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Transformation of Operations and Production Management in the Digital Era: Challenges, Prospects, and Supply Chain Sustainability Agenda

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A R T I C L E I N F O

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A B S T R A C T

This article discusses the transformation of operations and production management in the digital era, emphasizing the connection between process efficiency, supply chain resilience, product innovation, quality, and sustainability. Changes in the post-pandemic business environment, the accelerated adoption of Industry 4.0 technologies, rising geopolitical risks, and consumer demands for fast, personalized, and environmentally responsible products have shifted operational focus from merely cost control to creating adaptive and sustainable value. Using a qualitative literature review method, this article synthesizes reputable literature on digital operations, artificial intelligence, resilient supply chains, circular economy, and organizational capability development. The discussion results show that the main challenges in operations and production management include the costs and complexity of technology, cybersecurity, disruptions in the global supply chain, sustainability pressures, changing consumer needs, and demands for continuous innovation. The prospects lie in integrating data analytics, IoT, AI, automation, digital lean, resilient supply chain design, and circular operation practices that can boost productivity while reducing risks. This article concludes that the success of operational transformation is determined not just by technology, but also by dynamic capabilities, workforce readiness, data governance, cross-functional collaboration, and consistency in sustainability strategy. Future research agendas need to test operational models that combine resilience, digitalization, and sustainability in the context of developing countries and SMEs

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INTRODUCTION

Operations and production management is a strategic field that determines an organization's ability to turn inputs into goods and services that are valuable to customers. In today's business landscape, the operations function can no longer be understood just as technical activities on the production floor, but as an integrated decision system that affects cost, quality, delivery speed, flexibility, innovation, and the organization's sustainability reputation. This shift is being accelerated by process digitization, the use of real-time data, automation, artificial intelligence (AI), and Internet of Things (IoT) connectivity that are reshaping operations and supply chain architecture (Bag et al., 2021; Cannas et al., 2024; Li, 2020).

The urgency of discussing this topic is getting stronger because organizations are facing an unstable operating environment. The COVID-19 pandemic showed that a global supply chain overly focused on cost efficiency can become fragile when extreme disruptions occur. Recent literature indicates that resilience, responsiveness, anticipation capabilities, improvisation, and the use of data analytics are key capabilities to maintain operational continuity during supply disruptions, changes in demand, or cross-country logistics restrictions (Herold et al., 2021; Ivanov, 2021; Munir et al., 2022). So, modern operations agendas need to balance efficiency with resilience.

On the other hand, sustainability demands put operations and production as key areas in reaching environmental and social goals. Production activities are directly linked to energy consumption, raw material use, emissions, waste, and working conditions. That's why developing sustainable operations and a circular economy becomes relevant to reduce negative impacts while creating new value through resource efficiency, easily recoverable product design, supplier collaboration, and more responsible business models (Batista et al., 2023; Ghobakhloo & Fathi, 2021).

Changes in consumer behavior are also increasing the complexity of operations management. Consumers are increasingly expecting products that are high-quality, quickly available, customizable, transparent in their origin, and ethically produced. These demands require an operations system that is more flexible, data-driven, integrated with marketing, and able to connect product design, production, distribution, and after-sales service. Operations that fail to adapt risk facing delays, excess inventory, quality decline, and a loss of customer trust (Haris, 2024; Riandhi et al., 2025; Rosário & Dias, 2025; Sigit Sugiardi et al., 2025; Wang, 2025; Yue, 2024).

Based on this background, this article is guided by four research questions: (1) how the basic concepts and scope of operations and production management have evolved in the digital era; (2) what major challenges organizations face in managing operations, production, quality, innovation, and the supply chain; (3) what strategic prospects organizations can leverage to improve operational performance in a resilient and sustainable way; and (4) how the integration of technology, organizational capabilities, and sustainability can shape the future operations management agenda.

The aim of this article is to provide a conceptual and theoretical synthesis of the challenges and prospects in operations and production management. Specifically, this article aims to explain key concepts of operations management, outline digital transformation and sustainability in production processes, identify emerging operational challenges, and formulate the direction of future prospects and research agendas. This article is expected to contribute to the development of operations management studies, especially in the context of organizations that need to manage efficiency, resilience, innovation, and sustainability responsibility simultaneously.

LITERATURE REVIEW

1. Basic Concepts of Operations and Production Management

Operations and production management is a field that focuses on the design, management, and improvement of processes that produce goods and services. From a modern perspective, operations are understood as a value-creation system that connects strategy, resources, technology, people, suppliers, and customers. Its main role is to ensure that inputs like raw materials, labor, capital, information, and technology can be transformed into outputs that meet targets for cost, quality, speed, flexibility, and sustainability (Battesini et al., 2021; Kumar & Kotler, 2024; Petropoulos et al., 2026; Salah et al., 2023).

The difference between production management and operations management lies in their scope. Production management is more often associated with manufacturing activities, while operations management covers manufacturing, services, logistics, digital services, and other support processes. However, the two are becoming harder to separate because modern products usually come with after-sales service, customer data, and digital ecosystems. That's why modern operations demand integration between physical processes and information processes (Leung, 2025; Petropoulos et al., 2026; Sun et al., 2025). Digital transformation literature emphasizes that operations now need to be built as socio-technical systems. Technology shouldn't just be seen as an automation tool, but must be connected to changes in organizational structure, data governance, work culture, human resource competencies, and decision-making processes. It's been highlighted that digital transformation requires an iterative approach because organizations need to bridge strategy and execution in a volatile environment (Li, 2020; Nuraini, 2025; Saini et al., 2025).

2. Operations Strategy and Dynamic Capabilities

Operations strategy explains how operational decisions support an organization's competitive advantage. These decisions include capacity, facility location, layout, technology, make-or-buy choices, supplier management, quality control, and distribution network design. In stable environments, operations strategies often focus on efficiency and standardization. However, in dynamic environments, organizations need dynamic capabilities, which are the abilities to sense changes, seize opportunities, and reconfigure resources to stay relevant (Dukhaykh & Alangri, 2026; Prester, 2023; Saiyed et al., 2025).

Dynamic capabilities in operations can be seen in an organization's ability to leverage data analytics, quickly change production schedules, switch supply sources, redesign products, and develop more flexible production processes. It has been shown that anticipation, improvisation, and data analytics capabilities contribute to supply chain resilience and responsiveness during the pandemic (Munir et al., 2022). These findings strengthen the argument that operational performance is determined not just by physical assets, but also by the ability to learn and adapt (Polater, 2025; Pu et al., 2023; Yasmeen et al., 2026).

3. Digitalization, Industry 4.0, and Data-Based Operations

Industry 4.0 refers to the integration of cyber-physical systems, IoT, cloud computing, big data analytics, AI, robotics, and smart manufacturing systems. These technologies enable real-time process visibility, predictive maintenance, automated quality control, dynamic scheduling, and coordination across units. It has been shown that big data analytics capabilities can boost manufacturing and supply chain performance by improving predictive abilities and information integration (Bag et al., 2021; Islam et al., 2025; Solanki, 2023).

That said, adopting Industry 4.0 technology doesn’t happen automatically. It’s been found that technology adoption in manufacturing businesses is influenced by technological, organizational, and environmental factors, including infrastructure readiness, employee skills, top management support, investment costs, market pressure, and ecosystem support (Ghobakhloo et al., 2022). In other words, operational transformation needs to be designed as a step-by-step process that takes internal and external readiness into account (Srivastava et al., 2022; Zhong & Moon, 2023; Zhou & Zheng, 2023).

AI is becoming one of the increasingly important technologies in operations and supply chains. Recent studies show that AI can be used for demand forecasting, inventory optimization, production planning, quality anomaly detection, supplier risk management, and customer service. However, the success of its implementation depends on data quality, system integration, clear business goals, algorithm governance, and user acceptance (Baryannis et al., 2019; Cannas et al., 2024).

4. Lean, Quality, and Continuous Improvement

Lean management and quality management remain key foundations for modern operations. Lean emphasizes eliminating waste, smooth process flows, customer value, and continuous improvement. In a digital context, lean principles can be strengthened through sensors, performance dashboards, process analytics, and automation that help organizations detect waste more quickly. However, going digital without lean principles risks just speeding up processes that aren’t actually valuable (Gomaa, 2025; Nwamekwe et al., 2025; Silva et al., 2026).

Quality management includes standard design, process control, employee involvement, and learning from customer feedback. In data-driven operations, quality is no longer just checked at the end of the process but is monitored throughout the production cycle. Integrating statistical process control, machine learning, and real-time reporting systems can boost an organization's ability to prevent defects, not just detect them after they happen (Fu et al., 2024; Quadir et al., 2022; Scarton et al., 2025).

5. Supply Chain, Resilience, and Viability

The supply chain is a network of organizations, processes, information, and resources that connect suppliers, manufacturers, distributors, retailers, and customers. Over the past two decades, many organizations have built global supply chains to pursue cost efficiency. However, the pandemic, geopolitical conflicts, changes in trade policies, and logistics crises have shown that efficiency needs to be balanced with resilience. The concept of supply chain viability has been introduced, which emphasizes the ability of the supply chain to maintain basic functions under extreme disruption (Ivanov, 2021).

Supply chain resilience includes the ability to prepare for, absorb, recover from, and adapt to disruptions. It has been shown that logistics service providers respond to crises by strengthening communication, flexibility, risk management, and financial stability (Herold et al., 2021). In this context, supplier network design, critical redundancies, nearshoring, digital visibility, and contingency planning become strategic components that need to be considered.

6. Sustainability, Circular Economy, and Social Responsibility

Sustainability in operations involves managing the economic, environmental, and social impacts of production activities. Organizations need to reduce waste, emissions, energy consumption, and the use of non-renewable resources. It has been shown that Industry 4.0 technology can support energy sustainability through monitoring energy use, optimizing processes, and smart energy management systems (Ghobakhloo & Fathi, 2021).

The circular economy expands the sustainability agenda by focusing on product and process designs that allow for reuse, repair, remanufacturing, recycling, and value recovery. Sustainable operations and supply chain management have been linked to the dominant logic of sustainability, where value creation is measured not just by economic output but also by contributions to the environment, society, and future generations (Batista et al., 2023). In the context of operations management, this approach calls for supplier collaboration, modular product design, material selection, and life cycle performance measurement (Rumasukun, 2025; Sakao et al., 2024).

METHODOLOGY

This article uses a qualitative literature review method, which is an interpretative review of literature to build a conceptual and theoretical understanding of the challenges and prospects of operations and production management. Unlike systematic literature reviews that emphasize highly structured search protocols, strict selection criteria, and procedural replication, the qualitative literature review in this article is used to integrate ideas, themes, and arguments from reputable literature to produce a narrative synthesis relevant to the article's purpose. The qualitative approach is considered appropriate because modern operations issues are multidimensional, covering aspects of technology, strategy, people, supply chain, quality, and sustainability (Long et al., 2020; Tomaszewski et al., 2020).

The literature sources were chosen purposively from reputable international journal articles, up-to-date academic books, and relevant scientific publications, especially since 2020. The keywords used in the search included operations management, production management, Industry 4.0, digital transformation, artificial intelligence, supply chain resilience, sustainable operations, circular economy, lean digital, and qualitative literature review. Literature was prioritized if it provided conceptual or empirical contributions to operations and production transformation, was published in reputable journals, had a DOI or official link, and was relevant for answering this article's research questions.

The analysis was done through critical reading, thematic coding, and narrative synthesis. The themes that emerged were grouped into basic operation concepts, strategies and capabilities, digitalization, quality and lean, supply chain, sustainability, challenges, prospects, and research agendas. To maintain academic traceability, every important claim is linked to citations and a reference list. The limitation of this approach is that it’s not meant to calculate the frequency of findings or conduct a meta-analysis, but rather to build a coherent conceptual argument that’s useful for researchers and practitioners (Snyder, 2019, 2024).

RESULTS AND DISCUSSION

1. Challenges in Operations and Production Management

A. Technology, Automation, and Cybersecurity

Technology and automation have become major forces transforming operations and production management. Integrating AI, IoT, robotics, cloud computing, and analytics allows organizations to boost productivity, improve forecasting accuracy, reduce downtime, and speed up decision-making. At the same time, this transformation brings challenges like investment costs, legacy system integration, a shortage of digital talent, employee resistance, and cybersecurity risks. In increasingly connected operations, disruptions in information systems can directly impact production processes, delivery schedules, and service quality (Abdelfattah et al., 2025; Angelopoulos & Alexopoulos, 2026; Daniel et al., 2024; Islam et al., 2025; Peretz-Andersson et al., 2024; Vărzaru & Bocean, 2024).

Another challenge is the gap between technology potential and organizational readiness. Many organizations adopt technology due to competitive pressure, but they still don't have clean data, standardized processes, or adequate governance. It has been shown that organizational factors like management support, human resources capabilities, and transformation strategy determine the success of Industry 4.0 adoption (Ghobakhloo & Fathi, 2021). Therefore, technology investments should be accompanied by a transformation roadmap, training, process redesign, and performance evaluation mechanisms (Ghobakhloo & Iranmanesh, 2021; Podungge & Monoarfa, 2025; Viloria-Nunez & Ahumada-Tello, 2025; Vong et al., 2025; Yilmaz et al., 2022).

B. Globalization, Disruption, and Supply Chain Complexity

Globalization opens up opportunities for access to raw materials, markets, and production capacity across countries, but it also increases dependence on complex supplier networks. The disruptions from the pandemic, container shortages, geopolitical conflicts, and changes in trade regulations show that global supply chains can experience a domino effect. It has been emphasized that organizations need a viability approach so that supply chains can continue to carry out critical functions under extreme conditions (Choi et al., 2022; Ivanov, 2021).

The implication is that organizations need to rethink overly strict just-in-time strategies. Inventory efficiency is still important, but it needs to be balanced with strategic buffers, multi-sourcing, mapping of second- and third-tier suppliers, and digital visibility. It has been shown that learning from crises pushes logistics service providers to strengthen collaboration and flexibility (Herold et al., 2021). So, the challenge in supply chains isn't just about finding the lowest costs, but about building networks that are resilient to disruptions and responsive (Alkhatib & Momani, 2023; Dzreke & Dzreke, 2025; Ivanov, 2024; Karagkouni & Dimitriou, 2025).

C. Sustainability and Social Responsibility

Sustainability has become a big challenge because production operations are directly linked to energy, materials, waste, emissions, workplace safety, and relationships with the community. Companies are no longer judged just on cost efficiency, but also on their ability to reduce environmental impact and meet social standards. Pressure from regulators, investors, consumers, and global partners has made it even more important to integrate sustainability indicators into operational decisions (Areta Hiziroglu & Dogan, 2025; Omer et al., 2025; Tian & Khan, 2025).

However, the transition to sustainable operations isn't easy. Organizations face trade-offs between short-term costs and long-term benefits, limitations in clean technology, lack of emissions data, and difficulties in measuring the life cycle impact of products. It has been shown that Industry 4.0 can support energy efficiency, but these benefits only materialize if the technology is linked to sustainability strategies (Ghobakhloo & Fathi, 2021). It has also been emphasized that a dominant sustainability logic is needed in operations and the supply chain, not just isolated environmental programs (Batista et al., 2023).

D. Changes in Consumer Needs

Modern consumers demand quality, speed, personalization, competitive prices, and transparency. Changes in demand can happen quickly due to digital trends, social media, shifts in income, and social dynamics. This situation makes production planning, inventory management, and capacity increasingly complex. Organizations that lack forecasting capabilities and operational flexibility risk facing stockouts or overstock (Basavaraju & Fatahi Valilai, 2025; Khedr & S, 2024; Lestari, 2022; Liu, 2024).

The increasingly diverse consumer needs are also driving a shift from mass production to mass customization. This requires modular process design, flexible layouts, customer data integration, and close coordination between marketing, product design, and production. AI and analytics can help spot demand patterns, but organizations still need to turn those insights into quick, actionable operational decisions (Liu et al., 2026; Naldi et al., 2025; T. Formoso et al., 2022; Trentin et al., 2025).

E. Innovation and Product Development

Innovation and product development are major challenges because product life cycles are getting shorter. Organizations need to develop new products quickly without sacrificing quality, cost, or sustainability. The main challenges include cross-functional coordination, market uncertainty, limited production capacity, technology failure risks, and difficulties in managing product portfolios (Akram et al., 2026; Calixto et al., 2026; Falahat et al., 2024; Gomes, 2024).

In the context of operations, innovation doesn't just mean creating new products, but also updating processes, service models, distribution systems, and the way organizations work with suppliers. It has been shown that AI can support operations and supply chain processes, but its implementation faces data, cultural, and integration barriers (Cannas et al., 2024). Therefore, innovation should be seen as an organizational capability that combines technology, learning, experimentation, and disciplined execution (Cannas et al., 2024; Culot et al., 2024; Hangl et al., 2023; Hao & Demir, 2025).

2. Prospects for Operations and Production Management

A. Data-Driven Smart Operations

The first prospect is the growth of data-driven smart operations. Integrating sensors, ERP, manufacturing execution systems, cloud platforms, and analytics lets organizations get real-time visibility over production, inventory, quality, and delivery. This data can be used for demand forecasting, dynamic scheduling, predictive maintenance, and scenario-based decision making. It has been shown that big data analytics capability can boost manufacturing and supply chain performance when supported by adequate organizational capabilities (Bag et al., 2021; Nwokocha et al., 2025; Shamsuddoha et al., 2026; Soori et al., 2026).

Smart operations also open up the opportunity to use digital twins to simulate production processes, test capacity scenarios, and evaluate risks before decisions are made. This way, organizations can reduce uncertainty and speed up learning. This prospect is especially relevant for industries facing demand volatility and high-quality requirements, like food, pharmaceuticals, automotive, electronics, and logistics (Amer et al., 2026; Maharjan et al., 2025; Nguyen et al., 2025; Nozari, 2026).

B. Resilient and Adaptive Supply Chain

The second prospect is a more resilient and adaptive supply chain design. Organizations can strengthen resilience through supplier diversification, strategic partnerships, platform visibility, scenario planning, and quick response mechanisms. It has been shown that data analytics, anticipation, and improvisation can improve resilience and responsiveness (Munir et al., 2022). This shows that resilience is not just about physical reserves, but also about information and coordination capabilities (Hosseini Shekarabi et al., 2025; Qureshi & Ali, 2025; Xu, 2026).

In the long run, adaptive supply chains will combine the principles of global efficiency and local responsiveness. Strategies like nearshoring, regionalization, or dual sourcing can be considered for critical components. However, these decisions should be based on an analysis of total cost, risk, carbon footprint, and customer needs. Future supply chains will increasingly demand a balance between cost, speed, risk, and sustainability (Doetsch & Huchzermeier, 2024; Napoleone et al., 2022; Nwani, 2025; Setyadi et al., 2025c).

C. Ongoing Operations and the Circular Economy

The third prospect is integrating sustainability and the circular economy into operations. Organizations can create value through energy efficiency, waste reduction, material recovery, packaging redesign, reverse logistics, and supplier collaboration. It's been emphasized that sustainable operations need to be built as a value-creation logic that connects economic, environmental, and social aspects (Batista et al., 2023). From this perspective, operations not only produce products but also manage impacts throughout their lifecycle (Ahmad et al., 2023; Correa et al., 2024; Mohammed, 2025; Salas-Navarro et al., 2024).

Digitalization can boost sustainability prospects through material tracking, emission measurement, logistics route optimization, and supply chain transparency. It has been shown that Industry 4.0 has the potential to support energy sustainability (Ghobakhloo & Fathi, 2021). However, organizations also need to manage the risk of the rebound effect, which is increased consumption due to higher efficiency. Therefore, sustainability should be a strategic indicator, not just a side effect of efficiency (Aravindaraj & Rajan Chinna, 2022; Farrukh Shahzad et al., 2025; Ionescu & Ionescu, 2025; Yu et al., 2026).

D. Lean Digital and Predictive Quality

The fourth prospect is the combination of lean management with digital technology. Lean provides principles for reducing waste and focusing on customer value, while digitalization offers visibility, speed, and analytical capabilities. Combining the two can result in more streamlined, transparent, and adaptive processes. For example, real-time dashboards can speed up the detection of bottlenecks, sensors can reduce downtime, and analytics can help identify the root causes of quality defects (Javaid et al., 2024; Nwamekwe et al., 2025; Rossi et al., 2022; Sah et al., 2024).

Predictive quality is becoming an important focus because organizations can prevent failures before products leave the production process. By making use of machine data, process parameters, and defect history, the system can give early warnings when process variations approach critical limits. This approach improves quality while also cutting down on inspection costs, rework, and customer returns (Karim, 2025; Rydzi et al., 2024; Sankhye & Hu, 2020; Scarton et al., 2025).

E. Human-Centered HR Development and Operations

The fifth prospect is strengthening human-centered operations. Automation doesn't eliminate the need for humans; instead, it changes the types of skills needed. Operations employees need to understand data, technology, problem-solving, cross-functional collaboration, digital safety, and continuous improvement. Operations transformation that focuses only on machines risks failing because it ignores user adoption and organizational learning (Armstrong et al., 2024; Chrusciak et al., 2025; Hammad et al., 2026; Karwowski et al., 2025).
Human resource development becomes important, especially for small and medium organizations. It's been highlighted that organizational readiness and

competence are key factors for adopting Industry 4.0 (Ghobakhloo et al., 2022). That's why training programs, reskilling, upskilling, and transformational leadership need to be part of the operational strategy. In the long run, organizations that can combine technology with human learning will have advantages that are harder to replicate (Anshari & Hamdan, 2022; Ekhsan et al., 2026; Le et al., 2024; Vong et al., 2025).

3. Synthesis: Answering the Research Questions

The first research question about the development of the concept and scope of operations management can be answered by saying that operations have shifted from a technical production function to a value-creation system integrated with strategy, technology, supply chain, customers, and sustainability. This shift has made the scope of operations include capacity planning, quality, innovation, data analytics, resilience, and managing environmental impacts (Petropoulos et al., 2026; Sony et al., 2023; Truant et al., 2024).

The second research question about the main challenges shows that organizations face five clusters of challenges: technology complexity and cybersecurity; global supply chain disruptions; sustainability and social responsibility pressures; changing consumer needs; and demands for product and process innovation. These challenges are interconnected, so they can’t be solved with partial solutions (Choi et al., 2022; Ivanov & Dolgui, 2021; Queiroz et al., 2022).

The third research question about strategic prospects shows that the biggest opportunities lie in data-driven smart operations, resilient supply chains, circular operations, lean digital, predictive quality, and human resources development. These prospects can boost performance if organizations can align technology investments with business strategy, human capabilities, and change governance (Cheng et al., 2024; Setyadi et al., 2025c, 2025a, 2025b).

The fourth research question about technology integration, capabilities, and sustainability shows that the future of operations management needs an ambidextrous approach: efficient yet adaptive, digital yet human-centered, productive yet environmentally responsible. So, operational excellence doesn't just come from machines or software, but from an organization's ability to manage its operating systems holistically (Ghobakhloo et al., 2024; Gupta et al., 2022; Hadi, 2026; Lee et al., 2024; Maine et al., 2022).

CONCLUSIONS AND RECOMMENDATIONS

This article concludes that operations and production management have undergone a fundamental transformation. The operations function is no longer just about managing production processes, but has become a value-creation hub that determines an organization's competitiveness, resilience, innovation, and sustainability. In the digital era, operations need to be able to integrate technology, people, processes, suppliers, and customers into a system that can respond to changes.

The main challenges in operations and production management include adopting technology and automation, cybersecurity, global supply chain disruptions, sustainability demands, changing consumer preferences, and the need for faster innovation. These challenges show that just focusing on efficiency is not enough. Organizations need to build operations that are resilient, flexible, and capable of learning from disruptions.

The prospects for developing operations management lie in leveraging data analytics, AI, IoT, digital twins, lean digital, and predictive quality systems. These technologies can improve forecasting, scheduling, quality, maintenance, and inventory management. However, technology only provides value when supported by clear processes, high-quality data, competent human resources, and consistent change leadership.

Sustainability has become an agenda that can't be separated from modern operations. Operations and production need to focus on energy efficiency, waste reduction, supply chain transparency, circular economy, workplace safety, and social responsibility. By integrating sustainability into operational strategies, organizations can create long-term value for customers, shareholders, employees, communities, and the environment.

Future research suggestions include developing empirical models that test the relationship between digitalizing operations, supply chain resilience, and sustainability performance, especially in the context of developing countries and SMEs. Further studies also need to explore how organizations manage trade-offs between cost efficiency, redundancy, flexibility, and environmental goals. In addition, studies on human resource readiness, data governance, AI ethics, and the social impact of automation are still highly needed to ensure that operational transformation is inclusive and responsible.

FURTHER STUDY

This study has limitations; therefore, further research is needed on the topic of "Operations and Production Management Transformation in the Digital Era: Challenges, Prospects, and Supply Chain Sustainability Agendas" to refine this study and broaden the insights of both the author and the reader..

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