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The Impact of COVID-19 on supply chain analytics: A global review

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Abstract

The COVID-19 pandemic has triggered unprecedented disruptions across global supply chains, challenging businesses to reassess and optimize their supply chain analytics strategies. This paper delves into the far-reaching impact of the pandemic on supply chain analytics, providing a comprehensive global review of the challenges, innovations, and transformations that have emerged. The pandemic-induced disruptions have exposed vulnerabilities in traditional supply chain models, prompting organizations to reevaluate their analytics frameworks. The sudden fluctuations in demand, supply chain interruptions, and logistics bottlenecks necessitated a rapid response, pushing companies to leverage advanced analytics to enhance visibility and agility in their supply chain operations. This global review reveals that organizations have increasingly turned to predictive analytics, machine learning, and artificial intelligence to navigate the uncertainties introduced by the pandemic. These technologies have enabled real-time data analysis, forecasting, and scenario planning, empowering businesses to make informed decisions amidst the dynamic and unpredictable nature of the crisis. Moreover, the study highlights the importance of data-driven insights in risk management within the supply chain. Organizations have recognized the need for robust analytics tools to identify, assess, and mitigate risks associated with suppliers, transportation, and geopolitical factors. The integration of analytics into risk management strategies has become imperative for building resilient and adaptable supply chains. The study further explores the emergence of digital twins and blockchain technologies as transformative elements in supply chain analytics. Digital twins provide a virtual representation of the entire supply chain, facilitating simulation and optimization, while blockchain enhances transparency and traceability, crucial for ensuring the integrity of the supply chain. This global review underscores the profound impact of COVID-19 on supply chain analytics, emphasizing the paradigm shift towards data-driven decision-making, advanced technologies, and resilience-building strategies. As businesses continue to navigate the ongoing challenges, the integration of innovative analytics solutions remains pivotal in not only mitigating current disruptions but also in building agile and future-proof supply chains.

Keywords: COVID-19; Supply Chain; Analytics; Global; Review

1. Introduction

The COVID-19 pandemic has significantly impacted global supply chains, leading to disruptions and challenges across various industries. Supply chain analytics plays a crucial role in mitigating these challenges by providing insights and data-driven solutions to enhance supply chain performance and resilience. The purpose of this global review is to comprehensively assess the impact of COVID-19 on supply chain analytics and its implications for global supply chain management.

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The COVID-19 pandemic, caused by the novel coronavirus, has had far-reaching effects on global health, economies, and supply chains (Kumar et al., 2020). The pandemic has led to unprecedented disruptions in supply chains, affecting production, distribution, and logistics worldwide. As a result, there is a critical need to understand the implications of COVID-19 on supply chain analytics to develop effective strategies for managing these disruptions.

Supply chain analytics is of paramount importance in a global context, especially in the face of the challenges posed by the COVID-19 pandemic. It enables organizations to leverage data and advanced analytical tools to optimize supply chain operations, enhance decision-making, and improve overall performance (Trkman et al., 2010). The use of business analytics in supply chain management has been shown to positively impact supply chain performance, making it an essential tool for organizations operating within global supply chains (Chae & Olson, 2013).

The global review on the impact of COVID-19 on supply chain analytics aims to provide a comprehensive assessment of how the pandemic has affected the use of analytics in supply chain management. This review will explore the role of analytics in predicting and mitigating the impact of COVID-19 on global supply chains, as well as its implications for supply chain innovation and robustness capability (Shamout, 2019). Additionally, the review will examine the application and impact of new technologies, such as artificial intelligence, big data analytics, and machine learning, in managing supply chain disruptions during the pandemic (Muhammad & Manzoor, 2021; El-Khchine et al., 2018).

Furthermore, the review will consider the social and sustainability aspects of global supply chain resilience in the context of the COVID-19 pandemic. It will explore the implications of the pandemic on social sustainability and the resilience of global supply chains, taking into account the perspectives of industry professionals from leading production countries (Sajjad, 2021; Su et al., 2022). Additionally, the review will assess the influence of organizational commitment and virtual meetings on the perceived effectiveness of supply chain management during the pandemic (Prasetyo et al., 2022).

In conclusion, the global review on the impact of COVID-19 on supply chain analytics is essential for understanding the challenges and opportunities presented by the pandemic in the context of global supply chains. By synthesizing evidence from various reputable sources, this review aims to provide valuable insights into the implications of COVID-19 on supply chain analytics and its significance for global supply chain management.

2. Supply Chain Analytics and factors affecting it

Supply chain analytics play a crucial role in enabling operational supply chain transparency (Zhu et al., 2018). The application of technologies such as blockchain, IoT, artificial intelligence, big data analytics, cloud computing, 5G, and smartphone applications, as well as the use of robots and drones, has substantially impacted supply chain resilience, agility, and adaptability during the COVID-19 pandemic (Muhammad & Manzoor, 2021). Furthermore, the integration of supply chain data analytics with triple-A supply chain strategies has been found to significantly influence post-pandemic performance, emphasizing the importance of data analytics in effectively implementing strategies for sustaining company performance amid disruptions caused by COVID-19 (Khan & Piprani, 2022; Abrahams et al., 2024). The impact of COVID-19 on supply chains has been identified as a special case of supply chain risk, emphasizing the need for supply chain agility as an antecedent to firm sustainability in the post-COVID-19 era (Hassan et al., 2024; Wang & Wang, 2023).

The disruptions induced by COVID-19 have been addressed in various studies, highlighting the need to model the impacts of COVID-19 in supply chain activities and to assess supply chain resilience to the outbreak of COVID-19 in different industries (Karuppiah et al., 2022; Badhotiya et al., 2022; Farooq et al., 2022). The pandemic has also affected the food supply chain, leading to discussions on the implications of COVID-19 on socioeconomic factors and the impact of lockdown on the food supply chain and agri-business (Barman & De, 2021). Additionally, the COVID-19 pandemic has prompted a review of the strategies and corresponding competences needed to improve supply chain resilience, emphasizing the importance of strategic drivers to overcome the impacts of the pandemic and ensure resilience in supply chains (Kiers et al., 2022; Balogun et al., 2024; Moktadir et al., 2022).

In the post-COVID-19 situation, organizations can enhance their sustainable supply chain performance by giving extra attention to big data analytics capabilities and supply chain risk and innovativeness, emphasizing the role of big data in ensuring sustainability in supply chains (Nisar et al., 2022). The impacts of COVID-19 on global supply chains, logistics, and transportation have been examined, highlighting the need to enhance the resiliency of perishable product supply chains in the context of the COVID-19 outbreak (Kwon, 2020; Shanker et al., 2021). Supply chain analytics have been identified as a strong determinant for desirable organizational outcomes such as supply chain performance and agility, emphasizing their role in achieving desirable outcomes (Akindote et al., 2023; Shamout, 2020).

Factors affecting supply chain resilience and performance have been explored, including the impact of various disruptions on global supply chains, the role of supply chain financing on SMEs performance, and the importance of information sharing in agricultural product supply chains (Alvarenga et al., 2022; Vu et al., 2022; Wang et al., 2021). The impact of COVID-19 on shipping and logistics has also been studied, with a focus on the role of mobile service operation as a win-win model for both service providers and consumers (Hirata & Matsuda, 2021). Furthermore, the role of big data in enhancing the efficiency of supply chain management has been highlighted, emphasizing the development of supply chain analytics (Babarinde et al., 2023; Chouakang et al., 2022).

In conclusion, supply chain analytics, technological advancements, and strategic drivers play a crucial role in mitigating the impacts of disruptions, enhancing supply chain resilience, and ensuring sustainable supply chain performance, especially in the context of the COVID-19 pandemic.

3. Challenges Posed by the Pandemic

The COVID-19 pandemic has indeed brought about significant challenges across various sectors, including disruptions in demand and supply, logistic challenges, and the need for rapid and informed decision-making. The pandemic has led to unprecedented fluctuations in demand and supply chains, creating imbalances in inventory management (Feuerriegel et al., 2016). This has resulted in challenges for organizations, requiring closures or adaptations of their business models to meet the challenges posed by the pandemic situation (Almeida et al., 2022). Furthermore, transportation bottlenecks and warehouse constraints have emerged as significant logistic challenges during the pandemic (Daneshfar et al., 2022; Lukong et al., 2022). The pandemic has transformed the world and posed exceptional challenges to health care delivery, requiring rapid and informed decision-making (Karim et al., 2020). The dynamic and unpredictable nature of the crisis has made it essential to have real-time data analysis for effective decision-making (Segenreich, 2022).

The pandemic has not only been a major healthcare problem but has also posed enormous societal challenges, affecting various aspects of life, including work environments and mental health (Dreher et al., 2022; Maurik et al., 2020). The challenges posed by the pandemic have also extended to the education sector, with post-secondary education facing several difficulties in adapting to the new normal (Riddell et al., 2021). Additionally, the pandemic has introduced new challenges to work-from-home arrangements, including future uncertainty, health concerns, and the need for suitable home workspaces (Daneshfar et al., 2022; Kunene et al., 2022). The pandemic has also highlighted the significance of syndemic thinking in managing epidemics, emphasizing the need for a broader perspective in addressing public health crises (Nordin & Uusikylä, 2023).

In the context of demand and supply disruptions, the power grid operators have faced major challenges in stabilizing the grid and preventing imbalances between demand and supply (Feuerriegel et al., 2016). Moreover, the consideration of rapid reviews has posed challenges to directors of existing systematic review programs, emphasizing the need for efficient decision-making processes during the pandemic (Hartling et al., 2015). The pandemic has also led to the need for rapid response programs to support evidence-informed decision-making, highlighting the importance of utilizing the best available evidence for effective decision-making in public health (Haby et al., 2015).

In conclusion, the COVID-19 pandemic has presented multifaceted challenges, ranging from disruptions in demand and supply to logistic hurdles and the need for rapid and informed decision-making. These challenges have permeated various sectors, including healthcare, education, and work environments, necessitating real-time data analysis and the adoption of innovative approaches to address the dynamic and unpredictable nature of the crisis.

4. Evolving Strategies in Supply Chain Analytics

The adoption of predictive analytics in supply chain management has become increasingly prevalent. Predictive analytics, which is based on historical data processed through machine learning, has been utilized for forecasting demand and supply. This departure from conventional demand forecasting approaches has enabled intelligent forecasts that can adapt to the ever-changing demand in supply chains (Seyedan & Mafakheri, 2020). Furthermore, the integration of machine learning and artificial intelligence has significantly enhanced decision-making processes and improved overall supply chain efficiency (Li & Wang, 2021). This integration has allowed for the development of a modern supply chain of the social organization collaborative type, driven by continuous innovation and the emergence of 5G technology (Chouakang et al., 2022).

In addition to predictive analytics and artificial intelligence, there has been a growing focus on risk management within supply chain analytics. This includes the identification and assessment of risks in the supply chain, as well as the mitigation of these risks through data-driven insights. Supply chain adaptability has been recognized as essential, allowing for the adjustment of supply chain design to meet structural shifts in markets and modify supply networks to adapt to new strategies, products, and technologies (Phadnis & Darkow, 2021). The literature also emphasizes the importance of supply chain collaboration and coordination. Effective supply chain management requires coordination among various chain members, and with cooperation among partners, the supply chain can coordinate its operations and improve efficiency (Anitha & Patil, 2018; Phadnis & Joglekar, 2020). Furthermore, the economic evaluation of cooperation scenarios in supply chains has highlighted that the overall result of the supply chain is more important than individual results (Rodríguez & Cunha, 2018).

Moreover, demand forecasting has been identified as a critical aspect of supply chain analytics. Demand forecasts form the basis of all supply chain planning, and future demand forecasts are the basis of all strategic decisions and planning in a supply chain (Waller & Fawcett, 2013; Lai et al., 2018). The development of forecasting models and the selection mechanism for supply chain demand estimation has been crucial in driving supply chain operations and strategic decision-making (Zhang et al., 2010).

In conclusion, the evolving strategies in supply chain analytics encompass the adoption of predictive analytics, integration of machine learning and artificial intelligence, focus on risk management, supply chain adaptability, collaboration and coordination, and demand forecasting. These strategies are essential for enhancing decision-making processes, improving overall supply chain efficiency, and mitigating risks through data-driven insights.

5. Role of Data-Driven Insights in Risk Management

The role of data-driven insights in risk management is crucial for businesses to make informed decisions and mitigate potential risks. Leveraging analytics for supplier risk assessment involves ensuring supplier reliability and reducing dependency on single-source suppliers. By utilizing data-driven insights, organizations can assess the reliability of their suppliers and identify potential risks associated with single-source dependencies, thereby enabling them to diversify their supplier base and minimize vulnerabilities in the supply chain (Manuj & Mentzer, 2008; Norrman & Jansson, 2004).

Analyzing transportation risks through data-driven insights allows organizations to address transportation disruptions and optimize transportation routes for efficiency. By leveraging analytics, businesses can identify potential disruptions in transportation, such as delays or capacity constraints, and proactively develop contingency plans to mitigate these risks. Additionally, data-driven insights enable organizations to optimize transportation routes, leading to cost savings and improved operational efficiency (Gökalp et al., 2021; Moktadir et al., 2019).

Considering geopolitical factors in risk management involves evaluating political and economic uncertainties and adapting supply chain strategies to mitigate geopolitical risks. Data-driven insights provide organizations with the ability to assess geopolitical factors, such as trade regulations or geopolitical tensions, and develop strategies to mitigate their impact on the supply chain. This proactive approach helps businesses navigate geopolitical complexities and minimize potential disruptions to their operations (Brynjolfsson et al., 2011; Vanderhoeven et al., 2017).

In conclusion, data-driven insights play a pivotal role in risk management across various aspects of business operations, including supplier risk assessment, transportation risk analysis, and geopolitical risk considerations. By harnessing the power of analytics, organizations can make well-informed decisions, enhance resilience in their supply chains, and effectively mitigate potential risks.

6. Technological Transformations in Supply Chain Analytics

Technological transformations in supply chain analytics have been significantly influenced by the adoption of digital twins and blockchain technology. Digital twins, as virtual representations of physical assets, have found applications in supply chain management, enabling the modeling of supply chain designs supported by real-time operational parameters (Bhandal et al., 2022). This technology facilitates the simulation and optimization of supply chains, allowing for predictive and prescriptive analytics to enhance decision-making processes (Bhandal et al., 2022). Furthermore, digital supply chain twins have been recognized for their role in managing disruption risks and resilience in the era of Industry 4.0, highlighting their potential in addressing the complexities of modern supply chains (Ivanov & Dolgui, 2020).

In parallel, blockchain technology has emerged as a pivotal tool for ensuring transparency and traceability within supply chains. It has been applied to evaluate waste electronic product trade-in strategies, particularly in predictive twin disassembly systems, showcasing its potential to enhance sustainability and accountability in supply chain operations (Tozanli et al., 2020). Additionally, digital twins have been identified as drivers for supply chain visibility within logistics, offering a new paradigm for future logistics by leveraging information technology to benefit various facets of supply chain visibility (Moshood et al., 2021).

The integration of digital twins and blockchain technology aligns with the broader context of Industry 4.0, reflecting a wide-angle perspective on the digital twin's role in this industrial transformation (Kenett & Bortman, 2021; Mouchou et al., 2021). This convergence of technologies presents opportunities for supply chain analytics to evolve, enabling organizations to achieve greater operational efficiency, resilience, and transparency.

In conclusion, the incorporation of digital twins and blockchain technology in supply chain analytics represents a significant technological transformation. These innovations offer capabilities for virtual representation, simulation, optimization, transparency, and traceability within supply chain management, aligning with the demands of modern, complex supply chain ecosystems.

6.1. Recommendation

Organizations should prioritize investments in advanced analytics technologies, including predictive analytics, machine learning, and artificial intelligence. These tools have proven instrumental in enhancing real-time decision-making and forecasting capabilities, critical for navigating uncertainties in the supply chain. Establish robust monitoring systems to continuously assess and manage risks within the supply chain. Incorporate analytics into risk management strategies, identifying vulnerabilities in suppliers, transportation, and geopolitical factors, ensuring a proactive approach to potential disruptions. Foster an agile mindset in supply chain design and management. Utilize analytics to create flexible and adaptive supply chain models that can swiftly respond to changing market conditions, demand fluctuations, and unforeseen disruptions. Explore the integration of digital twins and blockchain technologies for enhanced supply chain visibility and traceability. Digital twins can provide virtual representations for simulation and optimization, while blockchain ensures transparency and integrity throughout the supply chain network. Encourage collaboration among supply chain partners and stakeholders. Establish platforms for real-time information sharing and collaboration, leveraging analytics to create a more connected and responsive supply chain ecosystem

7. Conclusion

In conclusion, the global review of the impact of COVID-19 on supply chain analytics reveals several key findings that are pivotal for the future of supply chain management. The pandemic exposed vulnerabilities in traditional supply chain models. Advanced analytics, including predictive tools and AI, proved crucial in decision-making. Risk management integrated with analytics became imperative. Digital twins and blockchain technologies emerged as transformative elements. The ongoing significance of supply chain analytics cannot be overstated. As global dynamics continue to evolve, analytics remains a linchpin for informed decision-making, risk mitigation, and overall resilience in supply chain operations. The implications of this global review extend beyond crisis management. They underscore the need for organizations to proactively build resilient and adaptable supply chains. Future supply chain strategies must be data-driven, agile, and technologically advanced, incorporating the lessons learned from the pandemic to navigate uncertainties effectively.

In essence, the transformative role of supply chain analytics highlighted in this review sets the stage for a new era of supply chain management, where data-driven insights and innovative technologies play a central role in building resilient, adaptable, and future-proof supply chains.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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