z. Yan, "Impact of business analytics and enterprise systems on managerial accounting," *Int. J. Account. Inf. Syst.*, vol. 25, pp. 29–44, May 2017, doi: 10.1016/j.accinf.2017.03.003.