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Strategic frameworks for digital transformation across logistics and energy sectors: Bridging technology with business strategy

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Abstract

Digital transformation has become a pivotal force in reshaping the logistics and energy sectors, driven by advancements in technology and the need to remain competitive in dynamic global markets. This review presents strategic frameworks to guide the integration of digital tools within these sectors, emphasizing the alignment of technology adoption with overarching business strategies. The logistics sector faces increasing demands for efficiency, transparency, and sustainability. Digital technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), blockchain, and big data analytics enable real-time supply chain visibility, predictive maintenance, and streamlined operations. Similarly, the energy sector is undergoing a paradigm shift, with smart grids, renewable energy integration, and energy storage solutions emerging as transformative technologies. This proposes tailored frameworks to support digital transformation, addressing critical components such as vision alignment, leadership, technology adoption, and metrics for measuring success. By analyzing case studies and best practices, the review demonstrates how organizations in logistics and energy have successfully leveraged digital solutions to achieve operational excellence, improve customer satisfaction, and drive sustainability initiatives. The challenges of digital transformation, including financial constraints, organizational resistance, and regulatory complexities, are also discussed. The review provides actionable recommendations to overcome these barriers, such as fostering a digital-first culture, securing funding for innovation, and ensuring compliance with industry standards. Ultimately, this review highlights the need for a strategic, collaborative approach to digital transformation, where technology serves as an enabler of innovation and growth. It concludes with insights into future trends, including the growing role of AI, automation, and cross-sector partnerships in driving digital ecosystems and advancing sustainability goals. These frameworks aim to equip stakeholders with the tools to navigate the complexities of digital transformation and unlock its full potential in logistics and energy industries.

Keywords: Strategic frameworks; Digital transformation; Energy sectors; Business strategy

1. Introduction

Digital transformation refers to the profound and accelerating shift that organizations undergo to incorporate digital technologies across all aspects of their business operations (Folorunso, 2024). This includes the integration of advanced technologies like artificial intelligence (AI), the Internet of Things (IoT), big data, cloud computing, and automation into core business processes. The goal of digital transformation is not just to replace old systems with new technologies but to fundamentally reshape how businesses operate, deliver value to customers, and engage in competition (Bassey *et al.*, 2024). From streamlining internal workflows to enhancing customer experiences and enabling data-driven decision-making, digital transformation is reshaping the way organizations interact with the world. As businesses embrace digital tools, they evolve into more agile and data-centric entities, capable of responding quickly to market changes, driving new business models, and fostering innovation (Ebeh *et al.*, 2024; Folorunso *et al.*, 2024). For instance, e-

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commerce platforms now leverage AI and machine learning algorithms to personalize customer experiences and improve supply chain management, demonstrating the power of digital transformation in enhancing business outcomes.

The importance of digital transformation is undeniable, especially in the face of rapid technological advances and changing customer expectations (Akerele *et al*., 2024). At its core, digital transformation drives efficiency by automating routine tasks, reducing human error, and enabling real-time analytics for decision-making. Through data-driven insights, companies can identify inefficiencies, optimize operations, and streamline their supply chains. Furthermore, these improvements often translate into cost savings and higher profitability (Crawford *et al*., 2023). Digital transformation is also a key enabler of innovation, opening new avenues for product development, service delivery, and customer engagement. In industries such as retail, for instance, the ability to leverage digital platforms and tools allows businesses to provide more personalized services, creating a competitive advantage in a crowded marketplace (Umana *et al*., 2024). As technology continues to evolve, businesses must innovate to remain relevant and meet the changing demands of the market. However, the journey to digital transformation comes with unique challenges, especially in traditional sectors like logistics and energy. In the logistics industry, for example, digitizing supply chains can be a complex task involving numerous stakeholders and diverse technologies. The integration of real-time data, IoT sensors, and automated systems requires overcoming legacy infrastructure and data interoperability issues (Uzoka *et al*., 2024). Similarly, in the energy sector, transitioning to digital platforms involves modernizing grid systems, ensuring cybersecurity, and meeting regulatory standards while adopting renewable energy technologies (Iwuanyanwu et a., 2024). Despite these challenges, the opportunities for efficiency, sustainability, and cost reduction are significant, making digital transformation a critical driver for both industries (Garba *et al*., 2024).

The purpose of presenting a strategic framework for digital transformation is to provide organizations with a roadmap that bridges the gap between technological advancements and business strategy. This framework is designed to guide companies through the complexities of digital adoption by aligning technological innovations with long-term business goals. It encourages a comprehensive approach that incorporates not only the acquisition of cutting-edge technologies but also a transformation in organizational culture, leadership, and talent management. Effective digital transformation requires alignment between technology and business strategy, ensuring that digital initiatives support and enhance overall business objectives. This alignment is particularly crucial in industries facing rapid disruption, as it allows companies to adapt quickly to changes in technology, customer behavior, and competitive dynamics. By focusing on both technological capabilities and strategic vision, businesses can optimize their operations, drive innovation, and gain a sustainable competitive edge in an increasingly digital world. Digital transformation is an essential component of modern business success. The strategic integration of digital technologies into business processes not only enhances operational efficiency but also fosters innovation and competitive advantage (Umana *et al*., 2024). By establishing a framework that aligns technology with business objectives, organizations can effectively navigate the challenges and opportunities of the digital age.

2. Understanding Digital Transformation

Digital transformation is a comprehensive and fundamental shift in how organizations use technology to fundamentally alter their operations, business models, and value propositions (Audu and Umana, 2024). It is not simply about adopting new technologies, but rather about leveraging these technologies to create a more efficient, agile, and competitive organization. At its core, digital transformation integrates digital tools into various aspects of a business to improve efficiency, innovation, and customer experience. This shift encompasses a broad range of technological innovations, such as artificial intelligence (AI), the Internet of Things (IoT), machine learning (ML), blockchain, and cloud computing (Folorunso *et al*., 2024). These technologies help organizations rethink how they operate, interact with customers, and make strategic decisions. Key components of digital transformation include the adoption of data-driven decision-making, the automation of processes, the integration of advanced analytics, and the creation of digital ecosystems. Data-driven decision-making allows businesses to leverage real-time data insights for operational improvements, while automation and analytics help streamline operations and drive innovation. The integration of digital tools often leads to the creation of interconnected systems that enable organizations to respond faster to market demands, optimize resource utilization, and enhance customer satisfaction (Uzoka *et al*., 2024). Moreover, a key aspect of digital transformation is the alignment of technology with overall business strategy, ensuring that the technological changes align with the organization's mission and vision, creating long-term value.

The logistics and energy sectors are uniquely positioned to benefit from digital transformation due to their complex operations, large-scale infrastructure, and substantial resource requirements (Bassey, 2022). In the logistics industry, digital transformation addresses several critical challenges, including optimizing supply chain management, improving delivery times, and reducing operational costs. Technologies such as IoT for real-time tracking, AI for predictive

analytics, and automation in warehouses and transportation systems enable logistics companies to optimize their operations by improving route planning, inventory management, and demand forecasting. The ability to track goods and analyze patterns in real time allows for more efficient resource management and enhanced customer service (Ojukwu *et al*., 2024). Similarly, in the energy sector, digital transformation helps companies optimize energy production, distribution, and consumption. Smart grids, for example, allow for more efficient and sustainable energy management by enabling real-time monitoring and automated adjustments. Predictive analytics can be used for maintenance, identifying potential issues before they lead to costly downtime or equipment failure. Additionally, blockchain technology provides opportunities for creating transparent, secure, and decentralized energy transactions, enabling peer-to-peer energy trading and improving overall energy distribution efficiency (Akerele *et al*., 2024). The adoption of these technologies helps meet industry-specific goals, such as reducing operational costs, improving sustainability, and ensuring more reliable service delivery.

While the potential benefits of digital transformation in logistics and energy sectors are immense, there are several challenges and barriers that organizations must navigate to ensure successful implementation (Umana *et al*., 2024). One of the most significant challenges is the high cost of digital transformation. Implementing advanced technologies such as IoT devices, AI systems, and smart grids requires substantial upfront investments in infrastructure, software, and hardware, which may be prohibitive for some organizations. Smaller companies, in particular, may struggle to find the capital needed to adopt these technologies at scale. Resistance to change within organizations can also be a significant barrier to digital transformation. Many employees and managers may be wary of the changes that digital tools bring, especially when it involves a shift in established processes and roles. Overcoming this resistance requires strong leadership, clear communication, and comprehensive change management strategies that help employees understand the benefits of digital transformation and how it will impact their work positively. Another challenge is the skill gap present in many industries, particularly in the logistics and energy sectors. As digital tools become more advanced, there is a growing need for employees with specialized skills in data analytics, AI, cybersecurity, and IT infrastructure management. Organizations must invest in training and upskilling their workforce to ensure they can fully leverage new technologies (Folorunso *et al*., 2024). Lastly, cybersecurity concerns are a major barrier to digital transformation. As more systems become interconnected and reliant on cloud computing, the risk of data breaches, cyberattacks, and other security threats increases. Securing critical infrastructure and ensuring the safety of sensitive data requires significant investment in cybersecurity measures, as well as the development of robust policies and protocols for managing digital risk. While digital transformation presents significant opportunities for the logistics and energy sectors, its successful implementation depends on overcoming challenges related to cost, resistance to change, skill gaps, and cybersecurity (Audu and Umana, 2024). By addressing these barriers and aligning digital transformation efforts with business goals, organizations in these industries can harness the full potential of emerging technologies to drive innovation, improve operational efficiency, and stay competitive in an increasingly digital world.

2.1. Technology Integration in Logistics and Energy Sectors

The Internet of Things (IoT) plays a transformative role in the logistics and energy sectors by enhancing operational efficiency and improving decision-making through real-time data collection and monitoring (Ojukwu *et al*., 2024). In logistics, IoT enables supply chain visibility, allowing companies to track goods from origin to destination. Through sensors embedded in vehicles, containers, and packages, logistics providers can monitor temperature, location, and condition in real time. This visibility allows for predictive maintenance, better inventory management, and optimization of routes, reducing delays and costs. For instance, IoT-enabled smart sensors in trucks can communicate traffic data, vehicle performance, and cargo conditions, allowing for timely interventions and improving overall logistics efficiency. In the energy sector, IoT enhances the management of energy grids by enabling real-time monitoring of energy production, distribution, and consumption. IoT devices connected to power stations and substations provide continuous data on system performance, enabling operators to detect issues early and address them before they escalate. Additionally, IoT devices can be used to optimize energy usage in homes and businesses, helping reduce waste and improve energy efficiency. Smart meters, for example, allow consumers to track their energy consumption and adjust usage patterns accordingly, leading to more efficient energy management (Bello *et al*., 2022).

Artificial intelligence (AI) and Machine learning (ML) technologies are key drivers of efficiency in both logistics and energy sectors. In logistics, AI and ML are used for predictive analytics to forecast demand, optimize inventory, and enhance route planning (Akerele *et al*., 2024). By analyzing vast datasets, AI algorithms can predict traffic patterns, weather conditions, and potential delays, helping logistics companies adjust their operations dynamically to ensure timely deliveries. In warehouse management, AI-driven robots can optimize storage and retrieval, increasing operational speed and accuracy. In the energy sector, AI and ML are used for predictive maintenance, demand forecasting, and optimizing energy production. Machine learning algorithms can analyze historical data to predict when equipment is likely to fail, enabling preemptive maintenance actions that reduce downtime and costs. Additionally, AI

is instrumental in smart grid management, where it can predict energy demand patterns, optimize distribution, and balance loads in real time. For renewable energy systems, AI helps optimize the integration of solar, wind, and other renewable sources into the grid by predicting production levels based on weather patterns and adjusting energy distribution accordingly (Bassey, 2023).

Blockchain technology has the potential to revolutionize both logistics and energy sectors by enhancing security, transparency, and efficiency in transactions (Umana *et al*., 2024). In logistics, blockchain can be used to securely track and record every step of a product's journey, ensuring the integrity of data and reducing the risk of fraud. Smart contracts on blockchain platforms can automate transactions and agreements between supply chain stakeholders, improving efficiency and reducing administrative overhead. In the energy sector, blockchain can improve transparency and trust in energy transactions, particularly for peer-to-peer energy trading. It can provide a secure and immutable ledger for tracking energy production and consumption, facilitating transparent billing and reducing the risk of fraud. Additionally, blockchain allows for the decentralized exchange of energy between producers and consumers, helping to integrate renewable energy sources more effectively (Audu *et al*., 2024). By securely recording energy transactions, blockchain can help promote the wider adoption of decentralized, renewable energy markets.

Cloud computing and big data are essential for managing the massive amounts of data generated in logistics and energy systems (Iwuanyanwu *et al*., 2024). Cloud platforms enable the storage, processing, and analysis of data in real time, facilitating more agile and scalable operations. In logistics, cloud-based platforms allow for seamless communication and collaboration across different supply chain actors, including suppliers, distributors, and customers. By integrating data from multiple sources, including IoT devices, cloud computing helps logistics companies streamline operations, reduce costs, and improve service levels. In the energy sector, cloud computing and big data technologies are used to manage the vast amounts of data generated by smart grids, sensors, and energy management systems. Real-time data analytics in the cloud help operators optimize grid performance, predict demand fluctuations, and enhance decision-making. Big data analytics also enables better forecasting of renewable energy production, allowing energy providers to plan for and manage the variability associated with renewable sources like solar and wind power.

The integration of renewable energy technologies into the energy grid is essential for meeting sustainability goals and addressing global energy challenges (Ebeh *et al*., 2024). Solar, wind, and other renewable energy sources are inherently intermittent, which poses challenges for grid stability and reliability. However, through digital technologies such as AI, IoT, and big data analytics, it is possible to better integrate renewable energy into the existing energy infrastructure. AI and predictive analytics can forecast renewable energy generation patterns, allowing grid operators to better manage supply and demand fluctuations. Smart grids, supported by IoT devices, can automatically balance energy loads, ensuring that renewable energy is effectively distributed across the grid. Additionally, energy storage technologies, such as batteries, are critical in ensuring that surplus renewable energy can be stored and used when demand is high, mitigating the challenges of intermittent energy sources (Uzoka *et al*., 2024). Overall, the integration of renewable energy technologies with digital innovations holds the potential to enhance the efficiency, sustainability, and reliability of energy systems. It is crucial that both the logistics and energy sectors continue to invest in these technologies to ensure that they can meet future energy demands while reducing environmental impacts. By embracing these advanced technologies, organizations can drive both operational efficiencies and sustainable growth, ultimately contributing to a more resilient and environmentally responsible future.

2.2. Strategic Framework Development

A robust digital transformation framework serves as a guide for organizations looking to integrate new technologies while aligning their operational and strategic goals (Bassey, 2023). The key pillars of such a framework include vision alignment, leadership, technology adoption, and continuous improvement. Vision alignment ensures that digital initiatives are directly connected to the organization's overall goals and values. This ensures that the transformation is not just about adopting new technologies but also driving meaningful business outcomes that align with the company's long-term vision (Umana *et al*., 2024). Leadership plays a crucial role in steering digital transformation efforts, ensuring that the change is embraced throughout the organization. Strong leadership ensures that there is a clear mandate, provides resources, and maintains momentum during the transformation process. Technology adoption involves the careful selection of tools and platforms that will enable the desired changes in operations, customer service, and strategic decision-making. Finally, continuous improvement is essential as digital transformation is an ongoing process. Organizations must be agile and able to adapt to new developments in technology and industry trends to maintain a competitive edge.

In the logistics sector, a digital transformation framework must address both operational efficiency and customer satisfaction. The framework focuses on supply chain digitization and logistics automation, which are critical to meeting

the growing demand for faster and more efficient services (Akerele *et al*., 2024). The digitization of the supply chain involves the integration of digital technologies such as IoT, AI, and cloud computing to enable real-time tracking, predictive analytics, and seamless coordination between supply chain partners. Logistics automation, on the other hand, involves the use of robotics, autonomous vehicles, and AI-powered decision-making systems to streamline processes and reduce human error. This can be seen in warehouses, where automated systems can handle inventory management, order fulfillment, and packaging, leading to faster turnaround times and reduced labor costs. Additionally, intelligent route optimization tools use data from various sources, such as GPS, weather forecasts, and traffic conditions, to improve delivery efficiency. These elements form the foundation of a comprehensive digital transformation framework that can significantly enhance the logistics sector's efficiency and responsiveness.

In the energy sector, a digital transformation framework must focus on the adoption of smart grids, energy storage solutions, and renewable energy integration (Bassey and Ibegbulam, 2023). Smart grids are advanced electrical grids that use digital communication and IoT devices to monitor and manage electricity flow more efficiently. They enable utilities to respond to real-time changes in energy demand and supply, integrate renewable energy sources, and reduce energy losses. Energy storage solutions, such as batteries and other energy storage technologies, are essential for balancing supply and demand, particularly with intermittent renewable energy sources like wind and solar. By storing excess energy during periods of high production and releasing it when demand peaks, energy storage helps ensure grid stability and reliability. Moreover, the integration of renewable energy into the grid is crucial for achieving sustainability goals. A well-developed framework should include strategies for optimizing renewable energy production, managing variability, and ensuring that renewable energy sources can be efficiently integrated into the grid alongside traditional energy sources.

Measuring the success of digital transformation initiatives is critical to understanding the effectiveness of the strategies being implemented. In both the logistics and energy sectors, organizations must define Key Performance Indicators (KPIs) and other metrics that reflect the desired outcomes of the transformation process. In the logistics sector, KPIs might include improved on-time delivery rates, reduced operational costs, increased inventory turnover, and enhanced customer satisfaction scores. In the energy sector, metrics such as energy efficiency improvements, the percentage of energy generated from renewable sources, grid reliability, and the reduction in greenhouse gas emissions are commonly used to evaluate success (Umana *et al*., 2024). Furthermore, the return on investment (ROI) for implementing digital technologies such as smart grids and energy storage solutions is a crucial metric for determining the long-term value of transformation efforts. Continuous monitoring of these KPIs enables organizations to adjust their strategies as needed, ensuring that the digital transformation journey remains on track and delivers tangible benefits.

Strategic framework development for digital transformation in logistics and energy sectors requires a comprehensive approach that addresses the unique challenges and opportunities of each industry. By focusing on the key pillars of vision alignment, leadership, technology adoption, and continuous improvement, organizations can create a roadmap for successful transformation. Frameworks tailored to logistics and energy sectors incorporating supply chain digitization, automation, smart grids, and renewable energy are essential for ensuring that these industries remain competitive, efficient, and sustainable in an increasingly digital world (Akerele *et al*., 2024). Finally, establishing robust KPIs allows organizations to measure the success of their digital initiatives, ensuring that they continue to adapt and thrive in a rapidly evolving technological landscape.

2.3. Challenges and Solutions in Digital Transformation for Logistics and Energy Sectors

One of the most significant challenges in digital transformation is organizational and cultural resistance. Employees may be apprehensive about adopting new technologies, fearing job displacement, unfamiliarity with new tools, or disruption of existing workflows. To overcome these barriers, it is essential to foster a digital-first culture within the organization. Leaders must play an active role in championing digital transformation, creating a sense of urgency and emphasizing the strategic importance of adopting new technologies (Ebeh *et al*., 2024). Education and training programs are vital to helping employees develop the necessary skills and understand the benefits of digital transformation. Moreover, change management strategies, such as involving key stakeholders early in the decision-making process and providing clear communication, can reduce resistance. Encouraging a culture of innovation where experimentation is embraced, and failures are seen as learning opportunities, can also help mitigate resistance. Organizations should highlight the long-term benefits, such as increased efficiency, improved customer experiences, and better decision-making capabilities, to align employees' interests with the transformation objectives.

Financial constraints often present a significant hurdle in implementing digital transformation initiatives, especially in industries like logistics and energy where the costs of new technology and infrastructure can be substantial (Bassey, 2023). To address these constraints, organizations can explore approaches for cost optimization and funding

innovations. Cloud-based solutions and SaaS (Software as a Service) platforms, for example, can reduce the initial capital expenditure by eliminating the need for large-scale IT infrastructure investments. These services also offer scalability, allowing organizations to expand their digital capabilities gradually based on their evolving needs. Additionally, public-private partnerships, grants, and venture capital can provide much-needed funding for transformative projects. Governments often offer incentives for companies investing in green technologies or digital innovation, which can help offset some of the financial burden. In-house financing strategies, such as allocating a portion of the budget toward digital transformation and adopting agile project management methods, can also ensure that investments are made gradually and in alignment with overall business goals (Oyindamola and Esan, 2023).

In both the logistics and energy sectors, regulatory and policy implications can complicate the adoption of new technologies. Industries such as energy are highly regulated, and compliance with legal standards concerning data privacy, environmental impact, and safety is paramount. Navigating these regulatory frameworks requires a deep understanding of the specific regulations that apply to digital technologies and the sector as a whole (Bassey *et al*., 2023). To address these challenges, organizations must collaborate closely with legal and regulatory bodies to ensure compliance. Engaging in proactive dialogues with regulators can help companies stay ahead of regulatory changes, particularly when implementing new technologies like smart grids or IoT devices, which may not always fall within existing regulatory frameworks. Additionally, creating an internal governance model that incorporates compliance checks at every stage of the digital transformation process helps ensure that new technologies are integrated without breaching legal and policy boundaries. Collaboration with industry peers and participation in cross-industry standard-setting organizations can also provide valuable insights and foster the development of policies that support innovation while safeguarding public interests.

While digital transformation offers significant benefits, implementing new technologies brings its own set of risks (Agupugo, 2023). Issues such as interoperability, scalability, and security can complicate the integration of new systems within existing infrastructures. In the logistics sector, for instance, integrating IoT sensors, AI-based systems, and cloud solutions may create compatibility issues with legacy systems, while in the energy sector, challenges can arise when attempting to integrate renewable energy technologies with traditional grid systems. To mitigate these risks, organizations must ensure that any new technologies are scalable and compatible with existing systems. Before full-scale implementation, pilot programs and phased rollouts can help identify potential interoperability issues and fine-tune integration processes. In terms of security, adopting robust cybersecurity protocols, such as encryption, multi-factor authentication, and regular security audits, is crucial to safeguarding sensitive data from cyber threats. Furthermore, using open standards and modular systems can improve the flexibility and adaptability of digital solutions, enabling easier integration with other technologies as the organization's needs evolve (Adepoju and Esan, 2023).

Digital transformation in the logistics and energy sectors presents numerous challenges, from organizational resistance and financial constraints to regulatory hurdles and technology implementation risks. However, through strategic leadership, cost optimization approaches, regulatory collaboration, and robust risk management frameworks, these obstacles can be mitigated (Bello *et al*., 2023). By fostering a culture of innovation, aligning technological investments with business objectives, and addressing implementation risks early on, organizations can successfully navigate the complexities of digital transformation. Ultimately, overcoming these challenges will enable logistics and energy sectors to enhance operational efficiency, improve service delivery, and drive long-term sustainable growth (Bello *et al*., 2023; Ebeh *et al*., 2024).

2.4. Future Opportunities and Trends in Digital Transformation for Logistics and Energy Sectors

The future of digital transformation in the logistics and energy sectors presents exciting opportunities for innovation, growth, and sustainability (Folorunso, 2024). As these industries continue to evolve, next-generation technologies, cross-sector collaborations, and sustainability goals will play a critical role in shaping their transformation. The following discusses some of the most significant opportunities and trends that will drive the future of digital transformation.

Artificial intelligence (AI) and automation are at the forefront of driving innovation in both logistics and energy sectors (Agupugo and Tochukwu, 2021). In logistics, AI is increasingly being used to optimize supply chains through predictive analytics, real-time tracking, and demand forecasting. Machine learning algorithms are enhancing route planning, inventory management, and customer service, leading to more efficient operations and cost reductions (Barrie *et al*., 2024). Automation, in the form of autonomous vehicles and drones, is also transforming the delivery process, reducing human error, and increasing speed. Similarly, in the energy sector, AI and automation are revolutionizing energy management, grid optimization, and renewable energy integration. AI-driven smart grids can efficiently distribute

energy based on real-time demand, reducing waste and improving the resilience of energy systems. Automation technologies are being applied to the maintenance and monitoring of energy infrastructure, ensuring that equipment operates at peak efficiency while reducing the need for manual labor and minimizing operational downtime. The continued development of AI, coupled with advancements in automation technologies, will enable both sectors to achieve new levels of operational excellence, transforming the way services are delivered and consumed (Esan *et al*., 2024). As these technologies mature, further breakthroughs in optimization, predictive maintenance, and decision-making will continue to drive operational innovations.

The future of digital transformation will be heavily influenced by the expansion of digital ecosystems, where cross-sector collaborations and partnerships will foster the development of integrated solutions (Bassey *et al*., 2024). In the logistics sector, partnerships between tech companies, manufacturers, and service providers will create seamless digital ecosystems that enhance supply chain visibility and efficiency. These collaborations can lead to the development of more advanced digital platforms for real-time tracking, inventory management, and data sharing, allowing for more transparent and agile supply chains. Similarly, in the energy sector, collaborations between renewable energy providers, grid operators, and technology companies will be crucial for integrating distributed energy resources (DERs) like solar and wind into the main grid. Digital solutions such as blockchain technology, IoT, and cloud computing will facilitate decentralized energy exchanges and peer-to-peer energy trading, creating more flexible and efficient energy markets (Bassey *et al*., 2024). Additionally, partnerships between private companies and government agencies will be key to supporting innovation, particularly in smart cities, energy storage solutions, and energy-efficient infrastructure. Expanding digital ecosystems will also enable data sharing and interoperability across sectors, allowing for more comprehensive insights and collaborative solutions. These interconnected systems will make it easier to address complex challenges, such as congestion in logistics networks or energy distribution inefficiencies, and drive innovation through shared knowledge and resources (Agupugo *et al*., 2022; Esan, 2023).

Sustainability is becoming increasingly integral to the digital transformation process, particularly as organizations seek to meet environmental and social governance (ESG) goals (Bassey *et al*., 2024). Digital tools, including IoT, big data analytics, and AI, are enabling logistics and energy companies to monitor and reduce their environmental impact. In logistics, route optimization algorithms help reduce fuel consumption and carbon emissions, while real-time tracking systems improve the efficiency of resource use. Automation, such as autonomous vehicles and drones, can also minimize human intervention and improve fuel efficiency in transportation, further contributing to sustainability (Bello *et al*., 2023; Agupugo *et al*., 2024). In the energy sector, digital transformation is driving the transition to cleaner, renewable energy sources. Smart grids, for example, allow for better integration of renewable energy and help optimize energy distribution, reducing reliance on fossil fuels. Moreover, AI-powered analytics can predict energy demand, allowing energy providers to better match supply with consumption and minimize waste. Digital technologies can also be used for monitoring environmental conditions, improving energy efficiency in buildings, and supporting the development of green technologies such as electric vehicles and energy storage systems. Meeting ESG goals will require a concerted effort to align digital transformation with sustainability objectives. As industries like logistics and energy increasingly integrate digital tools into their operations, they will also need to prioritize sustainability by reducing carbon footprints, optimizing resource usage, and ensuring equitable access to technology. The potential for digital transformation to advance both operational efficiency and environmental responsibility offers substantial opportunities for long-term growth (Manuel *et al*.., 2024).

The future of digital transformation in logistics and energy sectors holds significant promise (Bello *et al*., 2023). The ongoing integration of AI, automation, and other next-generation technologies is set to redefine operations, improving efficiency and driving innovation (Bassey *et al*., 2024). Expanding digital ecosystems will foster cross-sector collaborations, enabling industries to tackle complex challenges more effectively. Moreover, sustainability remains a key driver of digital transformation, with digital tools playing an essential role in achieving environmental and social governance goals. By embracing these trends and opportunities, the logistics and energy sectors can not only enhance operational performance but also contribute to a more sustainable, connected, and technologically advanced future (Agupugo *et al*., 2022; Esan *et al*., 2024).

3. Conclusion

This review highlights the profound impact of digital transformation on the logistics and energy sectors, emphasizing the importance of technology integration for operational efficiency, sustainability, and innovation. Key insights have underscored the critical role of technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), machine learning, blockchain, and cloud computing in reshaping business operations. These technologies enable more effective resource management, data-driven decision-making, and enhanced customer experiences, marking a paradigm shift from traditional operational models to more adaptive, agile systems. Strategic frameworks developed for both sectors

stress the importance of vision alignment, leadership, and a commitment to continuous improvement. Successful digital transformation requires organizations to foster a digital-first culture, where leadership plays a pivotal role in guiding technological adoption and overcoming resistance to change. A well-defined vision, coupled with strategic leadership, is essential to align technological investments with long-term business goals, ensuring that digital tools serve as enablers of value rather than mere costs. Furthermore, these frameworks provide a comprehensive approach to integrating new technologies with existing operations, ensuring smooth transitions and sustainable growth.

The digital transformation journey also demands an actionable call to embrace technology as a critical business enabler. Organizations must not only adopt cutting-edge technologies but also cultivate a mindset of adaptability and resilience to stay competitive in an increasingly digital world. The convergence of emerging technologies with business strategy is not just an opportunity but a necessity for maintaining relevance in the rapidly evolving logistics and energy sectors. By strategically harnessing the power of digital transformation, businesses can unlock new avenues for growth, enhance operational efficiency, and contribute to the achievement of broader environmental and social goals. Therefore, embracing technology is no longer optional but fundamental for future success and sustainability.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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