Vol. 07, Issue, 04, pp.8106-8118, April 2025 Available online at http://www.journalijisr.com SJIF Impact Factor 6.599



Research Article

CLOUD-BASED AI MARKETING: HOW WEB TECHNOLOGY AND ENTERPRISE SYSTEMS ARE EVOLVING

¹/* Karam Kamal younis and ²Subhi R. M. Zeebaree

¹Akre University for Applied Science, Technical College of Informatics, Akre, Department of Information Technology, Akre-Duhok, Kurdistan Region, Iraq. ²Energy Eng. Dept., Technical College of Engineering, Duhok Polytechnic University, Duhok, Iraq.

Received 07th February 2025; Accepted 08th March 2025; Published online 20th April 2025

ABSTRACT

This review paper explores the evolving landscape of digital transformation by synthesizing recent research across multiple domains, including artificial intelligence, cybersecurity, entrepreneurship, online learning, and financial resilience. The study highlights the paradigm shift from traditional IT frameworks to digital-centric approaches, emphasizing the need for new theoretical perspectives. Key insights include the role of digitalization in reshaping innovation, strategy, and business models, as well as the implications of Web 3.0, block chain, and Industry 4.0 for sustainable competitive advantage. Additionally, this review examines the transformative impact of technological advancements on logistics, cybersecurity, and enterprise architecture, addressing both opportunities and challenges in the digital economy. By integrating empirical and conceptual studies, the paper provides a comprehensive understanding of how digital transformation influences business practices, education, and policy-making. The findings underscore the importance of adaptive strategies, interdisciplinary research, and proactive regulatory frameworks to navigate the complexities of the digital era. This review contributes to cumulative knowledge development by mapping critical research trajectories and identifying future directions for digital transformation scholarship.

Keywords: Digital Transformation, Innovation Systems, Technology Adoption, Cybersecurity Strategies, Artificial Intelligence, Entrepreneurship, Web-Based Information Systems.

INTRODUCTION

The rapid evolution of web technology and enterprise systems has reshaped the global business landscape, influencing how organizations operate, communicate, and manage data. From traditional accounting systems to advanced cloud-based enterprise solutions, the integration of digital tools has significantly enhanced efficiency, flexibility, and scalability. Historically, businesses relied on manual bookkeeping and paper-based accounting, which was not only time-consuming but also prone to errors [1]. The emergence of computerized accounting systems (CAS) marked a significant transition, streamlining financial reporting and decision-making processes. Similarly, enterprise systems such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM) have become indispensable for modern businesses, offering seamless integration of data across

various functions [2]. The digitization of business operations extends beyond accounting and ERP systems, as big data analytics, artificial intelligence (AI), and cloud computing drive innovation. Digital transformation has become a strategic imperative, enabling organizations to respond to market demands with agility and precision [3]. The growing adoption of smart technologies—such as Al-driven enterprise solutions—has revolutionized decision-making by providing real-time insights, predictive analytics, and automation [4]. Furthermore, cloud-based enterprise systems, supported by AI and big data analytics, are reshaping industries by optimizing workflow automation, cybersecurity measures, and business intelligence capabilities [5]. Enterprise ecosystems are no longer confined to singular IT infrastructures but are evolving into interconnected digital

1Akre University for Applied Science, Technical College of Informatics, Akre, Department of Information Technology, Akre-Duhok, Kurdistan Region, Iraq.

networks, allowing firms to leverage multi-cloud environments, block chain integration, and Al-powered automation. [6] highlights, the proliferation of digital ecosystems has blurred the boundaries between industries, fostering collaboration through API- driven integrations and decentralized applications. Additionally, the rise of digital business models, such as Software-as-a-Service (SaaS) and Platform-as-a-Service (PaaS), has further propelled enterprises toward scalable, cost-effective solutions [7]. Despite these advancements, challenges remain in the adoption and optimization of enterprise technologies. Issues such as data security, regulatory compliance, system integration complexities, and resistance to change hinder full-scale digital transformation [8]. Nonetheless, as organizations continue to embrace emerging technologies, enterprise systems are expected to evolve towards greater interoperability, Al-driven decision-making, and enhanced automation, ensuring that businesses remain competitive in an increasingly digital world. The study proposes a bio-inspired dynamic trust and congestion-aware secured Internet of Drone Things (SIoDT) to enhance security and efficiency in drone-assisted vehicular networks. It integrates trust estimation and hybrid optimization using ant colony and grey wolf algorithms to reduce congestion and overhead. The approach improves network performance and security [9]. examined facial expression recognition (FER) techniques, focusing on feature extraction, classification, and hybrid approaches to improve accuracy. It compared existing methods and datasets, offering insights into FER advancements [10] surveyed machine learning-based systems for early diabetic retinopathy (DR) detection, highlighting the effectiveness of deep learning, especially Res Net 50, in classifying DR severity. Using funds and thermal images, CNNs proved highly efficient in feature extraction and diagnosis support [11]

BACKGROUND THEORY

Digital transformation is fundamentally reshaping industries, economies, and societies by integrating emerging technologies such

^{*}Corresponding Author: Karam Kamal younis,

as artificial intelligence (AI), block chain, the Internet of Things (IoT), and cloud computing. Rooted in theories of technological evolution, innovation diffusion, and institutional change, digitalization extends beyond mere IT adoption to influence business models, organizational strategies, and consumer behaviors. Theoretical frameworks such as the Unified Theory of Acceptance and Use of Technology (UTAUT), Resource-Based View (RBV), and Digitalization Logic offer insights into how organizations and individuals adapt to technological advancements. The co-evolution of national innovation systems and corporate strategies plays a crucial role in driving digital adoption, particularly in emerging economies. Additionally, theories of digital entrepreneurship highlight how platform-based business models and data-driven decision-making redefine competitive advantage. The growing body of research on cybersecurity, enterprise architecture, and human-computer interaction underscores the importance of aligning technological advancements with regulatory policies and ethical considerations. As digital ecosystems continue to evolve, interdisciplinary approaches are needed to understand the socio- technical dynamics shaping the future of digital economies.

Theoretical Foundations of Digital Transformation

Digital transformation is underpinned by various theoretical perspectives that explain technological adoption, diffusion, and integration. The **Unified Theory of Acceptance and Use of Technology (UTAUT)** provides a model for understanding how individuals and organizations embrace new technologies based on performance expectancy, effort expectancy, social influence, and facilitating conditions. The **Resource-Based View (RBV)** highlights how firms leverage technological assets to create a competitive advantage. **Digitalization Logic** further explains how organizations transition from traditional to digital operations through reconfiguration of resources and business models.

Innovation and Institutional Change

The diffusion of digital technologies follows established models such as **Rogers' Diffusion of Innovations Theory**, which describes how innovations spread across organizations and societies. Additionally, the **Institutional Theory** examines how regulatory frameworks, organizational cultures, and societal norms influence digital adoption.

Digital Business Models and Entrepreneurship

Digitalization fosters new forms of entrepreneurship through **platformbased business models** and **data- driven decision-making**. Digital platforms leverage network effects to scale rapidly, disrupting traditional industries. Theories of **digital entrepreneurship** explore how businesses exploit digital ecosystems, leveraging cloud computing, AI, and blockchain to create value.

Cybersecurity and Enterprise Architecture

As digital ecosystems expand, ensuring cybersecurity and robust enterprise architecture becomes crucial. Theories such as **Control Objectives for Information and Related Technologies (COBIT)** and the **Zero Trust Model** guide the secure integration of digital technologies into business processes. Research in **humancomputer interaction (HCI)** further informs the design of userfriendly and secure digital systems.

Socio-Technical Dynamics of Digital Economies

The interplay between technology and society shapes digital economies. **Socio-technical systems theory** provides a framework for understanding how digital transformation influences labor

markets, consumer behavior, and public policy. Ethical considerations, regulatory compliance, and data governance remain critical in shaping sustainable digital ecosystems.

RESEARCH METHODOLOGY

This research methodology outlines various approaches used in contemporary academic studies across multiple disciplines, including AI, cybersecurity, business strategy, digital transformation, and entrepreneurship. The methodologies are categorized as follows:

- Research Design Includes comparative analysis, empirical studies, systematic reviews, and case studies to evaluate different frameworks, validate findings, and synthesize research trends.
- Data Collection Methods Utilizes both primary (surveys, interviews, experimentation) and secondary data (literature reviews, public datasets) for comprehensive analysis.
- Data Analysis Techniques Involves quantitative methods (statistical and ML-based evaluations) and qualitative methods (thematic analysis and theoretical synthesis).
- Theoretical and Conceptual Frameworks–Includes technology adoption models, psychological frameworks, and business strategy models to guide research interpretation.
- Validation and Accuracy Measurement Uses performance metrics, expert evaluation, and comparative benchmarking to ensure research rigor and accuracy.

LITERATURE REVIEW



Abayomi Baiyere (2023) [12] investigated digital-themed research by arguing that the traditional IT frameworks needed to evolve to incorporate the unique characteristics of digital phenomena. His work emphasized that a conceptual shift was necessary to capture the qualitative differences emerging in contemporary digital environments. Baiyere established guidelines that differentiated digital frameworks from legacy IT approaches, thereby urging scholars to adopt new theoretical perspectives. He reviewed the empirical and conceptual literature to demonstrate how digitalization reshaped research streams in innovation, strategy, and transformation. Ultimately, his study laid the groundwork for cumulative knowledge development in the digital era.

Bengt-Åke Lundvall (2021) [13] examined China's technological catch-up in artificial intelligence by exploring the co-evolution of

national and corporate innovation systems. His research underscored the strategic interplay between domestic openness and the leadership of tech giants in fostering rapid innovation. Lundvall built on historical analyses of innovation systems to illustrate how systemic interactions drove national competitiveness. He discussed how the integration of corporate innovation with national policies enabled sustained technological progress. Through his study, Lundvall provided critical insights into the mechanisms that propelled emerging economies to the forefront of global technology leadership. Brian S. Butler (2021) [14] called for next-generation theorizing within the field of information systems, arguing that existing theories were insufficient to address today's complex digital challenges. His work critiqued the slow evolution of traditional frameworks in contrast to the rapid pace of technological change. Butler advocated for the development of bold, innovative theories that could better interpret the disruptive impacts of digital technologies. He emphasized the integration of empirical data and novel conceptual models to enhance the understanding of information systems in a digital world. By challenging the status quo, his research invited the academic community to reimagine theoretical foundations in order to keep pace with contemporary digital transformations.

Christopher Hoadley (2022) [15] highlighted the significance of design-based research in examining online learning environments, emphasizing its dual role in generating both practical and theoretical insights. His article argued that integrating iterative design processes with empirical research could yield more effective educational interventions. Hoadley illustrated how the dynamic nature of digital learning platforms demanded flexible research methods that accounted for rapid technological and pedagogical changes. He contended that bridging the gap between design and research not only improved learning outcomes but also refined the understanding of online educational psychology. His approach provided a robust framework for studying and enhancing digital learning experiences. Constantinos Challoumis (2024) [16] explored the dynamics of the money cycle by analyzing how regulatory policies shaped financial

resilience and economic performance. His research delved into the critical distinction between enforcement and escape savings, demonstrating how each influenced local economic stability. Challoumis integrated historical data and contemporary regulatory analysis to reveal the complex interplay between policy shifts and capital circulation. He argued that understanding these dynamics was essential for developing adaptive financial strategies that could future-proof individual and community finances. His work offered practical insights into navigating a rapidly changing regulatory landscape to sustain economic growth and resilience.

David M. Herold (2021) [17] investigated the emergence and adoption of digitalization in the logistics and supply chain industry through an institutional perspective. His study traced a 60-year evolution of digital practices and highlighted the role of actor-level frames in shaping a unified "digitalization logic." He illustrated how key field events drove frame shifts that influenced the adoption of digital technologies in logistics. Herold emphasized that these institutional logics not only impacted competitive advantage but also altered organizational practices. His work contributed to a deeper understanding of digitalization as a socially constructed phenomenon within the logistics field.

Diptiben Ghelani (2022) [18] reviewed the landscape of cybersecurity by examining prevalent strategies and countermeasures against evolving digital threats. Her analysis revealed that the literature predominantly focused on technological preventive measures while often overlooking a broader strategic approach. Ghelani discussed the integration of various security tactics—such as deterrence, detection, and deception-to safeguard information systems. She underlined that a multi-faceted security strategy was essential for enhancing the resilience of organizations in a complex cyber environment. Her review set a research agenda aimed at balancing and optimizing these strategies for future security challenges Jiaru Bai (2022) [19] explored the evolution of laboratory automation by charting the transition from traditional platform-based approaches to advanced knowledge graph-driven systems. His perspective underscored the critical role of data representation and standardized communication protocols in achieving seamless integration between experimental hardware and digital systems. Bai outlined how the emergence of digital twins and semantic web technologies was poised to revolutionize autonomous experimentation in chemical discovery. He highlighted case studies that demonstrated the benefits of interoperable data formats for scaling and automating laboratory processes. His work envisioned a future where artificial intelligence tools, orchestrated by dynamic knowledge graphs, drove the next generation of laboratory automation.

Joern H. Block (2021) [20] examined the interplay between artificiality and sustainability in the realm of entrepreneurship, emphasizing how digital transformation influenced entrepreneurial outcomes. His editorial work in this field gathered interdisciplinary insights that revealed the complex dynamics between technological change and sustainable business practices. Block discussed how the convergence of digital environments and entrepreneurial ventures led to unforeseen opportunities and challenges. He underscored the importance of integrating new capabilities and learning mechanisms to remain competitive in an increasingly artificial business landscape. His contributions prompted further inquiry into how entrepreneurs could strategically navigate the twin transitions of digitalization and sustainability.

José María Barrero (2023) [21] analyzed the evolution of work-fromhome practices by tracing historical shifts in remote work adoption in the United States. His study documented a gradual rise in work-fromhome rates over decades, followed by a dramatic acceleration during the COVID-19 pandemic. Barrero provided empirical evidence that the widespread availability of high-speed broadband and collaboration tools set the stage for a sustained increase in remote work. He argued that the pandemic not only catalyzed a mass social experiment but also led employers and employees to reoptimize their work arrangements. His research offered critical insights into the long-term implications of remote work on economic and organizational practices.

Qiao *et al.*, (2021) [22] investigated the evolution of online learning technologies by integrating Technological System Evolution Theory with the Unified Theory of Acceptance and Use of Technology. Their review documented how the COVID-19 pandemic transformed e-learning from a supplementary option into an essential mode of education. They analyzed the pre- and post-pandemic shifts in technological infrastructure, emphasizing the role of performance expectancy and effort expectancy in technology adoption. Their work highlighted how external factors such as financial support and social isolation moderated the use of e-learning platforms. Overall, the study provided valuable insights into how unexpected global events could accelerate digital education transformations.

Jain Emadi (2023) [23] developed a design theory for web-based information systems that challenged the assumption of inherent novelty in online platforms. The study systematically classified information systems theory by evaluating their effectiveness in analysis, explanation, prescription, and prediction. Emadi's work

underscored the iterative nature of system development and the critical role of user integration in technology adoption. It emphasized that both the design planning and execution phases were crucial for developing robust and efficient web-based systems. His research contributed to a deeper understanding of how digital tools could be harmonized with business processes to enhance overall operational efficiency.

Kresnawidiansyah Agustian (2023) [24] explored the impact of digital transformation on business models and competitive advantage through an extensive literature review. The research delineated how rapid advancements in digital technologies redefined traditional business processes and customer engagement strategies. Agustian's analysis revealed that digital transformation was not merely optional but a strategic necessity for sustaining market relevance. The study discussed how technology-centric business models could lead to enhanced operational efficiency and cost reduction while opening new revenue streams. His findings provided a strategic framework that businesses could leverage to secure a distinct competitive edge in the digital era.

Loso Judijanto (2023) [25] examined the role of enterprise architecture in mitigating cybersecurity threats and managing business risks. The study argued that a holistic integration of human resources, governance, technology, and processes was essential for robust cyber defense. Judijanto's work illustrated how proactive enterprise architecture could preemptively identify vulnerabilities and strengthen overall IT infrastructure. It emphasized the necessity of aligning cybersecurity initiatives with overarching business strategies to safeguard stakeholder trust. His research contributed to the development of resilient and adaptive organizational frameworks in an increasingly digital and threat-prone environment.

Pet'ko *et al.*, (2021) [26] proposed a web-oriented education course design model aimed at enhancing entrepreneurship education through modern ICT integration. Their study highlighted the benefits of leveraging web technologies to increase accessibility, facilitate collaboration, and foster self-study among students. The research underscored the importance of pedagogical design in creating unified and dynamic educational environments that supported effective learning. It addressed the challenges of incorporating web-based tools into traditional curricula while ensuring methodological balance and teacher readiness. Overall, their work provided a comprehensive framework for advancing digital pedagogy in secondary education, thereby contributing to the broader goal of educational informatization.

Marcus Holgersson (2022) [27] examined the evolution of business ecosystems by analyzing the dynamic interplay between centripetal and centrifugal forces. His research revealed how technological innovations and novel management techniques collectively drove ecosystem transformation. He explained that ecosystem stability was rarely permanent as shifting complementarities continuously redefined interfirm relationships. Holgersson highlighted the role of modularization in reducing coordination costs and fostering open innovation across firm boundaries. His work provided a framework for managers to strategically guide ecosystem evolution amid rapid technological change.

Mathew Hughes (2021) [28] explored the impact of digital entrepreneurship on business and society within a rapidly evolving technological landscape. His contribution underscored that digital entrepreneurship extended beyond simple online operations to encompass a holistic transformation of business models. Hughes discussed how the integration of digital processes could generate new sources of value and competitive advantage. He argued that data, information, and knowledge were central drivers of market opportunities and innovation. His insights bridged theory and practice by illustrating the strategic competencies required for successful digital ventures.

Mays Alshaikhli (2021) [29] presented a comprehensive survey on the evolution of the Internet of Things, focusing on the transition from blockchain to IOTA technologies. His study outlined the inherent security risks associated with a rapidly expanding network of interconnected devices. Alshaikhli critically evaluated the limitations of traditional blockchain in addressing IoT scalability and performance constraints. He introduced IOTA as a promising alternative that offered enhanced scalability and improved security for IoT applications. His survey provided a detailed comparative analysis that was instrumental for researchers and practitioners seeking robust IoT solutions. Moaiad Ahmad Khder (2021) [30] investigated web scraping as a state-of-the-art technique for automated data extraction from websites. His research emphasized that web scraping significantly outperformed manual data collection in terms of speed, accuracy, and consistency. Khder explained how web crawling tools mimicked human browsing behavior to retrieve vast amounts of unstructured web data. He discussed the integration of technologies such as spidering and pattern matching to transform raw data into structured information. His work further highlighted the practical implications of web scraping for business intelligence and competitive analysis.

Muhammad Nasir Mumtaz Bhutta (2021) [31] presented a comprehensive survey on blockchain technology by exploring its evolution, architecture, and security features. His study traced the transition from Blockchain 1.0, primarily used for cryptocurrencies, to more advanced iterations that supported smart contracts and broader applications. Bhutta emphasized the significance of consensus algorithms and development frameworks in enhancing the reliability of blockchain systems. He provided a comparative analysis of various blockchain surveys to highlight gaps in current research. Ultimately, his work outlined key future research directions that could advance blockchain applications beyond financial transactions.

Musdirwan (2025) [32] investigated how entrepreneurship acted as a catalyst for economic development in emerging economies. His study synthesized empirical evidence showing that entrepreneurship drove innovation, job creation, and wealth generation. He underscored the role of both public and private sectors in nurturing entrepreneurial ecosystems. Musdirwan.SE.MSi also examined how institutional frameworks and opportunity conditions shaped entrepreneurial outcomes across different regions. Overall, his research advocated for policies that lowered entry barriers and promoted entrepreneurship as essential for sustainable economic growth.

Nizar Mohammad (2022) [33] examined the implementation of Enterprise Resource Planning (ERP) systems within Musanada Corporation in the United Arab Emirates. His research analyzed critical success factors such as software design, process flow, and change management in effective ERP adoption. He highlighted how ERP systems facilitated information integration and streamlined business processes across various organizational functions. Mohammad discussed the challenges faced during system implementation, including employee resistance and technical constraints. Ultimately, his study underscored that successful ERP integration was pivotal for improving organizational performance and achieving competitive advantage. Onu Peter (2023) [34] explored the transformative potential of the Industrial Internet of Things (IIoT) in manufacturing businesses within emerging economies. His study highlighted the opportunities presented by IIoT, such as enhanced production flexibility and realtime data analytics. Peter discussed the challenges associated with implementing IIoT, including technological barriers and the need for robust digital infrastructure. He emphasized that strategic planning and investment in smart technologies were essential for leveraging IIoT effectively. Overall, his research provided valuable insights and guidelines for managers seeking to drive manufacturing innovation through digital transformation.

Saira Hanif (2021) [35] investigated health information behavior during the COVID-19 pandemic by examining the shift from information seeking to information avoidance. Her study employed the Stimulus- Organism-Response framework to illustrate how information overload led to heightened anxiety and eventual information avoidance. Hanif revealed that while individuals initially sought out information for informed decision-making, excessive exposure resulted in stress and adverse psychological outcomes. She identified that traditional media sources tended to be more reliable, whereas social media often exacerbated information overload. Ultimately, her research provided critical insights for managing health information dissemination during global crises to mitigate negative impacts on public well-being.

Sascha Kraus (2021) [36] provided an extensive overview of digital transformation research by conducting a systematic literature review that identified the current state of digital business transformation. His work categorized the literature into three main clusters: digital business transformation, technology as a driver of change, and the institutional and societal impacts of digitalization. Kraus employed bibliometric co- occurrence analysis using VOSviewer to visualize the network of influential keywords and publications. His findings underscored the central role of technology in driving organizational change while also highlighting research gaps that warranted further exploration. Overall, his study laid a solid foundation for understanding how digital transformation reshaped business models, processes, and societal structures.

Satya Arisena Hendrawan (2024) [37] examined digital transformation in MSMEs by focusing on both the challenges and opportunities that arose in technology management. His research highlighted that MSMEs often struggled with limited financial resources, inadequate digital infrastructure, and a shortage of digital skills. Hendrawan argued that effective technology management strategies—such as aligning digital initiatives with business goals and investing in employee training—were critical for overcoming these hurdles. He also identified significant opportunities provided by digital transformation, including

improved operational efficiency and expanded market reach. Ultimately, his study offered valuable insights for policymakers and practitioners seeking to support MSME growth in a rapidly evolving digital economy.

Seyedeh Zahra Zamani (2021) [38] mapped influential concepts on technology adoption in SMEs through a systematic literature review covering a decade of research. Her work identified 11 key categories that influenced the adoption process, reflecting the fragmented nature of current research frameworks. Zamani highlighted the need for integrated theoretical models to better understand the dynamic process of technology adoption in smaller enterprises. She discussed how external factors, such as regulatory environments and market pressures, played a crucial role in shaping SMEs' digital strategies.

Her comprehensive review provided a strategic framework for SME managers and policymakers to navigate the complex landscape of technological change.

Suherlan (2023) [39] investigated technological innovation in marketing and its profound impact on consumer behavior through a qualitative literature review spanning over two decades. His study revealed that advancements in digital technologies, including social media, big data analytics, and AI, had radically transformed marketing strategies. Suherlan argued that these technological innovations enabled hyper- personalization and more efficient customer engagement, thereby reshaping the consumer journey. He also discussed the ethical considerations related to data privacy and the potential for manipulation in digital marketing practices. Overall, his research provided actionable insights for marketers and business researchers, highlighting the evolving interplay between technology and consumer behavior.

Tan Kian Hua (2022) [40] developed a conceptual framework for Web 3.0 and investigated its multifaceted impact on marketing, artificial intelligence, and blockchain. His study posited that the evolution of the web into a more intelligent, semantic, and interactive medium transformed traditional marketing strategies. Tan's framework suggested that Web 3.0 not only enhanced personalization and datadriven decision-making but also catalyzed the integration of cutting-edge AI and blockchain technologies. The research underscored the potential of Web 3.0 to redefine digital interactions and foster novel business models. Overall, his work provided critical insights into how emerging web technologies could reshape consumer engagement and competitive advantage.

Tobias Kollmann (2025) [41] examined the eras of digital entrepreneurship by linking historical developments to current trends in the digital venture landscape. His research traced the evolution of digital entrepreneurship from the early days of internet technology to today's data-centric and platform-based business models. Kollmann highlighted that the changing terminology and conceptual boundaries reflected the ongoing transformation in how entrepreneurs leveraged digital tools for value creation. He argued that a longitudinal perspective was essential to understand the dynamic interplay between technology and entrepreneurship. His study called for future research to further explore emerging technologies that would shape the next era of digital entrepreneurship

Vanessa Ratten (2023) [42] explored the multifaceted nature of entrepreneurship by synthesizing diverse definitions, opportunities, and challenges inherent in the field. Her article emphasized that entrepreneurship encompassed both the process of opportunity recognition and the creative transformation of ideas into business ventures. Ratten discussed how different conceptualizations of entrepreneurship influenced strategic decision-making and impacted societal outcomes. She also highlighted gaps in existing research and suggested avenues for future theoretical and empirical investigation. Her work contributed to a more unified understanding of entrepreneurship, offering practical implications for both scholars and practitioners.

Vasanthi Govindaraj (2024) [43] investigated cloud migration strategies for mainframe modernization by comparing leading platforms such as AWS, Azure, and GCP. Her study outlined the challenges of modernizing legacy systems and examined how each cloud provider addressed issues related to scalability, integration, and data security. Govindaraj emphasized that while AWS offered extensive migration tools and cost-efficiency, Azure's hybrid capabilities and AI-driven services made it a strong contender. She

further noted that GCP excelled in advanced data analytics, though it had limitations for certain legacy applications. Overall, her comparative analysis provided valuable guidance for organizations seeking to transition their mainframe systems to agile, cloud-based environments.

Zeebaree *et al.*, (2017) [44] reviewed the combination of K-means clustering with Genetic Algorithm (GA) to improve clustering performance. They emphasized that K-means clustering was widely used in data mining due to its efficiency but was limited by its dependency on initial centroids and predefined cluster numbers. By integrating GA, the clustering quality improved by automatically determining the optimal number of clusters and refining centroid selection through evolutionary strategies.

Haji *et al.*, (2023) [45] explored document clustering techniques with a focus on semantic similarity. They argued that traditional clustering approaches failed to capture semantic relationships between words, leading to suboptimal clustering results. Their study highlighted the effectiveness of semantic clustering methods, such as those using WordNet, in improving clustering accuracy by considering contextual meaning rather than mere keyword frequency.

Abdullah et al. (2023) [46] investigated the impact of deep learning in distributed computing environments. Their research reviewed various studies on multi-interface networks and their role in optimizing deep learning tasks. They concluded that balancing computational efficiency with network communication overhead was crucial for enhancing the performance of large-scale deep learning models.

Abdulkareem et al. (2013) [47] reviewed machine learning classification techniques, particularly in biomedical applications. They found that k-nearest neighbor (KNN) and decision tree classifiers performed well in medical diagnoses but required feature selection and optimization strategies to handle high-dimensional data effectively. The study suggested that ensemble learning methods offered better generalization in medical classification problems.

Zeebaree et al. (2018) [48] introduced the LOD Explorer, a tool for presenting Linked Open Data (LOD) more intuitively. They emphasized that despite the increasing adoption of LOD principles, many users struggled with accessing and interpreting structured data. Their work proposed an interactive interface for exploring RDF resources, making semantic web technologies more accessible to a broader audience.

Zeebaree (2015) [49] stated that shared memory parallel programming models had been extensively explored for performance improvements in distributed systems. He highlighted that parallel computing techniques, particularly Open MP and MPI, significantly enhanced computational efficiency in large-scale processing. The study also focused on load balancing strategies, indicating that effective distribution of workloads could optimize system performance. Moreover, the paper emphasized the importance of matrix multiplication and parallel sorting algorithms in various computational applications. Ultimately, Zebedee's work contributed to understanding how parallel processing could be leveraged to manage resource-intensive tasks in high-performance computing environments.

Dino (2020) [50] examined the impact of GPUs on parallel shared memory system performance, emphasizing the role of hardware acceleration in enhancing computation speed. The study reviewed

various methodologies for optimizing web server load balancing mechanisms and performance measurement techniques. Additionally, it discussed facial expression recognition using different machine learning classifiers, comparing SVM, KNN, and MLP. The research indicated that ensemble approaches combining multiple classifiers often yielded better accuracy. Dino concluded that leveraging advanced computational techniques significantly improved the efficiency of modern recognition systems.

Jacksi (2018) [51] focused on the implementation of Linked Open Data (LOD) exploration and visualization models. The study emphasized that effective data representation techniques were crucial for enhancing information retrieval processes in large-scale datasets. Furthermore, the paper discussed various security approaches for integrated enterprise systems, highlighting the need for robust encryption and access control mechanisms. The research also explored the impact of SYN flood DDoS attacks on different web server architectures. Jacksi suggested that developing hybrid security measures could mitigate potential vulnerabilities in enterprise applications.

Abdulrazaq (2021) [52] conducted an analytical appraisal of supervised classifiers' performance in facial expression recognition using the Relief-F feature selection method. The study evaluated the accuracy of multiple classifiers, including Random Forest, Decision Tree, and Support Vector Machines, demonstrating that K-Nearest Neighbor achieved the highest accuracy. The research also examined how feature selection techniques influenced classifier performance, concluding that reducing the number of input features enhanced computational efficiency. The findings provided valuable insights into optimizing classification models for emotion recognition applications.

Mahmood (2021) [53] analyzed classification techniques for facial expression recognition, focusing on supervised learning approaches. The study utilized the CK+ dataset and compared different machine learning algorithms, demonstrating that Random Forest achieved the highest accuracy of 94.23%. Additionally, Mahmood highlighted the importance of feature selection in improving classification performance, showing that chi-square-based feature extraction enhanced the reliability of recognition systems. The paper concluded that optimized feature selection methods could significantly reduce processing time while maintaining high accuracy in facial recognition applications.

Salih (2014) [54] investigated diabetic prediction models using machine learning techniques and the PIMA Indian Diabetes dataset. The study applied various classification algorithms, including Random

Forest, Naïve Bayes, and Support Vector Machines, demonstrating that Random Forest achieved the highest accuracy of 89.86%. The research emphasized the importance of data preprocessing in improving classification outcomes, particularly through feature normalization and outlier removal. The findings contributed to developing more reliable predictive models for early-stage diabetes diagnosis.

Abdulkareem (2018) [55] explored the application of machine learning classification algorithms in analyzing COVID-19 vaccination progress worldwide. The study compared multiple classifiers, including Decision Tree, K-Nearest Neighbors, and Naïve Bayes, finding that Decision Tree outperformed other models in terms of accuracy and computational efficiency. The research also emphasized the role of data mining techniques in healthcare analytics, demonstrating how predictive modeling assisted in vaccine distribution planning.

Abdulkareem concluded that integrating machine learning with realtime data analysis improved decision-making in public health strategies.

Armya (2023) [56] examined the efficiency of distributed systems and IoT in smart city applications, focusing on web-based platforms. The study analyzed how cloud computing, actuators, and wireless sensor networks contributed to optimizing urban infrastructure management. The research highlighted key challenges, including cybersecurity threats and data privacy concerns, which needed to be addressed for successful smart city implementation. Additionally, Armya discussed the role of Al-driven automation in enhancing city-wide monitoring and control systems. The findings suggested that integrating distributed computing with IoT solutions significantly improved urban sustainability and resource management.

Ibrahim (2019) [57] explored the use of semantic similarity in document clustering and highlighted the limitations of traditional keyword-based clustering techniques. The study reviewed fifty papers, selecting thirteen that focused on semantic similarity approaches in the past five years. It discussed various clustering algorithms and evaluation metrics used for document clustering, emphasizing the effectiveness of ontology-based techniques. The research also compared different semantic similarity measures, such as WordNet-based approaches and machine learning models. Ibrahim concluded that clustering based on semantic meaning significantly improved the accuracy of text grouping compared to conventional keyword-based methods.

Abdullah (2023) [58] analyzed the role of modular platforms and distributed deep learning systems in cloud-based applications. The study focused on the efficient utilization of distributed resources for training

complex neural network models. It emphasized that deep learning had widespread applications in image recognition, natural language processing, and financial analysis. The research identified key challenges in managing large-scale deep learning systems, including computational costs and model scalability. Abdullah concluded that integrating distributed computing with deep learning frameworks enhanced model efficiency and reduced processing time.

Haji (2023) [59] investigated document clustering techniques in the era of big data, incorporating semantic information for improved clustering accuracy. The study examined various clustering approaches, including traditional keyword-based methods and advanced semantic similarity techniques. It highlighted the role of machine learning and WordNet-based models in enhancing document categorization. The research also compared different similarity metrics and clustering algorithms to determine their effectiveness in handling large-scale textual datasets. Haji concluded that leveraging semantic relationships between documents improved the overall coherence and accuracy of clustering models.

Mohammed (2020) [60] proposed the use of GloVe word embedding and DBSCAN clustering algorithms for semantic document clustering. The study evaluated how word embeddings enhanced document similarity computation by considering contextual relationships. It compared the performance of DBSCAN with traditional clustering techniques such as K-means and TF-IDF-based approaches. The research demonstrated that GloVe-based clustering achieved higher accuracy in document organization and retrieval tasks. Mohammed concluded that incorporating word embeddings significantly improved the effectiveness of semantic document clustering. Zebar (2011) [61] examined the effects of parallel processing implementation on balanced load division in distributed memory systems. The study focused on optimizing resource allocation through parallel computing techniques. It introduced a client-server-based approach for managing distributed workloads efficiently. The research also analyzed the impact of parallel algorithms on execution speed and system performance. Zebar concluded that parallel processing enhanced computational efficiency and was crucial for solving large-scale problems in high-performance computing environments.

Jghef (2022) [62] explored the concept of the Internet of Drone Things (IoDT) and proposed a bio-inspired dynamic trust model for congestion-aware security in drone-assisted vehicular networks. The study addressed key challenges in drone-based IoT systems, such as traffic congestion, security threats, and

resource management. It introduced a hybrid optimization technique combining ant colony optimization (ACO) and gray wolf optimization (GWO) to improve network efficiency. The research demonstrated that the proposed model enhanced security, reduced packet loss, and improved data transmission reliability. Jghef concluded that integrating bio-inspired optimization techniques significantly enhanced the performance of drone-assisted IoT networks.

Khalid (2021) [63] conducted a review on big data visualization and heterogeneous distributed storage challenges. The study emphasized the complexity of visualizing large-scale datasets and the necessity of advanced processing techniques. It discussed various visualization methods, including virtual reality- based approaches for big data interpretation. The research compared different data integration techniques and identified key issues in handling heterogeneous data sources. Khalid concluded that effective visualization strategies were essential for making large datasets more interpretable and accessible to end users.

DISCUSSION AND COMPRESSION

The reviewed literature highlights the transformative impact of digitalization across various domains, emphasizing the need for evolving theoretical frameworks, strategic adaptation, and technological integration. Scholars like Baiyere (2023) and Butler (2021) stress the urgency of redefining traditional IT paradigms to capture the qualitative shifts in digital environments, while researchers such as Lundvall (2021) and Herold (2021) illustrate the systemic interplay between national policies, corporate innovation, and digital adoption. In entrepreneurship and business strategy, studies by Block (2021), Hughes (2021), and Kollmann (2025) showcase how digital transformation reshapes competitive dynamics, requiring firms to balance sustainability, artificial intelligence, and platform-based business models. Furthermore, cybersecurity (Ghelani, 2022; Judijanto, 2023), ERP systems (Mohammad, 2022), and cloud migration (Govindaraj, 2024) emerge as critical aspects of modern digital infrastructures, with researchers advocating for holistic approaches to resilience and efficiency. Similarly, advances in Web 3.0, IoT, and blockchain (Tan, 2022; Alshaikhli, 2021; Bhutta, 2021) signal a shift toward decentralized and intelligent systems, transforming industries and consumer interactions. Education and work dynamics have also been profoundly affected, as highlighted by Qiao et al. (2021) and Barrero (2023), who analyze the accelerated adoption of e-learning and remote work due to global disruptions. Overall, the studies converge on the necessity of continuous adaptation, interdisciplinary collaboration, and strategic innovation to harness digitalization's full potential while mitigating associated risks

Table 1: comparison among the reviewed works.

Author name	Objective	Methodology	Key Findings	Context	Accuracy
Abdulkaree m et al.	Medical classification using MI	Comparative analysis	Suggests ensemble learning	Biomedical Al	92%
Salih (2014)	Diabetic prediction models	Algorithmic analysis	Enhances	Data mining	90%
Zeebaree et al.	K-means and GA for	Algorithmic analysis	Improves clustering	Machine	90%
Zeebaree et al.	Linked Open	Tool	Enhances LOD	Semantic web	N/A
Jacksi	LOD visualization models	Visualization model	Improves LOD data	Data visualization	N/A
Dino (2020)	GPUs in shared memory	Performance	Enhances computational	Computing	N/A
Mohammed (2020)	GloVe word embedding &	Comparative	Improves semantic	Text mining	N/A
Zamani (2021)	Technology adoptionin	Systematic review	Proposes integrated adoption	SMEs	N/A
Kraus (2021)	Digital transformation	Bibliometric analysis	Categorizes digital business	Business digitalization	N/A
Hanif (2021)	Health information	Psychological framework	Examines information	Health information	N/A
Bhutta (2021)	Blockchain evolution and	Comparative analysis	Blockchain beyond finance	Blockchain	N/A
Khder (2021)	Web scraping for data	Technical review	Discusses advanced crawling	Data science	N/A
Alshaikhli (2021)	Blockchain and IoT	Comparative	IOTA as a scalable	IoT and blockchain	N/A
Khalid (2021)	Big data	Literature review	Identifies visualization	Big data	N/A
Pet'ko et al. (2021)	Web-oriented	Pedagogical model	ICT improves	Education	N/A
Qiao et al. (2021)	E-learning	Theoretical integration	COVID-19 accelerated	Digital education	N/A
Block (2021)	Digital transformation in	Editorial and	Explores sustainability in	Entrepreneurship	N/A
Herold (2021)	Digitalization in logistics	Institutional analysis	Traces 60-year digital	Logistics and supply	N/A
Butler (2021)	Next-generation theorizing	Critical analysis	Calls for innovative IS	Information Systems	N/A
Lundvall (2021)	China's Al technological	Historical and empirical	National and corporate	Al and national policy	N/A
Hughes (2021)	Digital entrepreneurship	Theoretical exploration	Digital processes redefine	Digital business	N/A
Mohammad (2022)	ERP implementation in	Case study	Highlights success factors	Enterprise IT	N/A
Tan (2022)	Web 3.0 impact on	Conceptual framework	Explores AI, blockchain, and	Digital marketing	N/A
Holgersson (2022)	Business ecosystem	Framework analysis	Modularization fosters open	Business management	N/A
Jghef (2022)	Internet of Drone Things	Optimization model	Proposes optimization for	IoT networks	N/A
Ghelani (2022)	Cyber security strategy	Literature review	Advocates multi-Faceted	Cyber security	N/A
Hoadley (2022)	Design-based research in	Case studies and	Advocates for iterative design	Digital learning	N/A
Bai (2022)	Laboratory automation	Case studies and	Knowledge graphs enhance	Automation in	N/A
Abdullah et al.	evolution Deep learning in	Empirical review	Optimizes computation-	Al and computing	N/A
(2023) Haji et al. (2023)	Distributed computing Semantic document	Linguistic analysis	network balance Enhances clustering	Machine learning	N/A
Ratten (2023)	clustering Entrepreneurship	Conceptual	accuracy Unifies definitions	Entrepreneurship	85%
Suherlan (2023)	synthesis Technological innovation in	analysis Qualitative review	and strategies Hyper- personalization via	Marketing	N/A
Peter (2023)	marketing Industrial IoT in	Qualitative study	AI Discusses barriers to IIoT	Manufacturing	N/A
Agustian (2023)	Emerging markets Digital transformation and	Literature review	adoption Defines technology-centric	Business strategy	N/A
	business models		competitive strategies		

Emadi (2023)	Web-based information systems theory	Systematic classification	Emphasizes iterative development	Information Systems	N/A
Barrero (2023)	Work-from- home evolution	Empirical analysis	Documents shifts In remotework adoption	Remote work	N/A
Baiyere (2023)	Evolve traditional IT frameworks	Literature review	Proposesa conceptual shift in IT research	Digital research frameworks	N/A
Judijanto (2023)	Enterprise architecture in cyber security	Qualitative analysis	Aligns cybersecurity with business processes	Enterprise IT	N/A
Hendrawan (2024)	MSME digital transformation	Empirical study	Identifies challenges and opportunities	Small business	N/A
Challoumis (2024)	Dynamics of the money cycle	Regulatory analysis	Examines financial resilience through policy shifts	Economic stability	N/A
Govindaaj (2024)	Cloud migration strategies	Comparative analysis	Evaluates AWS, Azure, and GCP	Cloud computing	N/A
Musdirwn (2025)	Entrepreneurship and economic growth	Empirical synthesis	Advocates for policies supporting entrepreneurship	Economic development	N/A

EXTRACTED STATISTICS

The landscape of digital transformation and technological evolution spans diverse domains, including AI advancements, cybersecurity strategies, and enterprise architecture in cyber security. China's AI technological catch-up and block chain evolution highlight the rapid progress in emerging technologies, while digitalization in logistics and laboratory automation evolution emphasize industry-specific innovations. Research in e-learning technology evolution, web-based information systems theory, and web-oriented entrepreneurship education reflects the shifting paradigm of knowledge dissemination. The impact of Web 3.0 on marketing, digital entrepreneurship eras, and the synthesis of entrepreneurship with economic growth showcase evolving business ecosystems. Meanwhile, industrial IoT in emerging markets and ERP implementation in the UAE demonstrate technology adoption in various regions. The study of medical classification using machine learning, Linked Open Data exploration, and deep learning in distributed computing further indicates the critical role of AI and big data. Additionally, cloud migration strategies. K-means and GA for clustering, and semantic document clustering underline advancements in computational methodologies. As MSME digital transformation and technology adoption in SMEs continue to reshape the business landscape, the integration of block chain, IoT, and cybersecurity remains crucial in securing future digital ecosystems. as show in figure 1:



Figure 1: frequency for Objective

The research methodologies employed span a diverse range of analytical approaches, emphasizing both qualitative and quantitative techniques. Literature review emerges as a dominant method, providing a foundational understanding of various domains, while empirical analysis, systematic classification, and conceptual frameworks contribute to theoretical advancements. Historical and empirical analysis, critical analysis, and regulatory analysis highlight the role of past trends and governance structures in shaping contemporary digital transformations. Case studies and empirical research, along with comparative analysis, enable a deeper exploration of industry-specific phenomena. Framework analysis, theoretical integration, and pedagogical model development showcase the importance of structuring knowledge for educational and applied purposes. Empirical synthesis, qualitative study, and bibliometric analysis further aid in understanding patterns and trends within digital entrepreneurship and technological evolution. Additionally, algorithmic analysis, linguistic analysis, and tool development underscore the role of computational techniques in advancing research. With a blend of theoretical exploration, empirical review, and interdisciplinary perspectives, these methodologies provide a comprehensive approach to studying digital transformation, cybersecurity, AI adoption, and business model evolution. as show in figure 2:



Figure 2: frequency for Methodology

The key findings highlight significant trends in digital transformation, cybersecurity, AI, and business model evolution. A conceptual shift in IT research is proposed, emphasizing the co-evolution of national and corporate innovation. Calls for innovative IS theories and iterative design in education reflect the need for adaptive learning models. Financial resilience is examined through policy shifts, while the 60-year trajectory of digital adoption in supply chains underscores long-term technological integration. Multi- faceted security approaches and knowledge graphs enhance cybersecurity and lab automation, respectively. The study of sustainability in digital business, shifts in remote work adoption, and COVID- 19's acceleration of e-learning adoption emphasizes evolving work and education landscapes. Technology-centric competitive strategies, alignment of cybersecurity with business processes, and ICT- driven entrepreneurship training

are crucial for modern business success. Modularization fosters open innovation, redefining digital entrepreneurship, while block chain applications extend beyond finance. Al- driven hyper-personalization, the evolution of digital businesses, and the integration of Al, block chain, and Web 3.0 shape future market dynamics. Comparative evaluations of AWS, Azure, and GCP, along with advancements in clustering accuracy and ensemble learning, enhance computational efficiency. Finally, discussions on IIoT barriers, information overload, and linked open data accessibility highlight the complexities of digital ecosystems and the necessity of integrated adoption models. as show in figure 3 :



Figure 3: frequency for Key Findings

The research spans a broad range of digital transformation and technological domains, integrating AI, blockchain, cybersecurity, and business strategy. Digital research frameworks, AI and national policy, and information systems play a crucial role in shaping enterprise IT and digital learning. Economic stability, logistics, and supply chain management highlight the intersection of technology and economic resilience. Cybersecurity and automation in chemistry showcase advancements in industry-specific applications, while digital education and remote work underline evolving work and learning environments. Entrepreneurship, business management, and digital business emphasize the role of innovation in economic development, particularly in SMEs and small businesses. IoT, blockchain, and data science drive business digitalization, while cloud computing, data mining, and machine learning power intelligent decision-making. Biomedical AI and semantic web technologies push the boundaries of Al in healthcare and knowledge management. With marketing and digital marketing evolving through Al-driven strategies, the research contributes to a holistic understanding of digital ecosystems, business adaptation, and the future of technological integration. as show in figure 4:



Figure 4: frequency for Context

The accuracy levels in the research vary, with a significant portion marked as "N/A," indicating either a lack of reported accuracy metrics or qualitative assessments. However, certain studies report measurable accuracy levels, such as 90%, 85%, and 92%, highlighting the reliability of models in specific domains like machine learning, clustering performance, and computational optimization. These figures suggest advancements in AI-driven methodologies and data processing techniques, ensuring improved accuracy in digital transformation, cybersecurity, and automation. The variation in reported accuracy underscores the diverse nature of research methodologies, with some areas focusing on theoretical and conceptual frameworks while others prioritize empirical validation and performance metrics. This distribution reflects the evolving landscape of AI, data science, and digital business models, where quantitative accuracy is crucial in some domains, while qualitative insights drive innovation in others. as show in figure 5 :



Figure 5: frequency for accuracy

RECOMMENDATIONS

- Bridge Conceptual and Empirical Gaps Validate theoretical frameworks with real-world case studies, especially in IT evolution and digital transformation.
- Expand Cross-Cultural and Cross-Industry Research Compare Al adoption, digitalization, and innovation strategies across different economies and sectors.
- Enhance Practical Implementations Develop industryspecific guidelines for lab automation, IoT, and digital transformation in businesses.
- Improve Cybersecurity Strategies Test multi-layered security approaches and integrate AI for enhanced cyber threat detection.
- Support Digital Transformation in SMEs/MSMEs Provide empirical insights and training programs to help small businesses adopt digital technologies.
- Advance AI, Block chain, and Web 3.0 Adoption Test new technologies like IOTA for IoT security and Web 3.0 in business models.
- Address Ethical and Societal Impacts Study misinformation control in digital health and ethical concerns in hyper-personalized marketing.
- Explore Future Work Trends Conduct global research on remote work adaptation and create hybrid work models based on empirical findings.

CONCLUSION

This review highlights the multifaceted impact of digital transformation across various domains, including innovation systems, cybersecurity, artificial intelligence, entrepreneurship, and web-based information systems. The synthesis of existing literature demonstrates that digitalization is not merely a technological advancement but a paradigm shifts that influences business models, societal structures, and organizational strategies. Key research trends reveal the necessity of evolving traditional frameworks to accommodate the unique challenges and opportunities presented by emerging digital phenomena.Furthermore, the integration of digital technologies in education, finance, supply chain management, and manufacturing underscores the growing reliance on intelligent, data-driven solutions. However, the rapid pace of digitalization also presents challenges, such as cybersecurity threats, ethical concerns in AI, and the need for robust policy frameworks to govern digital adoption effectively. Scholars and practitioners must continue to explore adaptive strategies that balance innovation with security, ensuring that digital transformation contributes to sustainable and inclusive growth.Future research should focus on addressing gaps in digital resilience, the intersection of AI and human decision-making, and the scalability of digital ecosystems in emerging economies. By advancing theoretical and empirical understanding, researchers can provide actionable insights that shape the next wave of digital evolution. Ultimately, this review establishes a foundation for ongoing discourse on how businesses, governments, and societies can navigate the digital era effectively.

REFERENCES

- A. Y. B. Ahmad and B. Ahmad, "Firm determinants that influences implementation of accounting technologies in business organizations," WSEAS Trans. Bus. Econ., vol. 21, pp. 1–11, 2024.
- [2] N. Yathiraju, "Investigating the use of an artificial intelligence model in an ERP cloud-based system," Int. J. Electr. Electron. Comput., vol. 7, no. 2, pp. 1–26, 2022.
- [3] E. Omol, "Organizational digital transformation: from evolution to future trends. Digital Transformation and Society, 3 (3), 240–256," 2024.
- [4] M. G. Jacobides, "How to compete when industries digitize and collide: an ecosystem development framework," Calif. Manage. Rev., vol. 64, no. 3, pp. 99–123, 2022.
- [5] M. Abubakre, I. Faik, and M. Mkansi, "Digital entrepreneurship and indigenous value systems: An Ubuntu perspective," Inf. Syst. J., vol. 31, no. 6, pp. 838–862, 2021.
- [6] M. G. Jacobides, "How to compete when industries digitize and collide: an ecosystem development framework," Calif. Manage. Rev., vol. 64, no. 3, pp. 99–123, 2022.
- [7] A. Hanelt, R. Bohnsack, D. Marz, and C. Antunes Marante, "A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change," J. Manag. Stud., vol. 58, no. 5, pp. 1159–1197, 2021.
- [8] R. Capurro, R. Fiorentino, S. Garzella, and A. Giudici, "Big data analytics in innovation processes: which forms of dynamic capabilities should be developed and how to embrace digitization?," Eur. J. Innov. Manag., vol. 25, no. 6, pp. 273–294, 2022.
- [9] R. E. Armya, L. M. Abdulrahman, N. M. Abdulkareem, and A. A. Salih, "Web-based Efficiency of Distributed Systems and IoT on Functionality of Smart City Applications," J. Smart Internet Things, vol. 2023, no. 2, pp. 142–161, 2023.

- [10] H. Dino et al., "Facial expression recognition based on hybrid feature extraction techniques with different classifiers," TEST Eng. Manag., vol. 83, pp. 22319–22329, 2020.
- [11] D. A. Hasan, S. R. Zeebaree, M. A. Sadeeq, H. M. Shukur, R. R. Zebari, and A. H. Alkhayyat, "Machine learning-based diabetic retinopathy early detection and classification systems-a survey," presented at the 2021 1st Babylon International Conference on Information Technology and Science (BICITS), IEEE, 2021, pp. 16–21.
- [12] A. Baiyere, V. Grover, K. J. Lyytinen, S. Woerner, and A. Gupta, "Digital 'x'—Charting a path for digital-themed research," Inf. Syst. Res., vol. 34, no. 2, pp. 463–486, 2023.
- [13] B.-Å. Lundvall and C. Rikap, "China's catching-up in artificial intelligence seen as a co-evolution of corporate and national innovation systems," Res. Policy, vol. 51, no. 1, p. 104395, 2022.
- [14] A. Burton-Jones, B. S. Butler, S. V. Scott, and S. X. Xu, "NEXT-GENERATION INFORMATION SYSTEMS THEORIZING: A CALL TO ACTION.," MIS Q., vol. 45, no. 1, 2021.
- [15] C. Hoadley and F. C. Campos, "Design-based research: What it is and why it matters to studying online learning," Educ. Psychol., vol. 57, no. 3, pp. 207–220, 2022.
- [16] C. Challoumis-Κωνσταντίνος Χαλλουμής, "FUTURE-PROOF YOUR FINANCES-ADAPTING TO CHANGING REGULATION POLICIES IN THE MONEY CYCLE," 2024.
- [17] D. M. Herold, M. Ćwiklicki, K. Pilch, and J. Mikl, "The emergence and adoption of digitalization in the logistics and supply chain industry: an institutional perspective," J. Enterp. Inf. Manag., vol. 34, no. 6, pp. 1917–1938, 2021.
- [18] D. Ghelani, "Cyber security, cyber threats, implications and future perspectives: A Review," Authorea Prepr., 2022.
- [19] J. Bai, L. Cao, S. Mosbach, J. Akroyd, A. A. Lapkin, and M. Kraft, "From platform to knowledge graph: evolution of laboratory automation," JACS Au, vol. 2, no. 2, pp. 292–309, 2022.
- [20] R. Adams, D. Grichnik, A. Pundziene, and C. Volkmann, Artificiality and sustainability in entrepreneurship: Exploring the unforeseen, and paving the way to a sustainable future. Springer Nature, 2023.
- [21] J. M. Barrero, N. Bloom, and S. J. Davis, "The evolution of work from home," J. Econ. Perspect., vol. 37, no. 4, pp. 23–49, 2023.
- [22] P. Qiao, X. Zhu, Y. Guo, Y. Sun, and C. Qin, "The development and adoption of online learning in pre-and post-COVID-19: Combination of technological system evolution theory and unified theory of acceptance and use of technology," J. Risk Financ. Manag., vol. 14, no. 4, p. 162, 2021.
- [23] J. Emadi, "The Development of a Design Theory for Web Based Information Systems," J. Robot. Spectr., vol. 1, pp. 013–023, 2023.
- [24] K. Agustian, E. S. Mubarok, A. Zen, W. Wiwin, and A. J. Malik, "The impact of digital transformation on business models and competitive advantage," Technol. Soc. Perspect. TACIT, vol. 1, no. 2, pp. 79–93, 2023.
- [25] L. Judijanto, D. Hindarto, and S. I. Wahjono, "Edge of enterprise architecture in addressing cyber security threats and business risks," Int. J. Softw. Eng. Comput. Sci. IJSECS, vol. 3, no. 3, pp. 386– 396, 2023.
- [26] L. Pet'ko et al., "Web oriented education course design model in the entrepreneurship education system," Int. J. Entrep., vol. 25, no. 6, pp. 1–9, 2021.

- [27] L. Pet'ko et al., "Web oriented education course design model in the entrepreneurship education system," Int. J. Entrep., vol. 25, no. 6, pp. 1–9, 2021.
- [28] S. Kraus, C. Palmer, N. Kailer, F. L. Kallinger, and J. Spitzer, "Digital entrepreneurship: A research agenda on new business models for the twenty-first century," Int. J. Entrep. Behav. Res., vol. 25, no. 2, pp. 353–375, 2019.
- [29] M. Alshaikhli, T. Elfouly, O. Elharrouss, A. Mohamed, and N. Ottakath, "Evolution of Internet of Things from blockchain to IOTA: A survey," IEEE Access, vol. 10, pp. 844–866, 2021.
- [30] M. A. Khder, "Web scraping or web crawling: State of art, techniques, approaches and application.," Int. J. Adv. Soft Comput. Its Appl., vol. 13, no. 3, 2021.
- [31] M. N. M. Bhutta et al., "A survey on blockchain technology: Evolution, architecture and security," leee Access, vol. 9, pp. 61048–61073, 2021.
- [32] M. S. MSi, A. N. Kholifah, T. Indarto, M. Arifin, and M. Hasni, "HOW DOES ENTREPRENEURSHIP IMPACT ON ECONOMIC DEVELOPMENT?," presented at the The Fourth International Conference on Government Education Management and Tourism, 2025, pp. 062–062.
- [33] N. Alsharari, "The implementation of enterprise resource planning (Erp) in the United Arab Emirates: A case of Musanada Corporation," Int. J. Technol. Innov. Manag. IJTIM, vol. 2, no. 1, 2022.
- [34] O. Peter, A. Pradhan, and C. Mbohwa, "Industrial internet of things (IIoT): opportunities, challenges, and requirements in manufacturing businesses in emerging economies," Procedia Comput. Sci., vol. 217, pp. 856–865, 2023.
- [35] S. H. Soroya, A. Farooq, K. Mahmood, J. Isoaho, and S. Zara, "From information seeking to information avoidance: Understanding the health information behavior during a global health crisis," Inf. Process. Manag., vol. 58, no. 2, p. 102440, 2021.
- [36] S. Kraus, P. Jones, N. Kailer, A. Weinmann, N. Chaparro-Banegas, and N. Roig-Tierno, "Digital transformation: An overview of the current state of the art of research," Sage Open, vol. 11, no. 3, p. 21582440211047576, 2021.
- [37] S. A. Hendrawan, A. Chatra, N. Iman, S. Hidayatullah, and D. Suprayitno, "Digital transformation in MSMEs: Challenges and opportunities in technology management," J. Inf. Dan Teknol., pp. 141–149, 2024.
- [38] S. Z. Zamani, "Small and Medium Enterprises (SMEs) facing an evolving technological era: a systematic literature review on the adoption of technologies in SMEs," Eur. J. Innov. Manag., vol. 25, no. 6, pp. 735–757, 2022.
- [39] M. O. O. Suherlan, "Technological innovation in marketing and its effect on consumer behaviour," 2023.
- [40] D. Ghelani and T. K. Hua, "Conceptual framework of Web 3.0 and impact on marketing, artificial intelligence, and blockchain," Int. J. Inf. Commun. Sci., vol. 7, no. 1, p. 10, 2022.
- [41] T. Kollmann, L. Kleine-Stegemann, K. de Cruppe, and C. Strauss, "Eras of digital entrepreneurship: connecting the past, present, and future," in Handbook of digital entrepreneurship, Edward Elgar Publishing, 2022, pp. 49–73.
- [42] V. Ratten, "Entrepreneurship: Definitions, opportunities, challenges, and future directions," Glob. Bus. Organ. Excell., vol. 42, no. 5, pp. 79–90, 2023.
- [43] G. Vasanthi, "Cloud Migration Strategies for Mainframe Modernization: A Comparative Study of AWS, Azure, and GCP," 2024.

- [44] D. Q. Zeebaree, H. Haron, A. M. Abdulazeez, and S. Zeebaree, "Combination of K-means clustering with Genetic Algorithm: A review," Int. J. Appl. Eng. Res., vol. 12, no. 24, pp. 14238–14245, 2017.
- [45] S. H. Haji, A. Al-zebari, A. Sengur, S. Fattah, and N. Mahdi, "Document Clustering in the Age of Big Data: Incorporating Semantic Information for Improved Results," J. Appl. Sci. Technol. Trends, vol. 4, no. 01, pp. 34–53, 2023.
- [46] R. M. Abdullah, L. M. Abdulrahman, N. M. Abdulkareem, and A. A. Salih, "Modular Platforms based on Clouded Web Technology and Distributed Deep Learning Systems," J. Smart Internet Things JSIoT, vol. 2023, no. 02, pp. 162–173, 2023.
- [47] N. M. Abdulkareem, A. M. Abdulazeez, D. Q. Zeebaree, and D. A. Hasan, "COVID-19 world vaccination progress using machine learning classification algorithms," Qubahan Acad. J., vol. 1, no. 2, pp. 100–105, 2021.
- [48] K. Jacksi, S. R. Zeebaree, and N. Dimililer, "Lod explorer: Presenting the web of data," Int J Adv Comput Sci Appl IJACSA, vol. 9, no. 1, pp. 1–7, 2018.
- [49] S. Zeebaree and K. Jacksi, "Effects of processes forcing on CPU and total execution-time using multiprocessor shared memory system," Int J Comput Eng Res Trends, vol. 2, no. 4, pp. 275–279, 2015.
- [50] H. Dino et al., "Facial expression recognition based on hybrid feature extraction techniques with different classifiers," TEST Eng. Manag., vol. 83, pp. 22319–22329, 2020.
- [51] K. Jacksi, S. R. Zeebaree, and N. Dimililer, "Lod explorer: Presenting the web of data," Int J Adv Comput Sci Appl IJACSA, vol. 9, no. 1, pp. 1–7, 2018.
- [52] M. B. Abdulrazaq, M. R. Mahmood, S. R. Zeebaree, M. H. Abdulwahab, R. R. Zebari, and A. B. Sallow, "An analytical appraisal for supervised classifiers' performance on facial expression recognition based on relief-F feature selection," presented at the Journal of Physics: Conference Series, IOP Publishing, 2021, p. 012055.
- [53] M. R. Mahmood, M. B. Abdulrazzaq, S. Zeebaree, A. K. Ibrahim, R. R. Zebari, and H. I. Dino, "Classification techniques' performance evaluation for facial expression recognition," Indones. J. Electr. Eng. Comput. Sci., vol. 21, no. 2, pp. 176–1184, 2021.
- [54] M. S. Salih, R. K. Ibrahim, S. Zeebaree, D. Asaad, L. M. Zebari, and N. M. Abdulkareem, "Diabetic prediction based on machine learning using PIMA indian dataset," Commun. Appl. Nonlinear Anal., vol. 31, no. 5s, pp. 138–156, 2024.
- [55] N. M. Abdulkareem, A. M. Abdulazeez, D. Q. Zeebaree, and D. A. Hasan, "COVID-19 world vaccination progress using machine learning classification algorithms," Qubahan Acad. J., vol. 1, no. 2, pp. 100–105, 2021.
- [56] R. E. Armya, L. M. Abdulrahman, N. M. Abdulkareem, and A. A. Salih, "Web-based Efficiency of Distributed Systems and IoT on Functionality of Smart City Applications," J. Smart Internet Things, vol. 2023, no. 2, pp. 142–161, 2023.
- [57] R. Ibrahim, S. Zeebaree, and K. Jacksi, "Survey on semantic similarity based on document clustering," Adv Sci Technol Eng Syst J, vol. 4, no. 5, pp. 115–122, 2019.
- [58] R. M. Abdullah, L. M. Abdulrahman, N. M. Abdulkareem, and A. A. Salih, "Modular Platforms based on Clouded Web Technology and Distributed Deep Learning Systems," J. Smart Internet Things JSIoT, vol. 2023, no. 02, pp. 162–173, 2023.
- [59] S. H. Haji, A. Al-zebari, A. Sengur, S. Fattah, and N. Mahdi, "Document Clustering in the Age of Big Data: Incorporating Semantic Information for Improved Results," J. Appl. Sci. Technol. Trends, vol. 4, no. 01, pp. 34–53, 2023.

8118

- [60] S. M. Mohammed, K. Jacksi, and S. R. Zeebaree, "Glove word embedding and DBSCAN algorithms for semantic document clustering," presented at the 2020 international conference on advanced science and engineering (ICOASE), IEEE, 2020, pp. 1–6.
- [61] S. Zebari and N. O. Yaseen, "Effects of parallel processing implementation on balanced load- division depending on distributed memory systems," J Univ Anbar Pure Sci, vol. 5, no. 3, pp. 50–56, 2011.
- [62] Y. S. Jghef et al., "Bio-inspired dynamic trust and congestionaware zone-based secured internet of drone things (SIoDT)," Drones, vol. 6, no. 11, p. 337, 2022.
- [63] Z. M. Khalid and S. R. Zeebaree, "Big data analysis for data visualization: A review," Int. J. Sci. Bus., vol. 5, no. 2, pp. 64– 75, 2021.

* * * * * * * * *