

CHALLENGES OF IMPLEMENTING THE SUPPLY CHAIN DIGITIZATION PROCESS IN THE REPUBLIC OF SERBIA

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Abstract: *By using modern technologies, traditional supply chains are transformed into smart ones that need to face challenges in the digital era. Traditional supply chains exhibit numerous shortcomings in terms of security, safety, visibility, losses, delays. To tackle these challenges, companies need to apply the latest technological advancements. Technological innovations such as the Internet of Things, Cloud computing, Blockchain and others guide organizations towards the digitization of supply chains, making them sustainable, flexible and efficient. Despite the numerous benefits they bring, companies encounter obstacles in implementing new technologies, particularly regarding security risks in information exchange. The aim of this paper is to review relevant literature and demonstrate which digital technologies are significant for supply chain management and how these technologies have led to optimizing operational costs, performance, profits, and growing needs of customers. Additionally, it will explain how companies can enhance the process of information exchange as a key component of supply chain management. The paper will present the current state of digitalization of the supply chain in the Republic of Serbia. It will identify indicators of limitations for implementing digital solutions and present measures and guidelines for further development. The paper should provide guidelines for further theoretical and empirical research.*

Key words: *Digital transformation, digital technologies, supply chain management, information security, sustainability.*

1. INTRODUCTION

Digital technologies have transformed consumer behavior as well as the operations and activities of companies, which in turn affects the way society approaches information exchange. The quality and accuracy of information play a crucial role and serve as a link that unites all participants.

It has been shown that the traditional supply chain is not prepared to respond to dynamic changes and uncertainties that appear in the market (Negru^È, 2022; Li, & Song, 2022). Authors (Bancal, & Ray, 2022; Rizou, Galanakis, Aldawoud, & Galanakis, 2020; Aung, & Chang, 2014) note that the exchange of information among participants is not at a level that would enable supply chain management to react timely in terms of business optimization and meeting customer needs. The traditional supply chain is rigid, lacks transparency, exhibits weak cross channel connectivity and shows a lack of digitization (Talal, Kazmi, Joyia, & Naz, 2022). In order to achieve success through the concept of the 7Rs, which implies the right product, right quantity, right conditions, right place, right time, right customer and right price, the transformation of the traditional supply chain into a modern digitized chain based on contemporary IT technologies is necessary.

The application of digital technologies should lead to better processing and utilization of data, contributing to improved performance in both the public and private sectors and enhancing communication and collaboration among state, businesses and the population. In order to increase competitiveness and successfully respond to global social challenges it is crucial to encourage the digital maturity of Serbian companies. The digitalization of the supply chain in the Republic of Serbia lags behind EU countries. A small number of manufacturers, transportation companies and retailers use this type of technology for various reasons (high initial implementation costs, lack of modern IT technology, lack of trained personnel, etc.).

2. THEORETICAL BACKGROUND

Digitalization of the supply chain represents progress towards a fully integrated set of solutions that facilitate and accelerate data flow while also affect the overall chain's security. Attaran (2020) identifies 8 technologies as drivers of the digital supply chain.

2.1 Cloud computing

Cloud computing technology is based on the concept of making all necessary data available to the user at any given time. Cloud computing starts with the idea of resource sharing and on-demand availability, providing users with the ability to plan capacity according to their needs (Chen, & Ma, 2011). The three key contributions of cloud computing are connectivity, which establishes a network between suppliers, vendors, and customers. The second contribution is cognitive intelligence, which influences proactive decision-making and predictive analytics, which mitigates potential risks. The third contribution is scalability, which leads to efficiency, flexibility and cost optimization. By moving to cloud computing organizations can gain better access to resources and information, increasing flexibility and the ability to adapt to market conditions (Botta, De Donato, Persico, & Pescapé, 2016).

2.2 Big Data (Advanced analytics)

Advanced analytics in supply chains starts from the application of sophisticated techniques and tools that enable the processing and analysis of large amounts of data, making plans and forecasts and based on the achieving better business outcomes (Simonetto, Sgarbossa, Battini, & Govindan, 2022). Methods such as statistical modeling, machine learning, data mining, etc. are used to extract insights from complex data sets, providing information for decision-making. Big data analytics includes five dimensions: volume, velocity, variety, veracity and value. Based on these dimensions, advanced analytics is a powerful tool that enables companies to proactively monitor key performance indicators and make decisions based on valid data, which has proven critical in business optimization, risk management and overall supply chain sustainability.

2.3 Internet of Things (IoT)

The concept of the Internet of Things (IoT) is based on the use of a virtual platform that connects and enables communication among devices (RFID tags, barcodes, wireless sensors, GPS, etc.), leading to automation and faster information exchange within the supply chain. Business processes and devices connected in the IoT can be remotely controlled to facilitate easier and quicker data management (Gubbi, Buyya, Marusic, & Palaniswami, 2013). The system identifies real-time changes and demands, monitors inventory levels and promptly sends information to all participants. The Internet of Things reduces the time gap between data collection and decision-making, enabling faster response and adaptation to changes, thereby increasing agility and efficiency among supply chain participants.

2.4 Advanced Robotics

Robots have emerged as a result of the need to elevate the level and speed of service, improve distribution processes and optimize workers' working hours. Robots are used for performing manipulative and routine operations in production facilities and warehouses (Attaran, 2020). They contribute to increased productivity, efficiency, safety, accuracy and speed of operations, while also reducing risks and errors. Cobots (collaborative robots) are the outcome of recent technological advancements designed to work autonomously in physical interaction with humans in a shared workspace (Simonetto, Sgarbossa, Battini, & Govindan, 2022). The purpose of using robots is to replace manual vehicles, ensure safe, efficient, cost-effective material movement and enable employees to engage in value-added activities.

2.5 Additive Manufacturing (3D printing)

Additive manufacturing refers to hybrid machines that transform traditional production systems into intelligent ones. 3D printers are next-generation production tools that operate based on laser or inkjet printer principles, converting digital media products into solid three-dimensional objects with a "layered" structure defined as "additive manufacturing" (Paksoy, Koçhan, & Ali, 2021). The main reasons why companies use 3D printing technology are to produce smaller quantities of materials and more cost-effective parts in a shorter timeframe. Additionally, product prototypes can be designed and created in a faster and more flexible manner than before. The result of implementing 3D printers is lower costs and increased productivity in the supply chain.

2.6 Blockchain Technology

Blockchain represents a digital database consisting of interconnected blocks. Each block contains and stores data about various types of transactions. The four main characteristics of Blockchain are: 1) immutability, 2) decentralized system, 3) consensus mechanism, 4) transparency (Paksoy, Koçhan, & Ali, 2021). The application of Blockchain Technology positively impacts the supply chain by increasing transparency, ensuring transaction integrity and validity (Dursun, Birinci, Alptekin, Sertkaya, Hasekioglu, Tunaboynu, & Zaim, 2022). This technology reduces administrative tasks, provides quick access to relevant information and prevents potential fraud. Blockchain Technology contributes the most to information security (Nurgazina, Pakdeetrakulwong, Moser, & Reiner, 2021). The combination of Blockchain with other technological solutions encompassed by the concept of Logistics 4.0 brings numerous advantages, such as the integration of the physical and virtual world, enhanced speed and secure information exchange, contributing to sustainability across all segments of the supply chain.

2.7 RFID (Radio Frequency Identification)

RFID is a wireless information transmission technology used for locating and identifying individual items through radio waves. The components of RFID include tags, readers and controllers/ software. RFID technology is used in various fields where tracking and data processing are required. The application of RFID in supply chains is primarily associated with automated data collection and real-time information availability, which enhances traceability, control and efficiency to a higher level.

2.8 Augmented Reality (AR)

Augmented Reality (AR) is a simulation model that allows the combination of digital elements, such as text, images and sounds, with the real world, providing additional information, visualization and interaction with physical objects and processes. The application of AR in supply chains leads to improved operational efficiency in the area of warehousing by displaying information about inventory, order status, optimal routes and other relevant data, facilitating decision-making and reducing the time required for searching and handling goods (Angela, Lee, Pledger, Cendejas, Mannemela, & Awwad, 2021). In the field of employee training, AR technology enables simulations, virtual training and the display of complex processes in an interactive manner. Employees can be trained through virtual scenarios that depict real-life situations, helping them acquire the skills and knowledge necessary for efficient job execution.

3. METHODS

3.1 The Objective of the Research and Research Hypotheses

The aim of the empirical research is to analyze the constraints and advantages of implementing and applying digitalization processes in supply chains in the Republic of Serbia. Additionally, the importance of the research lies in determining the correlation between the adoption of digital technologies and the business performance (profitability) of the supply chain. Based on the defined research framework, the following research hypotheses can be formulated:

H1 - Constraints for implementing digitalization processes significantly influence the decision to adopt them in the supply chain in the Republic of Serbia. The first research hypothesis tests whether the existing constraints in the supply chain have a statistically significant impact on the supply chain management's decision regarding the adoption of intelligent digital systems.

H2 - The benefits of implementing digital solutions in the supply chain significantly influence the decision to introduce them in the Republic of Serbia. This hypothesis aims to test whether the expected benefits of digital solutions statistically influence the management's decision regarding their implementation.

H3 - The implementation and application of digital technologies are statistically significantly associated with the business performance (profitability) of the supply chain. The third research hypothesis tests whether the introduction of digital technologies has a positive or negative implication on the profitability and overall business performance of the supply chain.

3.2 Research Variables

A literature review indicated the limitations of traditional supply chains and potential advantages of modern supply chains. Indicators of constraints and advantages that directly impact the implementation and sustainability of supply chain digitalization processes have also been identified. Supply chain participants, including manufacturers, transportation companies, wholesalers and retailers were selected

as the independent clustering variable. The indicators of constraints and advantages for the adoption and implementation of digitalization processes in supply chain business activities were ranked as the independent measurement variables. The business performance (profitability) of the supply chain was chosen as the dependent variable.

Authors (Wang, Chaudhry, Li, & Li, 2016; Gubbi, Buyya, Marusic, & Palaniswami, 2013; Končar, Vučenović, & Marić, 2020; Granjal, Monteiro, & Sá Silva, 2015; Bedekar, Luthra, Garg, Mangla, & Berwal, 2018; Al-Fuqaha, Guizani, Mohammadi, Aledhari, & Ayyash, 2015; Whitmore, Agarwal, & Da Xu, 2015) list the following indicators as constraints or barriers: 1) lack of awareness about the importance of digitalization, 2) changes in the business model, 3) lack of financial resources, 4) underdeveloped infrastructure, 5) lack of qualified workforce, 6) user security, 7) standardization and lack of legislation.

Ranked indicators of advantages include: 1) integrated planning of production, transportation and distribution, 2) inventory level optimization, 3) lower transportation costs, 4) reduced errors and product returns upon delivery, 5) better utilization of warehouse capacity, 6) monitoring quality parameters and storage and handling safety conditions of products (Attaran, 2020; Abdel-Basset, Manogaran, Mohamed, & Gunasekaran, 2018).

3.3 Research Sample and Data Analysis Methods

The sample consists of business entities that differ in terms of their size, profitability and field of operation. The research includes employees in the manufacturing and processing sector, physical distribution, wholesale and retail. Descriptive statistics method is used to present the obtained results, while the research hypotheses are tested through one-way analysis of variance and multiple regression analysis. A standard Likert scale (1 - not important, 5 - crucially important) is used for ranking the provided indicators. The collected data is sorted and processed using the statistical package SPSS 20.

4. RESULTS & DISCUSSION

The research results show that the major obstacles for the efficient implementation of digitalization processes in supply chain management are the lack of financial resources, changes in the business model and the shortage of skilled workforce. On the other hand, the confirmed indicators of advantages, ranked as most significant by the respondents for the digitalization of the supply chain process, include integrated planning, inventory optimization and better utilization of storage capacity. Hypotheses H1 and H2 are accepted, concluding that the identified indicators of limitations and advantages significantly influence the decision to implement and apply digitalization processes in the supply chain. Furthermore, the research confirms a direct connection between the implementation of digital solutions in the supply chain and business performance (profitability). In this way, research hypothesis H3 is confirmed. The given research should serve as a guide for supply chain managers to understand which indicators need to be optimized in order to reduce limitations and barriers to the implementation of digitalization processes. Digitalization of the supply chain in the Republic of Serbia should encompass much more than just introducing new technologies into business, it requires fundamental changes in the way organizations think and perceive their operations. In other words, the digitalization of the supply chain should be viewed and understood as a continuous process of business transformation involving investments in projects, people, infrastructure, networks and information technologies, which entails the intertwined work of people, systems and business processes. Improvement directions for the digital supply chain should include financial incentives, employment incentives and security measures. All participants, including processors, manufacturers, distributors, wholesalers, retailers, customers and consumers, should be equally involved in this process. Enhancing the digitalization process would result in better visibility, transparency and product availability at every moment along the entire supply chain, leading to faster responses to end-user needs, increased flexibility, lower costs and corrections in shorter time intervals.

5. CONCLUSIONS

Republic of Serbia like other countries in the region, is undergoing a period of intense change due to geopolitical, economic, public health and environmental challenges. In order to successfully respond to these challenges in the coming period, it is necessary to harness the power of digital technologies, which if properly managed enable the creation of a sustainable economy and society. Recent experiences during the pandemic have shown that countries with a higher degree of digitalization had lower decline rates

compared to those with lower digital maturity, indicating that digitalization not only strengthens the economy but also provides greater resilience in times of crisis. The government should recognize and finance digital transformation projects that offer opportunities to increase competitiveness in the global market.

We can conclude that the state of digitalization in the supply chains in the Republic of Serbia is in a growth phase with significant room for improvement. Some companies have recognized the importance of digitalizing the supply chain and have actively worked on implementing digital solutions related to inventory management software tools, electronic data exchange, transport tracking and process automation. The most significant limitations for successful supply chain digitalization in the Republic of Serbia are considered to be the current digital infrastructure, limited financial subsidies and incentives, lack of tax and credit incentives, absence of subsidies for new jobs, free training for employees, etc. Additionally, an important prerequisite for supply chain digitalization is the change in administrative and legislative frameworks. Efforts and initiatives need to be directed by the state sector accordingly. On the other hand, the task of company management, both large and small is to raise awareness of the importance of changing the business model and based on that changing the way human resources are managed. Consequently, the national strategy should focus on redefining the existing education system and continuous improvement of educational programs that must be closely linked to the economy. Continuous training is increasingly seen as mutual protection for both the company and employees, and it also contributes to better competitiveness of the country in the global market.

The objectives of digital transformation in the Republic of Serbia in the coming period should focus on improving the necessary infrastructure, digitalizing business processes and services and enhancing digital competencies in all segments of society. To achieve these desired objectives, active collaboration among all key stakeholders from the public and private sectors, associations and the academic community is necessary to achieve synergy between knowledge, human capital and sources of funding. Very few academic research studies, especially in the domestic market, are dedicated to the issues of supply chain digitalization and this paper would fill the research gap in the given field.

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