ROLE OF DIGITIZATION STRATEGY IN SUPPORTING BETTER RESULTS OF SUPPLY CHAIN MANAGEMENT: A DIGITAL PERSPECTIVE

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Abstract

According to Mithas et al. (2022), technological developments enhance both operational speed and lower operational expenses and errors enabling businesses to provide quicker market reactions toward customer needs and Chauhan et al. (2023) agreed on the same idea adding that the foundation of digitization exists through cloud computing because it unites corporate information while improving operational efficiencies and creates scalable opportunities for innovative changes. The current study aimed to explore how aspects of digitization (real-time visibility, data analytics, automation, blockchain technology, Internet of Things (IoT), and cloud computing) may have an influence on enhancing the results of supply chain management (SCM). Through quantitative methodology, 292 production and supply chain managers within 2668 food and beverage organizations in Jordan self-administered a questionnaire that was uploaded online through Google Forms. Using Statistical Package for Social Sciences (SPSS), the main hypothesis was accepted, and it appeared that digitization plays a role in supporting better results of SCM within the food and beverage sector in Jordan. Regarding the adopted sub-variables, IoT appeared to be the highest in influence, given that a transparent monitoring system allows companies to enhance their delivery routes while minimizing delivery times and safeguarding product quality. The study recommended that organizations should investigate blockchain solutions to build transaction records beyond modification and expand supply chain monitoring, together with enhancing stakeholder collaboration, which results in enhanced operational performance.

Keywords: Supply Chain Management, Digitization, Real-Time Visibility, Data Analytics, Automation, Blockchain Technology, Internet of Things (IoT), Cloud Computing

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1. INTRODUCTION

Modern technology has created a complete transformation in business operations through its impact on supply chain management (SCM). The original supply chain systems based on paper documentation and human labor have developed into computerized data-oriented distribution

systems. Through technology innovations that combine the Internet of Things (IoT) with artificial intelligence (AI) and cloud computing, businesses achieve real-time supply chain tracking and demand prediction capabilities while sustaining continuous global supply chain communication. The combination of IoT sensors operates to track shipment locations and conditions, while AI systems make better inventory management and transport route stops possible.

Liu et al. (2023) saw that technology has improved the strategic capabilities of SCM beyond achieving operational efficiency. Blockchain technology operates as an example that unleashes brand-new transparency capabilities through supply chain monitoring to preserve product genuineness and maintain product safety levels. Herinckx and Ghislain (2022) noted that the food industry, together with pharmaceuticals, needs this particular functionality because both sectors depend on strict regulatory compliance and unwavering consumer trust. Digital platforms, together with collaborative tools, have developed better connections between suppliers, manufacturers, and distributors, which helps them coordinate risks more effectively. The implementation of technology by businesses brought about supply chains designed to endure disruptions from both worldwide disease outbreaks and international political conflicts. Through technological advancement, SCM has accomplished operational streamlining while transforming its strategic business contribution to success and sustainability (Islam et al., 2023).

This research study was carried out in order to explore the role of digitization in supporting better results of SCM within the food and beverage sector in Jordan from a digital perspective. From that, this research focused on a main question:

RQ1: What is the role of digitization in supporting better results of SCM within the food and beverage sector in Jordan from a digital perspective?

Answering this question required us to follow a set of objectives that included:

- Highlight the concept of supply chain in the food and beverage sector
- Explore how the supply chain can be digitized
- Draw the connection between digitization and supply chain results in terms of real-time visibility, data analytics, automation, blockchain technology, IoT, and cloud computing.

As a variable adoption justification, it can be said that SCM has changed radically over the past few years due to modern technology that has facilitated smoother, clearer, and stronger operations. The empirical data and the general course of technological evolution in the domain prove the inclusion of such digital variables as real-time visibility, data analytics, automation, blockchain technology, IoT, and cloud computing as determinants of SCM. As for real-time visibility, it enables the supply chain stakeholders to track the shipments and inventory, as well as the operational activities in real-time, so that they can make proactive decisions. Past research findings, including those by Martinez (2023), note that real-time tracking using IoT can help improve transparency and responsiveness of the supply chain. The variable in question is of paramount importance since it directly influences the speed of operation, minimizes delays, and enhances customer satisfaction, and is supported in the work by Mithas et al. (2022), who emphasize that real-time tracking minimizes operational errors, as well as improves agility. Data analytics allows processing of a large amount of data to get actionable information, predict demand, and manage logistics. Adeusi et al. (2024) indicate that predictive and prescriptive analytics enhance the supply chain resilience and quality of decisions. Data analytics is a critical determinant of SCM performance because of its ability to transform big data into strategic knowledge to facilitate proactive risk management and continuous improvement. Automation by the use of robotic process automation (RPA), automated warehouses, and autonomous vehicles automates repetitive tasks and reduces the chances of human error. As research by Khan et al. (2023) indicates, automation accelerates operation cleanliness and precision, resulting in cost savings. The effects of automation are, however, tempered by its maturity in terms of implementation; hence, although effective, it may have a fluctuating effect as compared to other factors. Blockchain proposes an immutable ledger that promotes transparency, traceability, and trust in supply chain activities. The decentralized nature of blockchain control, as stated by Gupta et al. (2022) and Hashem (2025), decreases fraud, improves product authenticity, and simplifies compliance, particularly in sensitive industries such as food and pharmaceuticals. Its potential to produce secure and transparent records of transactions ultimately leads to better SCM results, especially when it comes to improving accountability and integrity of operations. IoT products such as sensors, radio frequency identification (RFID) tags, and GPS trackers give real-time, continuous information on the position of shipments, environmental conditions, and asset status. Martinez (2023) affirms that connected sensors through IoT are used to carry out predictive maintenance, inventory optimization, and increased visibility. The ability of IoT to enable immediate surveillance and command renders it an important factor in the realization of operational effectiveness and nimbleness. Cloud platforms enable supply chain partners to share, collaborate, and integrate data in a scalable manner. Chauhan et al. (2023) emphasize the fact that cloud computing decreases the cost of infrastructure and improves data accessibility and coordination. Cloud computing allows exchanging data in real time and facilitates the use of AI and IoT, which form the digital basis of SCM performance optimization in various operations.

Another justification for the choice of these variables is their interdependency, which promotes digitalization in SCM as a whole. According to Khedr and Sheeja (2024), the combination of IoT, AI, blockchain, and cloud platforms produces a synergetic effect, which strengthens decision-making, operational efficiency, and supply chain resilience. Besides, these variables adjust to the growing complexity and globalization of the supply chains, and managers can adapt quickly to disruptions and changing market needs (Islam et al., 2023).

Examining the current literature, there was a lack of empirical research on how exactly digital technologies (IoT, AI, blockchain, cloud computing, and automation) can be applied and utilized successfully in the Jordanian food and beverage industry. Also, a lack of knowledge on how these

digital variables interact synergistically or independently to affect the performance of the supply chain in developing economies was present. In addition, little has been explored about the technological maturity and the barriers to the adoption experienced by Jordanian firms, especially in the context of automation. And besides, there is the absence of context-specific evidence regarding the strategic implications of digitalization on the importance of supply chain resilience, transparency, and operational performance in the local environment.

Based on that, this current research aimed to explore how aspects of digitization (real-time visibility, data analytics, automation, blockchain technology, IoT, cloud computing) may have an influence on enhancing the results of SCM.

The theoretical framework of the study is based on the resource-based view (RBV) and technology-organization-environment (TOE) model that helps to consider the role of digital resources and organizational capabilities in SCM outcomes. Applying a quantitative research design, mainly by using structured questionnaires and statistical analysis using the Statistical Package for Social Sciences (SPSS), the study checks the importance of such variables as real-time visibility, data analytics, blockchain, IoT, automation, and cloud computing. The key results indicate that the influence of IoT and cloud computing on the performance of SCM is the most significant, whereas the impact of automation is relatively small, which is evidence of the contextual and developmental limitations in Jordan. The contributions of the study are that it can offer empirical evidence of the positive effect of digital transformation in a developing environment, inform policymakers and practitioners about the priority of technological investments, and supplement the current theoretical models by focusing on the significance of technological interdependencies to improve supply chain resilience and efficiency.

Carrying out this study was built on reaching theoretical and practical implications. From a theoretical perspective, the research advances digitization in SCM knowledge by developing a theoretical framework that addresses the food and beverage industry in Jordan. Supply chain efficiency and transparency, as well as resilience, improve when IoT, alongside blockchain features and data analytics technology, is implemented. The study expands the RBV and TOE framework through evidence that digital transformation serves as an emerging market strategic resource for competition.

From a practical perspective, the findings of this study present applicable strategies that benefit Jordanian food and beverage supply chain practitioners concerning digital optimization. Through digital instruments, businesses enhance supply chain control methods while decreasing waste creation and providing better product traceability and market swift reaction capabilities. Policymakers, together with industry leaders, should use the research findings to develop supportive regulations alongside initiatives that promote digital adoption for establishing an efficient, sustainable food supply chain ecosystem.

The quantitative research methodology was embraced, whereby a structured questionnaire was used. The instrument has been administered to stakeholders of the supply chain in materials involved with the Jordanian food and beverage industry. We have relied on statistical analysis (SPSS) to filter and analyze the primary data gathered and come up with the necessary results. The research results suggested that the most considerable positive effect of IoT and cloud computing on the SCM performance in the Jordanian food and beverage sector can be observed. Automation has a relatively low impact, implying that there may be a lack of technology maturity or low technology adoption. The research is affirmative of the synergistic advantage of digital variables, where interdependencies enhance fair supply in the chain in addition to improved operational competence. One of the contributions was the fact that the study established empirical evidence on the positive role of digital transformation in a developing country setting. It also provided practical implications to the practitioners and policymakers by indicating priorities on technological investments and further theoretical knowledge by advancing and confirming the applicability of the RBV and the TOE model across all digital variables, integrating themselves in the performance of SCM in emerging markets.

The rest of this paper is structured as follows. Section 2 reviews the relevant literature. Section 3 analyses the methodology that has been used to conduct empirical research on adopted variables. Section 4 presents the research results. Section 5 discusses the results. Section 6 presented the overall conclusion, recommendations, and future research orientation.

2. LITERATURE REVIEW

2.1. Supply chain management (SCM)

Agarwal et al. (2022) defined supply chain as a term referring to all entities along with their activities and resources, together with technologies that produce and deliver products or services to end consumers. All entities that contribute to product creation start with suppliers who provide raw materials, followed by manufacturers, then distributors, proceed to warehouses along with transportation providers, before customers can access products through retailers. The smooth movement of products between production and consumption depends on the essential functions of every supply chain entity. Physical goods represent only one part of the supply chain since it also includes information management and financial processes that enable these operational flows. Supply chain functions as an interconnected network that converts raw components into completed goods and distributes them properly while maintaining their correct state and timing of delivery (Haikal et al., 2020).

According to Chang et al. (2022), supply chain management refers to the strategic supervision that handles all manufacturing and distribution tasks between initial material stages and ultimate consumer stages. The complete operational cycle involves strategic coordination of all processes, including sourcing and manufacturing, and logistics functions that focus on operational enhancement and cost reduction, and achievement of improved customer satisfaction. Lohmer et al. (2022) added that the success of SCM requires all suppliers, alongside manufacturers and distributors, together with retailers to work jointly for continuous operations and timely shipping. Modern SCM

operations are complex within digital economies, which need advanced technological systems, including data analysis and AI, along with blockchain technology for better decision processes and supply chain visibility and trackability. The processes controlled by SCM enable organizations to remain competitive through sustainability alongside enhanced business resilience across all sectors (Sharma et al., 2022).

Almutairi et al. (2023) stated that SCM serves as the deliberate coordination of complete supply chain operations with the purpose of optimizing performance and decreasing expenses while improving user satisfaction. SCM enables organizations to optimize seamless operations through its management of sourcing activities, production and inventory control, transportation systems, and distribution processes. Jaboob et al. (2024) agreed on the fact that the focus of this management approach includes developing stakeholder partnerships together with optimal resource management and technology-based visibility improvement for better decision-making capabilities. The implementation of efficient SCM gives businesses the capabilities to deal promptly with market needs and reduce risks, and sustain marketplace leadership. Present-day supply chains have grown highly complex because of economic globalization, so organizations need fresh methods with digital platforms to manage disruptions and sustainability needs, and shifting consumer expectations.

The concept of digitization refers to the conversion of analog information, along with processes and systems, to digital formats. Transforming physical data, including paper documents, into digital data prepares the information for storage alongside computerized analysis through digital technologies (Vrana & Singh, 2021). Electronic conversion of paper documents allows companies to achieve better record accessibility and search capabilities and simplified document sharing (Gradillasm & Thomas, 2025). The digitization process includes both data conversion and automated process management, where software replaces traditional handwritten logs to manage inventory records. Digitization uses digital tools to improve performance, along with accuracy rates and accessibility, while creating an environment where advanced technological progress can take place (Abbasi et al., 2022).

Charfeddine and Umlai (2023) argued that the modern business landscape relies on digitization as its primary fuel for industrial improvement, which leads organizations through operational simplification and cost reduction, and better decision processes. Digital transformation begins with digitization, which merges processed data with advanced technology systems operated by AI and cloud computing, and internet-connected devices. Fang and Shen (2023) agreed on the same idea, adding that the SCM sector uses two major digitization techniques, such as real-time tracking through sensors and digital relationship management platforms for suppliers. Digital transformation enables businesses to tap into advanced opportunities that lead to business innovation, along with scalability and better market competitiveness in modern digital environments. To achieve successful digitization, businesses need to adopt new technology together with having ready organizations and cultural acceptance for digital solutions (Rakhmonov, 2023).

Real-time visibility describes the operational monitoring and tracking of supply chain activities in their actual progress. The process of digitization provides businesses with full visibility into their supply chain operations that start with raw material procurement and end with customer delivery. Companies accomplish this through the integration of systems, along with IoT sensors and tracking tools. Companies achieve better results through real-time tracking because they gain the ability to handle disturbances swiftly and maximize stock and shipping speed. Logging services achieve timely delivery and decreased delivery delays through real-time shipment tracking. Digital systems together with IoT devices stream continuous information, which allows stakeholders to make well-informed choices and exhibit operational transparency (Martinez, 2023).

The application of sophisticated computing systems and data processing software allows large-scale supply chain information analysis. Through digital processes, companies can now acquire data immediately and use vast datasets to produce usable knowledge points. The capability of predictive analytics involves predicting customer demand, together with the detection of delivery obstacles and route optimization processes. The combination of historical detection through descriptive analytics enables organizations to receive prescribed solutions through prescriptive analytics. Modern business analytics platforms that leverage AI tools allow companies to extract valuable decision-making insights from their extensive data source (Adeusi et al., 2024).

SCM automation enables technology systems to carry out regular operations independently through minimal human interaction. Three automation systems, known as RPA, automated warehouses, and self-driving vehicles, constitute part of this framework. Through automation, organizations achieve faster operations and lower expenses, and eliminate human mistakes. The application of robotic systems in automated warehouses allows robots to handle pick and pack processes, which produces higher operational efficiency. The integration of automated systems through digitization enables companies to unite with IoT and AI technology for developing intelligent supply chain operations (Khan et al., 2023).

Blockchain maintains an encrypted system that distributes transaction information between different parties through decentralized control and complete record transparency. SCM uses blockchain to deliver secure data tracking along with unalterable data verification measures. The system provides unquestionable transparency and trust through its ability to generate an indestructible collection of every item transaction across the supply chain. The technology delivers exceptional value to businesses operating in food and pharmaceutical production since it helps track materials throughout their entire lifecycle. Through digitization, blockchain creates records that stay unaltered, so various stakeholders can instantly check product authenticity and origins (Gupta et al., 2022; Hashem, 2025).

IoT describes the interconnected system of objects that gather information before sharing it across networks. Real-time monitoring of goods'

location and status, and their condition, becomes possible through IoT devices, which include sensors, GPS trackers and RFID tags in SCM. Through IoT, organizations perform predictive maintenance on equipment alongside environmental monitoring (for perishable goods) and maximize their asset usage. Through digitization, IoT data converges with other systems to generate a connected supply chain operation that achieves enhanced performance and effectiveness (Martinez, 2023; Hashem et al., 2022).

Companies can access IT services as well as storage solutions and web-based applications through cloud computing services. Cloud platforms used for SCM create environments that enable partner cooperation while advancing data exchange and growing operations across systems. Cloud-based services facilitate instant supply chain collaborations between partners who operate from any geographic location. The implementation of AI and IoT becomes possible through cloud computing while minimizing initial infrastructure costs (Aamer et al., 2023).

2.2. Integrating technology to enhance supply chain management

Tan and Sidhu (2022) and Dadsena et al. (2024) stated that the adoption of technology within SCM operates as an essential approach to optimize the operations and visibility, and strengthen the resilience of contemporary supply chains. According to Khedr and Sheeja (2024), advanced technologies, including IoT and AI, together with blockchain as well as data analytics systems, enable real-time tracking and automated decision-making, and predictive analytics. The IoT detects items during shipping while AI systems make predictions about market needs to maximize stock levels. Supply chain managers receive vital operational decisions through these technologies, which enable them to detect upcoming problems and minimize expenses while enhancing supply timing efficiency. Organizations gain a flexible supply chain through a tool combination that enables them to handle changing market dynamics and shifting customer needs (Mohsen, 2023; Sahoo et al., 2023).

Xu et al. (2023) argued that technology integration fosters greater collaboration and transparency across the supply chain ecosystem. Cloud-based platforms coupled with digital networks provide suppliers and retailers and distributors, and manufacturers the capability to exchange data and share information together without interruption. The transactional capabilities of blockchain technology establish an unalterable transaction history for monitoring purposes, specifically beneficial for both the food and pharmaceutical sectors that require safety and compliance standards. RPA serves as an automation technology that helps optimize repetitive tasks, thus creating time available for human personnel to participate in strategic work (Zhu et al., 2022; Kashem et al., 2024).

Perano et al. (2023) introduce a research methodology that might be applied to conduct a systematic literature review of the state of the art of technological development in the sphere of the digitalization and unphysicalization of supply chains. A three-dimensional and conceptual framework that concentrates on how digital technologies (DTs) and business processes relate to supply chain performance is portrayed. The research reveals the new forms of SC administration practices and spheres that may have a beneficial impact on the use of DTs. It is against this background that there is a high chance of the emerging practices being characterized as the future best practices. A systematic review of literature was carried out on DTs in the management of the supply chain. The reason is that the employed methodology algorithmically and objectively unifies the information included in thousands of scientific documents. This direction was followed by analyzing selected papers to explore the recent literature in the field of SC digitalization and unphysicalization. Eighty-seven DTs have been chosen to be analyzed and are further divided into 11 macro-categories. The 17 business processes associated with supply chain management are considered, and 17 various impacts on supply chain management are presented. Of the list of 1,585 papers, 5,060 new practices were identified and ultimately outlined singularly in unison under the three domains of DT, business process, and influence on the supply chain performance. An individual analytical approach has offered a valuable journey to make when attempting to collate the existing literature materials regarding supply chain management. The DTs, which are the most prevalently used in the practices, are mentioned and characterized, as well as the most regarded business processes and their impacts. The graphical depiction of the three-dimensional conceptual framework is done to enable the generation of the optimal combinations of DT, business process, and impact on supply chain performance. These mixes are indicative of the most constructive sources of the adoption of the novel dynamics of the supply chain digitalization and unphysicalization. Further analysis finds and establishes the most valuable contexts through which Big Data helps in supply chain performance.

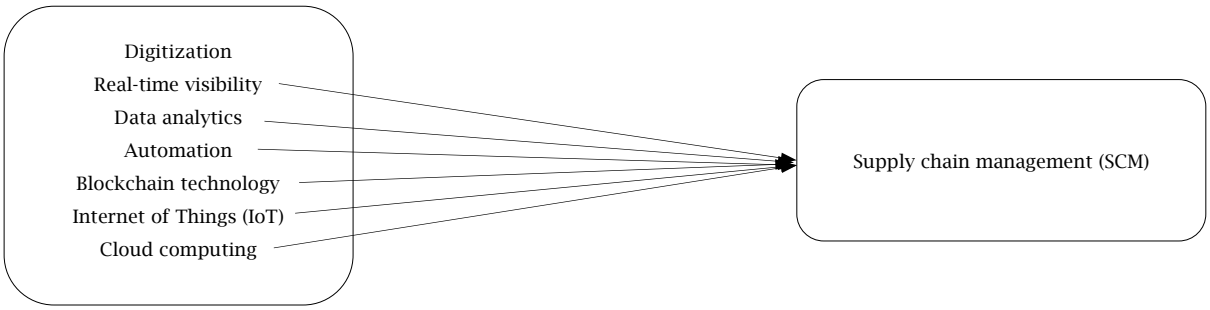
Seo et al. (2023) explored suitable digitization practices and sound assessment parameters of maritime container supply chains. The authors determined the level of Port of Busan supply chain digitalization in South Korea and drew three approaches to digitalization, taking into consideration the industry needs and discussing the matter with the experts working in the ports. The authors theorized 11 evaluation criteria to study the key strategies of digitalizing within the supply chain operations reference model, based on a survey of 46 experts, and found that the use of multi-criteria decision-making methods in prioritizing the strategies and evaluation criteria. The findings outline the condition of the digitalization of the port-focal supply chain in the real world. The model can be effectively tailored to contain evidence-based assessment measures of digitalization strategies and establish a feasible method to drive progress on the supply chain digitalization strategies. On the basis of the survey and analysis, the authors conclude that enhancing data accessibility as well as data quality beats the adoption of the data and information sharing platform.

As indicated in the literature review, although a substantial body of literature exists to support the radical influence of DTs like IoT, blockchain, and cloud computing on SCM, there exists a significant gap in the study of a particular application of these DTs and their success in the food and beverage

industry in the context of the developing Jordanian economy. The previous literature highlights the ability of these technologies to boost transparency, responsiveness, and resilience, but there is very little empirical evidence on how these variables interact synergistically or in isolation in such situations. Also, the effect of automation seems to be understudied in these areas, which implies that further local research on the technological maturity and hindrances of the adoption should be conducted. The study, therefore, attempts to fill these gaps by making empirical information on the relative significance and influence of digital variables on the performance of SCM in Jordanian food and beverage firms.

After presenting research questions and objectives, we have developed a theoretical framework from which the study's hypotheses were extracted:

Figure 1. Theoretical framework



Source: Authors' elaboration.

Based on the above theoretical framework, the following set of hypotheses was extracted:

H1: Digitization plays a role in supporting better results of SCM within the food and beverage sector.

H1a: Real-time visibility plays a role in supporting better results of SCM within the food and beverage sector.

H1b: Data analytics plays a role in supporting better results of SCM within the food and beverage sector.

H1c: Automation plays a role in supporting better results of SCM within the food and beverage sector.

H1d: Blockchain technology plays a role in supporting better results of SCM within the food and beverage sector.

H1e: IoT plays a role in supporting better results of SCM within the food and beverage sector.

H1f: Cloud computing plays a role in supporting better results of SCM within the food and beverage sector.

3. RESEARCH METHODOLOGY

3.1. Methodological approach

We have chosen to follow the quantitative methodology to realize the aim of the study. Quantitative methodology was better chosen as it helped in collecting primary data from a larger sample size. This was the best choice to generalize results.

3.2. Population and sample

The population of the study consisted of all production and supply chain managers within 2668 food and beverage organizations in Jordan. A convenient sample of 336 was chosen to represent the population of the study. After the application process, we were able to retrieve 292 responses to the questionnaire. This indicated a response rate of 80.44% as a statistically accepted ratio.

3.3. Tool of study

A questionnaire was developed to be the main tool of the study in order to collect primary data. The questionnaire consisted of two main sections. The first took into perspective the demographics of the study tool, while the other section contained statements related to sub-variables of the study. Checking the validity of the study tool was done through arbitration. A group of specialized academics in the field has arbitrated the questionnaire, and the statements that gained 85% of their approval were kept.

3.4. Screening and data analysis

SPSS was chosen to screen and analyze the collected primary data. Table 1 presents the statistical tools that were used:

Table 1. Statistical processes

Section	*Statistical test*
Demographics	Frequency and %
Questionnaire	Mean (μ) and standard deviation (σ)
Hypotheses testing	Multiple and linear regression

Source: Authors' elaboration.

We have utilized Cronbach's alpha (α) to check the reliability and consistency of the study tool. It appeared that variables scored higher than 0.70, which meant that the tool was reliable and consistent.

Table 2. Alpha value

Variable	*α*
Real-time visibility	0.713
Data analytics	0.846
Automation	0.74
Blockchain technology	0.745
IoT	0.706
Cloud computing	0.709
Supply chain management	0.746

Source: Authors' elaboration.

Another methodology that may be used to complete such a study is a qualitative one, for example, in-depth semi-structured interviews with the representatives of the important stakeholders of the supply chain in the Jordanian food and beverage organizations. The given approach would enable a more detailed insight into the practice of DTs implementation and perception in place, as well as contextual issues and organizational aspects of adoption. A purposive sample of managers, IT specialists, and supply chain coordinators will allow the researchers to obtain rich, detailed data on how exactly digitization affects the performance of SCM and understand what can potentially inhibit or promote its effect, which may remain unrecognized in quantitative surveys. Then the data obtained during the interviews may be analyzed thematically and reveal patterns and subtle views to make the findings deeper and more contextual to help either support or complement the quantitative study.

4. RESULTS

4.1. Demographics

Through calculating frequencies and percentages in Table 3, it was noticed that the majority of respondents were males, forming 80.1% of the total sample. Results also indicated that the majority of respondents held a Master's (MA) degree in related fields, forming 50.7% and had experience in the field that was more than 18 years, forming 34.2% followed directly by those who had experience that ranged between 12–17 years, forming 33.6%.

Table 3. Demographics

	f	%
Gender		
Male	234	80.1
Female	58	19.9
Education		
Bachelor (BA)	89	30.5
Master (MA)	148	50.7
Doctor (PhD)	55	18.8
Experience		
Less than 5 years	24	8.2
6–11	70	24.0
12–17	98	33.6
More than 18 years	100	34.2
Total	**292**	**100.0**

Source: Authors' elaboration.

4.2. Questionnaire results

Mean (μ) and standard deviation (σ) in analyzing the questionnaire indicated that all statements were positively received by respondents, as they all scored a mean that was higher than the mean of scale 3.00, and this was seen as a positive result from a statistical point of view.

Table 4. Questionnaire analysis

Statement	μ	σ
Through digitization, real-time tracking is enabled	3.743	1.051
Identifying bottlenecks and risks is more attainable	3.671	1.266
There would be a chance to optimize routes and make quick decisions	4.027	0.896
Efficiency and responsiveness are more powerful through real-time visibility	3.918	0.967
Decision-making is more efficient with digitization	4.229	0.877
Real-time visibility	**3.918**	**0.697**
Based on data analytics, a vast amount of data can be processed	3.784	1.014
Supply chain data can be processed to be of use for decision makers	4.041	0.840
Data analytics is based on valuable analytics tools	4.045	0.898
Data analytics can change data into patterns and trends for better understanding	4.188	0.847
Risk management, forecasting, and prediction are more efficient	4.045	0.898
Data analytics	**4.021**	**0.709**
All repetitive tasks are automated for better time management	4.271	0.934
Automation can streamline operations for scheduling management	4.442	0.881
Inventory is better processed through RPA	4.195	0.915
Automation can lead to better productivity	4.202	1.041
AI can automate routine processes and manage time better	4.007	1.005
Automation	**4.223**	**0.670**
Through BC, transparent transactions can take place	3.644	0.954
All transactions across the supply chain can be managed through BC	3.908	0.882
BC guarantees accountability in chain operations	3.873	0.854
With BC, even traceability can appear as a better approach	4.134	0.750
Many industries can make use of BC in their SCM	4.151	0.807
Blockchain technology	**3.942**	**0.597**
Integrating IoT in SCM can collect data in real time	4.010	0.921
IoT can manage asset and equipment conditions	4.168	0.818
Managing risks of failure can be attained through IoT	4.182	0.807
Processes and monitoring can be better applied to assets and shipments	3.966	1.051
With IoT, there would be a chance to control the visibility of the supply chain	4.103	0.784
Internet of Things (IoT)	**4.086**	**0.593**
CC offers more stability to monitor the supply chain	3.777	0.964
CC can access data about the supply chain for stakeholders	4.038	0.902
Cloud platforms can collaborate with the decision makers of the supply chain	4.158	0.883
CC can work across different systems to reach more agility	4.144	0.804
With CC, the supply chain is more connected as a whole network	4.120	0.913
Cloud computing	**4.115**	**0.628**
Improved visibility supports the results of SCM	4.277	0.822
All supply chain partners enjoy a good level of collaboration	4.250	0.831
Through digitization, inventory management is more controlled and monitored	4.103	1.020
Efficiency is always increased with SCM	4.267	0.798
Risk mitigation is more powerful and comes up with real results through digitization	3.952	0.895
Supply chain management	**4.170**	**0.614**

Source: Authors' elaboration.

4.3. Multicollinearity test

The independent variables underwent VIF (variance inflation factor) and tolerance analysis to assess multicollinearity, as in Table 5. The subsequent anticipated developments can be attributed to these calculations. The data demonstrates the lack of multicollinearity, with all VIF values remaining below 10 and all Tolerance values above 0.10 (Gujarati & Porter, 2009).

Table 5. Multicollinearity

Variable	*Tolerance*	*VIF*
Real-time visibility	0.357	2.799
Data analytics	0.302	3.312
Automation	0.494	2.026
Blockchain technology	0.431	2.318
IoT	0.252	3.975
Cloud computing	0.242	4.135

Source: Authors' elaboration.

4.4. Hypothesis testing

Multiple regression was used to test the main hypothesis. It was noted that the F value was significant at the level 0.05. The statistics suggested that digitization plays a role in supporting better results of SCM. A correlation coefficient of 0.854 indicated a strong relationship. The independent variables explained 72.9% of the variance seen in the dependent variable.

Table 6. Testing the main hypothesis (*H1*)

Model		*B*	*Std. Error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	0.401	0.158		2.542	0.012	0.854	0.729
	Real-time visibility	0.175	0.046	0.198	3.845	0.000		
	Data analytics	-0.220	0.049	-0.252	-4.501	0.000		
	Automation	0.057	0.040	0.062	1.422	0.156		
	Blockchain technology	0.182	0.048	0.178	3.789	0.000		
	IoT	0.742	0.063	0.718	11.691	0.000		
	Cloud computing	-0.006	0.061	-0.006	-0.095	0.924		

Source: Authors' elaboration.

4.5. Testing sub-hypotheses

Linear regression was used to test sub-hypotheses as in Table 7, and the following results were reached.

In *H1a*, the F value was significant at the level 0.05. The statistics suggested that real-time visibility plays a role in supporting better results of SCM. A correlation coefficient of 0.597 indicated a medium relationship. The independent variables explain 35.6% of the variance seen in the dependent variable.

H1b resulted in the F value that was significant at the level 0.05. The statistics suggested that data analytics plays a role in supporting better results of SCM. A correlation coefficient of 0.461 indicated a medium relationship. The independent variables explain 21.3% of the variance seen in the dependent variable.

H1c F value was significant at the level 0.05. The statistics suggested that automation plays a role in supporting better results of SCM. A correlation coefficient of 0.378 indicates a medium relationship. The independent variables explain 14.3% of the variance seen in the dependent variable.

In *H1d*, the F value was significant at the level 0.05. The statistics suggested that blockchain technology plays a role in supporting better results of SCM. A correlation coefficient of 0.611 indicates a medium relationship. The independent variables explain 37.3% of the variance seen in the dependent variable.

H1e resulted in the F value being significant at the level 0.05. The statistics suggested that IoT plays a role in supporting better results of SCM. A correlation coefficient of 0.835 indicated a strong relationship. The independent variables explain 69.7% of the variance seen in the dependent variable.

In *H1f*, the F value was significant at the level 0.05. The statistics suggest that cloud computing plays a role in supporting better results of SCM. A correlation coefficient of 0.713 indicates a strong relationship. The independent variables explain 50.9% of the variance seen in the dependent variable.

Table 7. Testing sub-hypotheses (Part 1)

H1a: Real-time visibility plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	2.109	0.166		12.717	0.000	0.597	0.356
	Real-time visibility	0.528	0.042	0.597	12.657	0.000		
H1b: Data analytics plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	2.565	0.185		13.864	0.000	0.461	0.213
	Data analytics	0.401	0.045	0.461	8.849	0.000		
H1c: Automation plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	2.708	0.214		12.663	0.000	0.378	0.143
	Automation	0.348	0.050	0.378	6.955	0.000		

Table 7. Testing sub-hypotheses (Part 2)

H1d: Blockchain technology plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	1.709	0.190		8.997	0.000	0.611	0.373
	Blockchain technology	0.625	0.048	0.611	13.138	0.000		
H1e: Internet of Things (IoT) plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	0.650	0.138		4.707	0.000	0.835	0.697
	IoT	0.862	0.033	0.835	25.819	0.000		
H1f: Cloud computing plays a role in supporting better results of SCM								
Model		*B*	*Std. error*	*Beta*	*t*	*Sig.*	*R*	*R-square*
1	(Constant)	1.307	0.168		7.804	0.000	0.713	0.509
	Cloud computing	0.697	0.040	0.713	17.327	0.000		

Source: Authors' elaboration.

5. DISCUSSION

We focused in the current study to shed light on the role of digitization in increasing positive results of SCM through multiple variables of digitization that included (real-time visibility, data analytics, automation, blockchain technology, IoT, cloud computing). Achieving that aim required us to depend on quantitative methodology. For that, we have built a questionnaire and collected primary data from 336 production and supply chain managers within 2668 food and beverage organizations in Jordan. We screened and analyzed the data using SPSS. Results accepted the main hypothesis as the correlation coefficient of 0.854 indicated a strong relationship, and the independent variables explained 72.9% of the variance seen in the dependent variable.

Among the chosen sub-variables of digitization, results indicated that IoT had the highest influence and a strong relationship in enhancing SCM, with a variance that reached 69.7%. Through the IoT, supply chains gain superior management capabilities because they achieve instant monitoring and automated operations, and data analytics throughout their entire operational network. Real-time visibility of shipments is enabled through IoT devices, including sensors and GPS trackers, which track goods and vehicles, and equipment in continuous monitoring for businesses to monitor the location and status, and condition of their shipments. This agrees with Martinez (2023), who argued that IoT-generated data works with complex analytics coupled with AI to create maintenance forecasts and maximize stock preparation and forecast predictions. The implementation of IoT technology generates operational insights that boost supply chain efficiency, as well as productive decision-making and lower expenditures, and build supply chain strength against uncertainties.

In the second rank, cloud computing scored a variance of 50.9% and a strong relationship to the dependent variable. Cloud computing serves SCM by delivering a secure, all-in-one solution that allows flexible data storage and collaborative work together with real-time information sharing throughout the supply chain network. The cloud enables business connectivity with suppliers and customers, along with manufacturers and distributors, through supply chain data hosting, which allows effective communication and operational coordination. Real-time tracking operations through this system allow companies to monitor inventory together with orders and shipments, which decreases operational delays and enhances supply chain visibility. Chauhan et al. (2023) agreed on this result, adding that cloud platforms empower companies to execute complex analytics and AI that enable them to assess enormous data collections while optimizing inventory levels and managing potential risks in their supply chain operations. Cloud computing enables businesses to scale their operations without massive capital investments, thus their supply chains become more responsive and cost-efficient, and resilient in ever-changing markets.

The remaining variables (real-time visibility, data analytics, automation, blockchain technology) scored a medium relationship, with the highest among them being blockchain technology, which scored a variance of 37.3%. Blockchain technology demonstrates a medium-strength positive correlation to SCM performance based on the correlation coefficient of 0.611. Blockchain technology, together with additional factors, explained 37.3% of what determines SCM results as measured by the dependent variable. Better efficiency, together with transparency and improved overall performance, becomes achievable through Blockchain technology integration for supply chain operations. Results agreed with Gupta et al. (2022).

Real-time visibility and data analytics also came to be influential, with a medium relationship scoring a variance of 35.6% and 21.3%, respectively. However, the least influential variable was automation, which came in the last rank with a variance of 14.3% only. SCM receives substantial improvements through real-time visibility together with data analytics by enabling operational efficiency increase and delivering actionable insights. Real-time visibility enables businesses to monitor inventory along with shipments and production activities while they occur, which leads to fast disruption management and delivery time reduction, and efficient resource distribution. These technologies combine to produce proactive decisions while lowering expenses, while enhancing customer satisfaction in a supply chain that becomes more adaptable and resistant to dynamic market changes, as agreed with Adeusi et al. (2024) and Khan et al. (2023).

6. CONCLUSION

The current research substantiates and complements the available literature on the constructive influence of digital technologies (including IoT, cloud computing, and blockchain) on the SCM. The results show the existence of a significant overall outcome between digitization and SCM performance, with the IoT proving the most

significant variable, as previously suggested by other researchers, such as Mithas et al. (2022) and Chauhan et al. (2023). The ability of blockchain to provide transparency and trust, especially in regulated industries, is also verified and is in line with Gupta et al. (2022). These findings support the knowledge that interlinking digital platforms promotes superior collaboration, responsiveness, and accountability in supply chains.

Nevertheless, the research provides details that differ from some of the past studies, especially in the case of the limited effect of automation, which explains only 14.3% of the variance and is not statistically significant. This implies that the strategic implications of automation can be context-specific and underdeveloped in the Jordan food and beverage industry as compared to developed markets. Also, real-time visibility is an important factor, but may be predetermined by other technologies such as IoT, and this is a clear representation of the fact that these variables are highly interdependent. Comprehensively, the results indicate that the benefits of digital transformation are highly dependent on technological maturity and organizational preparedness, particularly in developing economies, and that more needs to be done to understand how these two variables work synergistically to achieve the best outcome in SCM.

Based on results, we recommend that organizations focus their IoT investments on the IoT because it demonstrates the highest impact on SCM. The technology tools enable real-time visibility and predictive maintenance along with data-driven decision-making to deliver improved operational performance at decreased costs and better supply chain stability. Also, cloud computing took the second position in SCM influence by supplying secure, scalable, collaborative solutions for real-time information storage and sharing. Businesses should implement cloud computing platforms to enhance network interoperability between supply chain participants as well as improve inventory controls for better results with AI-driven analytics and insights that boost operational efficiency and reduce costs.

It is worth mentioning that the current study was limited to the fact that it focuses exclusively on the food and beverage sector in Jordan, causing its research findings to apply only within this geographic area and thus impeding their value for other regions and industries with dissimilar economic and cultural settings. Also, the research study used a restricted sample size in combination with particular business types (such as large enterprises) that could disregard challenges faced by small and medium-sized enterprises (SMEs) in their digital technology adoption.

Launching from results, we recommend future orientation for research that focuses on the analysis of digitization effects on supply chain management between different industrial sectors (such as pharmaceuticals and retail), which should be included in future research to identify particular challenges and opportunities within individual sectors. There could also be a space to conduct research over extended periods that would reveal comprehensive evidence about the permanent changes digitization creates to supply chain performance and sustainability within the food and beverage industry.

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