

Digitalization and resilience in Brazilian automotive supply chains: an analysis of the benefits and challenges of digitalization

RODRIGO OLIVEIRA DA SILVA

UNIVERSIDADE FEDERAL DE JUIZ DE FORA (UFJF)

VANESSA DA SILVA CAMPOS

UNIVERSIDADE FEDERAL DE JUIZ DE FORA (UFJF)

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1. INTRODUCTION

Contemporary supply chain management (SCM) has transcended mere flow optimization to become a multifaceted field of complexity, driven by a series of interconnected factors. Globalization, the growing demand for product customization, and the dizzying technological evolution have created an unprecedented operational environment. However, it is the emergence of large-scale disruptive events—ranging from natural disasters and geopolitical conflicts to public health crises like the COVID-19 pandemic and systemic interruptions such as the global semiconductor shortage—that has unequivocally exposed the inherent fragility of traditional supply chain structures. Such events, often characterized as "black swans" or elements of a VUCA (Volatile, Uncertain, Complex, Ambiguous) world and, more recently, BANI (Brittle, Anxious, Non-linear, Incomprehensible), have clearly demonstrated the urgent need for more flexible, adaptable, and, above all, inherently resilient contingency strategies (Christopher, 2016; Sheffi, 2005; Ivanov, 2022; Eckstein et al., 2025; Seow et al., 2019; Ocicka & Turek, 2021; Bakar et al., 2025).

To manage supply chains in this dynamic and complex scenario, digitalization presents itself as a fundamental component for achieving comprehensive visibility, transparency, traceability, and enabling real-time decisions (Christopher & Lee, 2004; Teixeira & Lacerda, 2010; Christopher, 2016; Tang, 2006; Pyun & Rha, 2021).

In this context, automotive supply chains stand out due to their intrinsic network of actors, transnational reach, and reliance on Just-in-Time processes. The automotive industry, by its very nature, is a fertile ground for the application of digitalization, which has the potential to transform everything from demand planning and raw material acquisition to modular production and finished vehicle delivery, optimizing every link in the chain (Xu et al., 2024).

Given the scenario of complexity and uncertainty, and the need for in-depth study on the application of digitalization in specific contexts (Adeyemi et al., 2024), the present study aimed to analyze the use of digitalization as a means of mitigating risks in the automotive supply chain, circumscribed to the Brazilian context, emphasizing its main practices, challenges, and opportunities.

This article is justified by its significant contributions, both theoretically and practically, to the field of business administration and to operations and logistics management. The research advances the academic debate by contextualizing and applying perspectives on supply chain management and resilience, with the use of digitalization (Virmani et al., 2025, Rashid et al., 2024; Zhou et al., 2023; Christopher, 2016), in an emerging market environment like Brazil, which presents challenges and particularities such as logistical infrastructure and regulatory instability (Fleury et al., 2009).

On a practical level, the results of this study offer valuable and actionable insights for managers and decision-makers working in supply chain management, especially in the Brazilian automotive sector. By identifying and categorizing sector-specific risks and analyzing the impact of digitalization on their mitigation, the article provides a relevant perspective for implementing technologies that can enhance end-to-end visibility, component and product traceability, supplier collaboration, and crisis response capability.

This article is structured into five chapters. The First presents the introduction, objective, and justification for the study. Chapter Two provides the theoretical framework that supports the research. Methodology is in chapter Three. Chapter Four presents the analyses and discussions. Finally, chapter Five contains the final considerations.

2. THEORETICAL FOUNDATION

The theoretical foundation of this research rests on three interrelated axes: Supply Chain Management, Digitalization, and Risk Management. The integration of these perspectives is fundamental to understanding how these elements contribute to analyzing the application of digitalization in the automotive supply chain. This multidimensional approach facilitates the analysis of interconnections among digitalization, supply chains, and risk management and mitigation practices, highlighting the importance of these dimensions for achieving the study's objectives. According to Slack et al. (2022), operations management encompasses the planning, coordination, and control of production and delivery activities, serving as the starting point for the following discussion.

2.1. OPERATIONS, LOGISTICS, AND SUPPLY CHAIN MANAGEMENT

Operations and logistics management play a central role in discussions about organizational efficiency and competitiveness. Historically, these areas have evolved from support functions to strategic functions within companies, resulting in a continuous reconfiguration of production and logistics processes. The literature shows that alignment between operations, logistics, and other business sectors enhances the overall performance of organizations (Spring & Araujo, 2009; Richey et al., 2016; Slack et al., 2022).

In this context, logistics practices involve not only transport and warehousing, but also activities such as demand planning, inventory control, customer service, and risk management. Integrated logistics emerges as a fundamental element providing agility and flexibility in operations, directly contributing to customer satisfaction, cost control, and the sustenance of competitive advantages (Ballou, 2006; Christopher, 2016).

Thus, logistics, by articulating all stages of the value aggregation macro-process—from the initial supplier to the final consumer—becomes indispensable for commercial success. This perspective reinforces the view of the supply chain as a collaborative and inter-organizational process, where value creation is conditioned on efficient interface management and the integration of different links in the chain (Chopra, 2019).

Supply Chain Management (SCM) expands the perspective of business logistics by incorporating interconnected activities, ranging from raw material sourcing, through production, to delivery to the final consumer, involving suppliers, manufacturers, distributors, retailers, and customers. SCM emphasizes the importance of coordination and cooperation among all participants, seeking to maximize delivered value and minimize operational costs and waste throughout the chain (Mentzer et al., 2001; Christopher, 2016; Chopra, 2019).

With the advancement of digital technologies, supply chains have become more dynamic and transparent, enabling agile information sharing, real-time monitoring, and risk anticipation. Tools such as integrated management systems (e.g., Enterprise Resource Planning - ERP), data analytics, the Internet of Things (IoT), and artificial intelligence (AI) have brought new possibilities for optimization, increasing the capacity to respond to demand changes and mitigate disruptive events (Ivanov, 2022). Furthermore, recent trends highlight sustainability and resilience as central competencies for the future of supply chains (Longo et al, 2024).

Therefore, efficient supply chain management requires not only technical knowledge but also the ability to build collaborative relationships, foster information exchange, and adopt innovative practices. Managers must balance economic, social, and environmental objectives to ensure competitiveness and sustainability in an increasingly complex and volatile scenario (Seuring & Gold, 2013). A deep understanding of these concepts is essential for a critical analysis of logistics practices adopted in different business segments, serving as a basis for the analyses in this research.

2.2. DIGITALIZATION OF SUPPLY CHAINS

The digitalization of supply chains represents a profound transformation in logistics processes, intensely influenced by emerging technologies such as Blockchain, the Internet of Things, Management Information Systems (MIS), and Artificial Intelligence (Sarkis et al., 2021; Mishra et al., 2023; Rogeon, 2025). These technologies are promoting significant optimization of operations, making them more efficient, responsive, and flexible (Cichosz et al., 2020). With the implementation of these resources, it is possible to connect data and flows in real-time, enhancing visibility over inventories, deliveries, demands, and operational performance throughout the entire chain (Mishra et al., 2023).

Digital transformation, however, goes beyond the simple adoption of new technologies. It is a strategic reconfiguration process that requires cultural, organizational, and process changes, as well as the development of new digital competencies among employees and managers. The digital approach redefines not only business practices but also how companies interact with suppliers, customers, and other stakeholders, bringing challenges related to adaptation, information security, and the integration of heterogeneous systems (Wei et al., 2024; Wang et al., 2024; Carpitella, 2024).

In Table 1, the more traditional "tools" related to supply chain digitalization were highlighted. Additionally, Table 1 briefly presents the benefits and challenges of using such tools.

Table 1 - Digitalization tools, benefits, and challenges

Tools	Description	Benefits	Challenges
<i>Digital Twins</i>	Virtual simulation of processes and products for real-time optimization.	Process optimization, waste reduction, and improved decision-making.	High implementation cost, need for precise data.
<i>Blockchain</i>	A decentralized ledger of transactions and data along the chain.	Transparency, traceability, data security.	Integration, complexity, resistance to change.
<i>Big Data Analytics</i>	Analysis of large volumes of data to predict demand and optimize inventory.	Improved demand forecasting, inventory optimization.	Need for advanced IT infrastructure.
<i>Internet of Things (IoT)</i>	Connection of devices and sensors for real-time monitoring.	Continuous monitoring, predictive maintenance.	Security vulnerabilities, high initial costs.
<i>Cloud Computing</i>	Storage and processing data on remote servers.	Scalability, reduced infrastructure costs.	Dependence on cloud providers, privacy issues.
<i>Artificial Intelligence (AI)</i>	Automation of processes and advanced data analysis for optimization.	Intelligent automation, advanced insights.	Need for technical expertise, high cost.
<i>Augmented Reality (AR)</i>	Visualization and interaction with data in real environments for operational support.	Improved data visualization, technical support.	High hardware and software costs, learning curve.

Source: Adapted from Dombrovskiy *et al.* (2023).

2.3. DIGITALIZATION IN SUPPLY CHAIN RISK MANAGEMENT

Risk management is an essential process for various organizations, with its central principle being the identification, assessment, and mitigation of potential threats that could impact their strategic and operational objectives. It is a structured approach, fundamental for facing the uncertainty and complexity present in the contemporary business environment,

allowing for the anticipation, treatment, and even transformation of potential threats into opportunities for improvement and innovation (Hopkin, 2022).

Supply chain risk management is strongly influenced by the need for cooperation and trust building among its various links. Christopher and Lee (2004) emphasize that trust significantly contributes to reducing vulnerabilities, in addition to enhancing operational performance and the ability to respond to unexpected events. The absence of trust, in turn, can increase risks, leading to inefficiencies and losses throughout logistical flows.

Beyond trust, the importance of an integrated approach to risk management along the supply chain stands out. This integration presupposes the incorporation of practices for prioritizing and controlling risks, considering especially the dynamic context of market demands, economic fluctuations, and exposure to various disruptions (Pfohl et al., 2010). Thus, risk management must involve all links of the chain, promote collaboration, and allow for the formation of collective resilience (Yilmaz, et al., 2025; Agrawal et al., 2024).

Recent global supply chain disruptions, such as those resulting from the COVID-19 pandemic, highlighted the need to rethink traditional risk management models. Organizations that invested in supplier diversity, data intelligence, and flexible structures were able to respond more agilely to unexpected disruptions. The experience showed, therefore, that organizational resilience does not depend only on the robustness of contracts and processes, but, above all, on the capacity for adaptation and innovation in risk analysis and mitigation (Sudan et al., 2023; Mohammed et al., 2023).

Moreover, the highly competitive and globalized environment increases the exposure of supply chains to emerging risks, such as those related to environmental sustainability and social responsibility. Increasingly rigorous regulations, stakeholder pressure, and demands for ethical standards drive companies to integrate socio-environmental risk management practices into their logistics processes. In this sense, the digitalization of information flows and the use of advanced analytical tools enable more precise diagnoses and faster responses, allowing companies to act proactively against not only operational but also reputational and regulatory threats (Yilmaz, et al., 2025; Agrawal et al., 2024).

Resilience in supply chains emerges as a strategic factor to ensure competitive advantage, especially in contexts of uncertainties and disruptions. To strengthen it, organizations have invested in strategic interconnections, such as collaboration between partners, information sharing, and digital integration, enabling rapid response and adaptation to adverse events. In the automotive sector, these practices, supported by digital technologies, make chains more prepared to face challenges, ensuring operational continuity and sustainability in the face of global complexities (Bruckler, et al., 2024; Guntuka et al., 2024; Kumar et al., 2024).

3. RESEARCH DESIGN

This research is characterized by a qualitative approach, with an exploratory bias. The choice is justified by the purpose of deepening the understanding of risk mitigation in supply chains through digitalization, phenomena that demand a detailed analysis of contexts, perceptions, and experiences. The qualitative method allows capturing the inherent complexity of the object of study, granting flexibility to the investigation and permitting interpretations based on inductive reasoning (Creswell, 2014).

The study was guided by an exploratory design, ideal for topics with little prior systematization in the literature and that require analysis based on empirical evidence (Fischer & Guzel, 2022; Whittle & Reissner, 2024). The research was structured through a case study, allowing for an in-depth understanding of how organizations in the automotive sector have implemented strategies to strengthen resilience in their supply chains (Yin, 2015).

Data collection involved multiple sources, such as analysis of institutional documents, sectoral reports, and semi-structured interviews with managers and professionals working in automotive supply chains. This triangulation of evidence sources seeks to provide greater robustness to the findings (Yin, 2015; Houghton et al., 2013), by enabling the confrontation of information and distinct points of view.

The qualitative data obtained was processed through content analysis, which allowed identifying categories, patterns, and relevant relationships for understanding the studied phenomenon (Abadia & Sousa, 2023). The use of this technique provides an in-depth reading of discourses and documents, highlighting factors that influence resilience in supply chains and the articulation between technology, strategy, and collaboration. The analysis process followed systematic stages: floating reading, coding, categorization, and interpretation of information, with support from specialized digital tools when necessary.

4. RESULTS AND ANALYSIS

This chapter presents and analyzes the research findings, organized into five main pivots: participants' demographic data, predominant risks in the supply chain, digital technologies adopted, benefits and challenges of digitalization, and a discussion integrating these dimensions considering sector references. The analysis covers not only the responses of 19 professionals from the national automotive industry but also secondary data from ANFAVEA yearbooks (2020-2025) and the McKinsey report (2023), broadening the scope on the trends, vulnerabilities, and technological advancements experienced by the sector.

The profile of the participants highlights experienced human capital: 15 out of 19 respondents have more than 15 years of experience, mainly allocated to strategic functions (engineering, IT, purchasing, projects, and logistics). This context lends robustness to the representativeness of the perceptions gathered, allowing for greater reliability in the analysis of the risks and strategies discussed.

The identification of the main risks exposed recurring challenges in the automotive chain, such as dependence on global suppliers, vulnerability to critical input shortages, and the impact of external disruptive events, such as pandemics and geopolitical instabilities. In this context, digitalization stands out as a mitigation element, being widely recognized by the interviewees. Technologies such as IoT, Big Data, ERP systems, and artificial intelligence emerge as facilitators for both monitoring and planning, favoring risk identification, proactive management of disruptions, and maintenance of operational resilience.

The evidence also suggests that the benefits of digitalization transcend tactical gains, increasing demand predictability, real-time monitoring, cost reduction, and process efficiency. However, challenges such as high implementation costs, a shortage of qualified professionals, integration of legacy systems, and exposure to cyber risks remain significant barriers to full digitalization. This duality reinforces the need for integrated policies and initiatives, both in the private and institutional spheres, to consolidate gains and overcome limitations.

Finally, the document analysis itself shows that the trends identified by the participants converge with the diagnosis of the main publications and organizations in the global automotive sector. Digitalization has been establishing itself as a strategic response to the growing instability and complexity of global chains, requiring companies to have a systemic vision, continuous adaptation, and constant investment in technology and training.

4.1. RESEARCH-EVIDENCED RISKS

This research, by combining the analysis of perceptions from automotive chain actors — through interviews — with evidence extracted from sectoral documents, reinforces the understanding that the nature of the risks faced by the sector is characteristically broad, dynamic, and interconnected. This panorama aligns with contemporary literature approaches, which emphasize not only the multiplicity of risks — be they of exogenous origin, such as

global disruptive events, or endogenous, related to internal structure and processes — but also the need for integrated, transversal, and technology-intensive solutions.

The participants' reports in this study directly converse with authors such as Ivanov (2020), Cichosz et al. (2020), Adeyemi et al. (2024), Bruckler et al. (2024), and Carpitella (2024), by highlighting risks associated with demand volatility, supply interruptions, critical dependence on certain links in the chain, and cyber vulnerabilities. Such risks, reiterated in the sectoral documents analyzed (ANFAVEA, 2020-2025), demonstrate a convergence between what is discussed in international literature and what is perceived in the Brazilian context.

Specifically, the growing role of digital technologies as key elements in risk forecasting, prevention, and mitigation strategies stands out. This finding is corroborated by the interviewees of this research, who pointed to the intensified use of advanced traceability systems, analytics, IoT, and AI, aligning with the recommendations of Ivanov (2022) and Sudan et al. (2023). Such advancements enable increased visibility of logistical flows, scenario simulations, and real-time responses to disruption or anomaly determinations.

Furthermore, the literature highlights that supply chain resilience increasingly depends on the development of dynamic capabilities for collaboration and data sharing (Bruckler et al., 2024; Dombrovskiy et al., 2023; Guntuka et al., 2024), an aspect also present in respondents' reports and illustrated in documented experiences. The adoption of more flexible contracts, the revision of supplier clauses, and the creation of collaborative networks appear as crucial practices in both theory and observed practice.

This empirical evidence, considering the research's theoretical foundation, therefore points to a structural vulnerability of the automotive chain, but also to a tendency to overcome these bottlenecks through the intensified use of emerging technologies and collaborative practices. In summary, the results suggest that the challenges faced by the sector demand coordinated investment in innovation, digital integration, and shared risk management—central guidelines on the recent literature agenda and widely reflected in the experiences of the surveyed agents.

4.2. DIGITALIZATION AND RISK MITIGATION

Digitalization has consolidated itself as a central element of contemporary risk mitigation strategies in the automotive chain. The analysis of the reports shows that its main contribution lies in its ability to increase real-time visibility over material flows, supplier status, and demand variations. Such visibility, stemming from the integration between information systems and IoT solutions, allows for preventive interventions that reduce exposure to critical supply disruptions.

However, digitalization transcends the mere adoption of technological tools. Many interviewees emphasized that digital transformation requires rethinking processes and, above all, establishing a culture of shared data and collaboration among the links of the chain. This movement, aligned with the concept of Supply Chain 4.0 (Adeyemi et al., 2024), enhances the anticipation and monitoring of risks, making mitigation actions more guided by analytical intelligence than by intuition or previous experience.

Operationally, advancements such as the use of sensors for cargo tracking, data analytics for demand forecasting, and interactive dashboards that facilitate the monitoring of key performance indicators (KPIs) of risk stand out. The application of Digital Twins allows for simulations in a virtual environment, testing the impact of different scenarios, such as port delays or critical parts shortages. This type of simulation, previously restricted to large multinationals, is beginning to spread among national companies, driven, in part, by the needs imposed by recent crises, especially the Covid-19 pandemic.

Another relevant point identified refers to the transformation of the professional profile required to operate in a digitized environment. It is not enough to master systems: professionals

are called upon to interpret large volumes of data, make quick decisions based on evidence, and work in multidisciplinary teams, often geographically distributed. This change requires structured training actions, as well as the integration of new talents with advanced digital competencies.

Digitalization has also promoted profound changes in power relations and governance within the chain. Companies capable of investing in robust digital solutions begin to play a leading role, guiding integration processes and information standardization. On the other hand, suppliers that do not keep pace with this evolution tend to become technologically outdated, becoming fragile links and more susceptible to replacement. One observed consequence was the growth of digital onboarding initiatives, where chain leaders support strategic partners in their technological maturity journeys, to reduce systemic risks.

Despite the highlighted benefits, the results also reveal emerging challenges. Among them are growing concerns about cybersecurity, especially given the increase in digital attacks on logistical infrastructures. Dependence on stable connectivity, fragmentation of legacy systems, and barriers to integration with smaller suppliers constitute obstacles to the complete digitalization of the chain. This scenario reinforces the need for solid IT governance policies and continuous investments in updating and technological resilience.

In the Brazilian context, digitalization shows significant progress but still faces limitations related to the high cost of implementing technologies, infrastructure deficiencies in less developed regions, and disparities in digital maturity among different hierarchical levels and segments of the chain. Even amidst these adversities, reported cases demonstrate that real-time sharing of logistics information enabled consistent responses to disruptive events, such as transport strikes or port delays, reducing financial losses and strengthening trust among agents.

Finally, it is essential to consider that digitalization does not eliminate risks but transforms their nature. New challenges arise, such as vulnerability to cyberattacks, the complexity of data management in multi-system environments, and the need for continuous updating of competencies. Such dilemmas require a strategic approach, integration with compliance policies, and, above all, the adoption of a continuous learning mindset among professionals and organizations.

In summary, digitalization emerges not only as a technological instrument but as a catalyst for business resilience. Its role, therefore, must be understood considering a systemic and evolutionary perspective, where mastering tools is only the starting point. The true differential lies in the ability of companies to integrate data, people, and processes into collaborative strategies for anticipating and responding to increasingly complex and dynamic risks.

With the purpose of consolidating the empirical and theoretical evidence discussed throughout this study, Table 2, below, presents an analytical structure that condenses the main identified risks, the digital technologies used in mitigating these risks, the perceived benefits, and the inherent challenges of digital transformation in the national automotive sector.

Table 2 - Main research findings

Analytical Category	Main Findings and Analyses
1. Context and Complexity of the Brazilian Automotive Chain	<ul style="list-style-type: none"> • The automotive SCM is intrinsically complex, driven by customization demand, multiple links, and the diversity of commercial practices and information systems. • The Brazilian automotive industry is vital for GDP and job creation but exposed to macroeconomic volatility and infrastructural deficiencies. • Digitalization is a "sine qua non" condition for modern management, aiming for greater responsiveness and resilience.

Analytical Category	Main Findings and Analyses
<p>2. Main Identified Risks</p>	<ul style="list-style-type: none"> • Disruptions: Shortage of semiconductors and electronic components, dependence on international suppliers, and logistical bottlenecks. • Deficient Infrastructure: Low quality of highways and limited rail network, increasing costs and delays. • Economic Volatility: Fluctuations in raw material prices and demand, as well as regulatory and environmental risks. • Human and Technological Risks: Lack of qualified professionals and vulnerability to cyberattacks.
<p>3. The Role of Digitalization in Risk Mitigation</p>	<ul style="list-style-type: none"> • Digitalization is crucial for mitigating risks, increasing transparency, efficiency, visibility, and control in logistics flows. • It enables real-time monitoring, end-to-end traceability, predictive analytics, and automation of decision-making processes. • The COVID-19 pandemic significantly accelerated the adoption and investment in digital technologies in the sector.
<p>4. Applied Digital Technologies</p>	<ul style="list-style-type: none"> • Widely used: Internet of Things (IoT/IIoT), Big Data & Analytics, ERP and SCM Systems, Artificial Intelligence (AI) for forecasting and optimization. • Emerging/Potential: Digital Twins, Blockchain (still limited use in Brazil compared to potential), Telemetry Solutions, and Digital Compliance.
<p>5. Tangible Benefits of Digitalization</p>	<ul style="list-style-type: none"> • Operational Efficiency: Improved inventory and demand management, reduction of operational costs, and process optimization. • Visibility and Response: Advances in traceability, chain integration, and greater agility in responding to real-time disruptions. • Innovation and Competitiveness: Drives innovation in products/services and confers significant operational advantages.
<p>6. Challenges and Barriers to Digitalization</p>	<ul style="list-style-type: none"> • Costs and Integration: High initial investments and difficulties in integrating new systems with legacy infrastructures. • Workforce and Culture: Shortage of qualified professionals and resistance to organizational change. • Vulnerabilities: Increased cyber risks and dependence on robust internet infrastructure. • Disparity in technology adoption between large companies and SMEs.
<p>7. Risk Mitigation Strategies</p>	<ul style="list-style-type: none"> • Digital: Adoption of digital technologies (IoT, AI, ERP, etc.) for continuous monitoring and predictive analysis. • Non-Digital/Complementary: Diversification of suppliers, maintenance of safety stocks, strengthening of strategic partnerships, business continuity planning, and rational delocalization (nearshoring).
<p>8. Implications and Contributions of the Study</p>	<ul style="list-style-type: none"> • Digitalization is a strategic imperative for the survival and growth of the Brazilian automotive sector, redefining risk management. • The study articulates digital transformation in the sector's risk management, evidencing advancements and gaps in the national context.

Analytical Category	Main Findings and Analyses
	<ul style="list-style-type: none"> • Suggestions for the future: Need for public policies to encourage investments in connectivity infrastructure, workforce training, and data standardization.

Source: Prepared by the authors

Table 2 offers a consolidated view of the main research results, revealing the duality inherent in digitalization: a transformative force essential for competitiveness and resilience, but one that also introduces new challenges and demands continuous adaptations. The findings reinforce that, although the Brazilian automotive sector has made important progress in adopting digital technologies to mitigate risks, the depth and capillarity of this transformation are still unequal. The strong dependence on semiconductors and the insufficiency of national logistics infrastructure remains critical vulnerabilities, which digitalization helps to manage but does not solve in isolation. The contrast between the theoretical potential of technologies like blockchain and their limited practical application in Brazil illustrates the gap between what is possible and what is effectively implemented.

Considering this scenario, the study underlines the urgency of a systemic approach to the digitalization of the automotive supply chain. It is not just about acquiring new tools but about promoting a cultural and infrastructural change that encompasses all links, including small and medium-sized enterprises. Collaboration among stakeholders — industry, government, and academia — proves imperative to overcome financial, technological, and training barriers. Only through articulated public policies and targeted investments, especially in connectivity infrastructure and human capital formation, will it be possible to consolidate the advances made and position Brazil as a more robust and innovative player in the global automotive landscape.

5. CONCLUSION

This study aimed to analyze digitalization as a risk mitigation strategy in the Brazilian automotive supply chain. Through an approach that combined literature review, documentary analysis, and interviews with professionals from the sector, it was possible to draw a comprehensive overview of the advancements and challenges of digital transformation in this crucial segment of the economy.

The results demonstrate that digitalization is fundamental to expanding visibility, transparency, and the ability to respond to operational and strategic risks. Technologies such as IoT, Big Data, ERPs, and AI are essential for optimizing management, promoting traceability, and boosting collaboration. However, the study also revealed significant challenges, such as the need for continuous investments in digital infrastructure, the complexity of system integration, and the shortage of qualified professionals. Cultural aspects and resistance to change also stand out as relevant barriers.

Despite these challenges, digitalization represents a strategic opportunity for the Brazilian automotive chain, providing greater resilience and competitiveness. It is recommended to managers and public policymakers that they invest in integrated strategies that contemplate not only the acquisition of technology but also human capacity building, the development of collaborative norms, and incentives for innovation.

For future research, it is suggested to explore international comparative studies, deepen the understanding of digitalization's impacts on sustainability, and investigate emerging technologies, such as digital twins and blockchain, in local contexts. It is hoped that this work inspires new strategic engagements, consolidating Brazil as a relevant actor in the constantly transforming global automotive scenario.

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