

DOI: <https://doi.org/10.63332/joph.v5i3.857>

## The Impact of Digital Supply Chain on Sustainable Performance: The Moderating Role of Big Data Analytics Capabilities

Amro Adel Abu Lemoun<sup>1</sup>, Hatem Dellagi<sup>2</sup>, Suleiman Ibrahim Shelash Mohammad<sup>3</sup>, Badrea Al Oraini<sup>4</sup>, Asokan Vasudevan<sup>5</sup>, Mohammad Faleh Ahmmad Hunitie<sup>6</sup>

### Abstract

*Amidst a period characterized by the restructuring of global supply chains via digitalization, its implications on sustainability have become a necessity, especially in developing economies. This research investigates the contribution of the digital supply chain to sustainable performance, with big data analytics capacity as a moderating factor, in the Jordanian industrial sector. Based on a comprehensive dataset collected from 308 managers spanning various industrial sectors, the research offers empirical evidence on how digitalization reshapes industrial sustainability. The results indicate that the overall level of digital supply chain adoption in Jordanian industries is moderate. Similarly, big data analytics capability revealed a positive significant effect on sustainable performance, with human capability being the most essential. Nevertheless, the moderating effect of big data analytics capability was selective; it effectively improved the connection between digital logistics and sustainable performance, but did not have any notable effect on digital suppliers or digital manufacturing. This study gives a holistic model for industrial companies to deal with the dynamics of contemporary supply chains by incorporating digital transformation, big data, and sustainability, thereby resulting in environmental, social, and economic sustainability in the long run.*

**Keywords:** Digital Supply Chain, Sustainable Performance, Big Data Analytics Capabilities, Industrial Sector, Jordan.

### Introduction

In light of the rapid digital transformation witnessed in the current era, companies around the world are increasingly relying on digital supply chain technologies (DSC) to achieve higher levels of efficiency and agility in dealing with emerging challenges (Abbas & Sağsan, 2019). The integration of digital technologies, such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain (BC), has contributed to a radical change in the field of supply chain management. Ali et al. (2024) stated that this transformation has provided companies with the ability to access accurate and real-time data, along with the use of predictive analytics and the reduction of routine activities that contribute to improving operational processes and enhancing strategic performance. Given the rising global trend toward achieving sustainable development

<sup>1</sup> Faculty of Economic Sciences and Management, University of Tunis El Manar, 1068 Rommana, Tunisia, Email: [efyarmok@yahoo.com](mailto:efyarmok@yahoo.com).

<sup>2</sup> Department of quantitative methods, Faculty of Economics and management Science of Nabeul, Carthage University, 2036 La Soukra, Tunisia

<sup>3</sup> Electronic Marketing and Social Media, Economic and Administrative Sciences Zarqa University, Jordan, Research follower, INTI International University, 71800 Negeri Sembilan, Malaysia, Email: [dr\\_sliman@yahoo.com](mailto:dr_sliman@yahoo.com), (Corresponding Author), ORCID: (0000-0001-6156-9063).

<sup>4</sup> Department of Business Administration, Collage of Business and Economics, Qassim University, Qassim – Saudi Arabia, Email: [baryeny@qu.edu.sa](mailto:baryeny@qu.edu.sa)

<sup>5</sup> Faculty of Business and Communications, INTI International University, 71800 Negeri Sembilan, Malaysia..

<sup>6</sup> Department of Public Administration, School of Business, University of Jordan, Jordan.



goals (SDGs), industries face mounting challenges that require them to align supply chain strategies with environmental, social, and economic sustainability objectives (Covaci & Zaraté, 2020, Mohammad et al., 2025). While digital transformation offers significant benefits that may contribute to achieving this goal, the extent to which supply chain digitization can enhance sustainable performance remains a matter of wide debate, particularly in developing economic contexts such as Jordan. In such economies, industrial sectors face multiple obstacles, including structural, technical, and financial challenges, that prevent them from adopting integrated digital solutions in supply chain management (Abu Lemoun et al., 2024).

Sustainable performance (SP) is a key priority for organizations seeking to achieve a sustainable, long-term competitive advantage and maximizing stakeholder value (Piwowar & Iqbal, 2023). Environmental performance encompasses practices aimed at reducing the carbon footprint, reducing waste, and improving resource efficiency (Sharma et al., 2022). Social performance focuses on promoting ethical business practices, ensuring workplace safety, and implementing corporate social responsibility initiatives (Kouaib et al., 2020, Mohammad, 2025). On the other hand, economic performance represents an organization's ability to achieve consistent financial growth and expand market reach while maintaining sustainable operational efficiency (Yin et al., 2023). The extent to which a DSC impacts these three dimensions depends on organizations' ability to digitally integrate suppliers, manufacturing processes, and logistics networks, thereby enhancing resource management efficiency and mitigating sustainability risks (Shaikh & Ali, 2025). Previous studies have shown that adopting digital technologies within supply chains contributes to enriching SP by enabling predictive analytics, improving logistics operations, reducing energy consumption, and enhancing transparency within supplier networks (Yerpude et al., 2022; Amouei et al., 2023). Despite this promising evidence, empirical research on the relationship between the DSC and SP remains limited in industrial sectors within Jordan. This shortcoming of research highlights the importance of conducting in-depth studies to evaluate the role and dynamics of digital services in enhancing sustainability outcomes, laying the foundation for developing effective policies and strategies within the local market context.

Big data analytics capabilities (BDAC) are a key pillar of effective DSC in the context of sustainability. With the exponential growth in the amount of data generated by sensors, customer transactions, and supply chain operations, organizations are increasingly relying on BDAC tools to extract data-driven insights, enhance operational decisions, and optimize resource utilization more efficiently (Bahrami & Shokouhyar, 2022). BDAC requires companies to have a comprehensive ability to collect, process, and analyze massive amounts of structured and unstructured data, leveraging advanced machine learning, artificial intelligence, and cloud computing technologies (Balusamy et al., 2021, Ekanayake et al., 2024). However, BDAC is not limited to technology alone, it encompasses elements such as human expertise, organizational culture, and strategic frameworks that rely on data-driven decision-making, fundamentally impacting organizations' ability to extract the true value of big data to achieve sustainability goals (Dahiya et al., 2022). As an influencing factor, BDAC has the potential to enhance the SP impact of DSC by enhancing operational efficiencies, predicting supply and demand changes, and providing proactive risk management in industrial settings (Del Giudice et al., 2021). Despite its potential power, empirical evidence on the moderating role of BDAC between DSC and SP remains limited, especially in developing economies where digital maturity levels vary widely across industries.

Jordan's industrial sector is witnessing significant progress towards digital transformation. However, many companies still face significant challenges in adopting modern technologies,

making data-driven decisions, and integrating SDGs (Ibrahim et al., 2023). As a developing economy with a constantly evolving industrial base, Jordan's path to integrating DSC and building BDAC faces unique obstacles, such as infrastructure constraints, cybersecurity challenges, a lack of qualified talent, and high implementation costs (Matarneh & Mohsen, 2024). Therefore, examining the direct impact of DSC on SP, in addition to exploring the role of the BDAC as a moderating factor, is essential to understanding how Jordanian companies can leverage digital transformation to achieve their sustainability goals. This study aims to address this gap through an empirical analysis of the relationship between DSC, SP, and BDAC, while offering theoretical insights and practical recommendations for decision-makers, industrial leaders, and supply chain professionals.

## Literature Review

DSC represents a transformative development in how goods and services are produced and exchanged across global markets. Historically, supply chains have been linear and heavily reliant on manual processes, paper-based documentation, and limited technological intervention. Consequently, companies operated with localized supply chains constrained by communication and transportation constraints (Aćimović & Stajić, 2019). The emergence of the DSC concept coincided with significant developments in the business environment and the shift toward digital transformation. In general, the term digital supply chain refers to the integration of digital technologies across the end-to-end supply chain process to improve visibility, efficiency, and collaboration among various stakeholders (Al-Hindi, 2022). Covaci and Zaraté (2020) described DSC as an interconnected ecosystem driven by digital technologies that enable the seamless flow of data, materials, and information from suppliers to customers. Accordingly, several theoretical frameworks, supported by established theories in management science, have been developed to understand and implement DSCs.

The Supply Chain Operating Reference (SCOR) model identifies five core processes essential to any supply chain: plan, source, make, deliver, and return (Ntabe et al., 2015). In the context of the DSC, the SCOR model is being adapted to leverage advanced technologies and data-driven strategies, transforming traditional supply chain operations into more agile, transparent, and efficient ones (Sabri, 2019). At the heart of the Digital Supply Chain Network (DSCN) framework is the concept of a digitally connected ecosystem. This refers to the integration of all supply chain stakeholders, including manufacturers, suppliers, distributors, and retailers, through cloud-based systems that enable continuous and transparent data sharing (Sharma et al., 2022). Furthermore, the Triple-A supply chain framework was developed by Lee (2004) to include three key attributes: agility, adaptability, and alignment, as essential for building a resilient and high-performance supply chain. In the context of DSC, these attributes are greatly enhanced by the integration of digital technologies such as artificial intelligence and the Internet of Things, as these technologies enable organizations to build more responsive, flexible, and efficient supply chains to address the challenges of today's dynamic and interconnected business environment (Feizabadi et al., 2019).

In this study, DSC is represented by three dimensions. (1) Digital suppliers are organizations or entities that leverage digital technologies to predict demand patterns, optimize procurement processes, and reduce delivery times (Abu Lemoun et al., 2024). This perspective emphasizes that digital suppliers play a key role in creating more resilient DSCs by providing data-driven insights to mitigate anticipated risks. (2) Digital manufacturing refers to the use of advanced automation and digital twins to create virtual replicas of production systems, enabling

organizations to simulate, monitor, and optimize manufacturing processes in real time (Rahamneh et al., 2023). This dimension allows for improved flexibility and customization of production processes to meet individual customer requirements more efficiently. (3) Digital logistics focuses on integrating digital technologies such as robotic process automation (RPA) and autonomous vehicles to streamline the movement of goods from manufacturers to customers (Hijjawi et al., 2023). Accordingly, digital logistics provides real-time data on shipments, helping companies respond more efficiently to changes in customer demand and external disruptions.

Since the Brundtland Report in 1987, SP has emerged as a primary goal for organizations seeking to balance economic, environmental, and social responsibilities while ensuring long-term success. This has led to the emergence of several frameworks that encompass SP, the most prominent of which is the Triple Bottom Line (TBL) framework, which transformed traditional business performance assessments beyond mere financial metrics by measuring corporate success based on profitability, social welfare, and environmental sustainability (Elkington, 1997). Accordingly, Ertz et al. (2025) defined sustainable performance as a company's ability to simultaneously achieve economic prosperity, environmental conservation, and social welfare, while ensuring the needs of future generations are not compromised. Yin et al. (2023) defined it as an organization's ability to continually generate economic value while adapting to social and environmental challenges, ensuring long-term business continuity and stakeholder satisfaction. Nazeer et al. (2024) emphasized that sustainable performance is achieved when an organization aligns its financial objectives with environmental and social considerations, integrating sustainability into decision-making processes at all levels.

DSCs incorporate innovative digital technologies, which allow organizations to attain real-time sight and flexibility in operations (Ali et al., 2024). These capabilities are especially major in addressing the urgent demands of sustainability. For Amouei et al. (2023), DSC is an essential framework for optimizing resources, minimizing waste, and promoting greater transparency throughout the supply chain, with the ultimate contribution being towards sustainable development outcomes. The interaction of DSC and SP is informed by a model of dynamic capabilities, one that focuses on the firm's capacity to innovate and evolve through the successful deployment of resources and technologies across changing environments (Dwivedi & Paul, 2022). The integration of digital technology and supply chain activity improves these dynamic capabilities through its improved forecasting of market changes, decreased response time versus supply disruption, and integration of more environmentally friendly processes. Chen et al. (2023) identified that companies leveraging DSC technologies perform more sustainably in every dimension of sustainability. In the same way, Joshi and Sharma (2022) identified that digitalization enables transparency and operational efficiency, translating into improved adherence to social responsibility stipulations as well as enhanced cost-effectiveness. Nevertheless, though these advantages have been broadly acknowledged, the extent to which specific elements of the DSC propel SP may differ. For instance, digital manufacturing can directly influence environmental sustainability by reducing waste and energy consumption, whereas digital suppliers can influence social sustainability by enhancing labor practices and ethical sourcing (Tian et al., 2025). Hence, a clear understanding of the contribution of each dimension is necessary for a comprehensive evaluation of the direct support service's influence on sustainability. To this end, the following research hypothesis is developed:

**H1a:** Digital suppliers significantly impact sustainable performance.

**H1b:** Digital manufacturing significantly impacts sustainable performance.

**H1c:** Digital logistics significantly impact sustainable performance.

The expansion of the Internet, social media, and the Internet of Things (IoT) has resulted in data swelling at a fast rate with regard to volume, variety, and velocity. This phenomenon calls for organizations to pursue analysis approaches that adapt to the character of this data in an attempt to extract insightful strategic information (Khan et al., 2024). Al-Darras et al. (2022) clarified that BDAC is the ability of an organization to deploy, combine, and effectively leverage its tangible and intangible resources in a way that supports big data-enabled decision making and performance improvement. Ferraris et al. (2019) determined it as the capacity of an organization to leverage sophisticated data analysis software, machine learning algorithms, and visualization methods to analyze huge volumes of structured and unstructured data to inform decision-making. Sedkaoui (2018) contended that BDAC are the dynamic ability of organizations to acquire, process, and analyze big data in a bid to construct new knowledge and enhance decision-making at various organizational levels.

From an RBV, Chong et al. (2024) represented BDAC as a multi-dimensional construct comprising technological capability, human capability, and organizational capability, which operate synergistically together to derive valuable insights from big data. (1) Organizational capability characterizes an organization's potential to integrate, create, and rearrange internal and external capabilities to respond effectively to dynamically changing circumstances (Mikalef et al., 2018). This explanation fits the adaptive nature of BDAC, wherein organizations need to constantly align to emerging data technologies, enhance their analytical routines, and harmonize big data initiatives with general strategic business goals. (2) Technological capability is defined as an organization's ability to explore, learn, and exploit new technologies in a bid to drive innovation and enable business transformation (AlNuaimi et al., 2021). In the context of BDAC, this means that organizations must continuously experiment with new analytical techniques, integrate AI-driven insights into their business processes, and develop innovative data-driven products and services. (3) Human capability refers to the ability of an organization to create a data-driven workforce that infuses analytical intelligence into decision-making at all stages of an organization (Sabharwal & Miah, 2021). The definition highlights that the effectiveness of big data is not only dependent on technology but also on employees' ability to read, communicate, and act on data-driven recommendations

The association between SP and BDAC is well demonstrated in the literature, citing the fact that organizations with strong analytical capability can align business goals with sustainability objectives more easily. By the use of predictive analytics and real-time monitoring, organizations can reduce environmental impacts by promoting energy efficiency, minimizing waste, and enhancing supply chain transparency (Alyahya et al., 2023). BDAC also impacts social performance by means of increased stakeholder engagement, employment practices, and customer responsiveness through data-informed insights (Mesquita et al., 2025). Economic performance is, in return, enhanced by BDAC through cost reduction, process efficiency, and enhanced innovation, which in combination result in long-term profitability (Er & Mosawi, 2022). Mikalef et al. (2018) demonstrated that BDAC has a significant positive impact on strategic and operational performance, e.g., sustainability measures, by enabling firms to use data for competitive decision-making. Similarly, Ertz et al. (2025) confirmed that companies with high maturity of BDAC have higher environmental and social responsibility due to enhanced insights and process improvements. The application of sophisticated analytical

capabilities, data-oriented culture, and nimble decision-making structures enables systemic ability for integration of sustainability strategies with business strategy, and consequently, for better triple bottom line outcomes. On these grounds, the next research hypothesis is advanced:

**H2a:** Organizational capability significantly impacts sustainable performance.

**H2b:** Technological capability significantly impacts sustainable performance.

**H2c:** Human capability significantly impacts sustainable performance.

Digitally enabled supply chains contribute to enhanced logistics efficiency, improved coordination with suppliers, and the development of flexible manufacturing strategies, leading to an overall improvement in sustainable performance within organizations (Farajpour et al., 2023). However, the extent to which DSC practices impact sustainability outcomes varies across organizations depending on organizational context. Academics increasingly emphasize that the availability of specific organizational capabilities can be a key factor in enhancing the sustainability potential of DSCs (Cetindamar et al., 2020; Abdulameer & Ibrahim, 2023). In this context, BDAC not only serves as a direct driver of sustainability performance but also serves as a strategic facilitator that enhances or facilitates the impact of digital transformation on sustainability outcomes.

BDAC represents a high-level organizational capability that enables organizations to optimize digital supply chain initiatives by deconstructing and analyzing vast amounts of complex data and transforming them into actionable knowledge (Bahrami & Shokouhyar, 2022). This capability contributes to the creation of more adaptive supply chains, enhanced alignment between operational processes and sustainability goals, and improved strategic decision-making (Mikalef et al., 2018). Zhang et al. (2023) noted that BDAC significantly amplifies the impact of digital technologies on organizational performance, especially in dynamic environments that require comprehensive analysis and real-time decision-making. Similarly, Li et al. (2024) found that companies with strong BDAC are better able to realize the sustainability benefits associated with digital transformation, due to improved decision quality and enhanced operational integration. This importance is particularly relevant within the industrial sector, where supply chains are complex due to the multiplicity of stakeholders and the interconnectedness of materials and information. In this context, BDAC contributes to enhanced visibility, transparency, and predictive capabilities of supply chains, thus maximizing the sustainable impact of digital transformation initiatives (Dubey et al., 2021). Based on these arguments, the following hypothesis is proposed as a contribution to the current study.

**H3a:** Big data analytics capabilities moderate the relationship between digital suppliers and sustainable performance.

**H3b:** Big data analytics capabilities moderate the relationship between digital manufacturing and sustainable performance.

**H3c:** Big Data analytics capabilities moderate the relationship between digital logistics and sustainable performance.

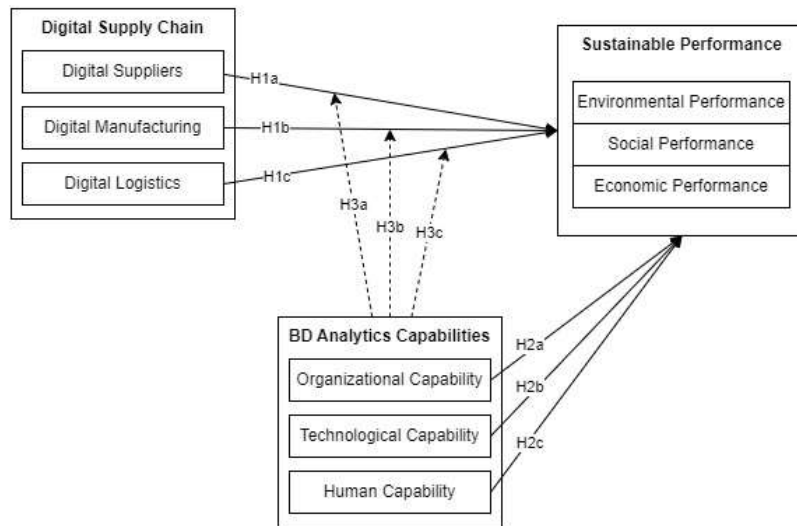


Figure 1. Conceptual Model

Figure 1 displays the research framework, explaining relationships among DSC, SP, and BDAC. It shows a direct positive relation from DSC to SP, which is divided into three sub-dimensions: digital suppliers, digital manufacturing, and digital logistics, all of which are anticipated to impact SP individually. It also demonstrates a direct relation from BDAC to SP. The figure shows arrows from BDAC to the lines connecting each dimension of DSC to SP, indicating that BDAC will presumably enhance the role of digital supply chain practices to contribute to sustainability.

## Methodology

The current research is based on a positivist research philosophy, which centers on the importance of objective observation, measurement, and analysis to understand phenomena. According to this approach, reality is assumed to exist independently of human experience, allowing it to be examined using scientific methods to determine cause-and-effect relationships (Ali, 2024). The research also relies on a quantitative, deductive approach that begins by formulating hypotheses based on established theories and literature. These hypotheses are then tested through empirical data collected via structured questionnaires (Casula et al., 2021, Galdolage et al., 2024). Furthermore, a cross-sectional research design was applied to collect data at a specific point in time. This design aims to provide a comprehensive picture of the prevailing practices and relationships in the industrial sector in Jordan. Although this type of research design is limited in its ability to track temporal changes, it has proven effective in identifying patterns and examining relationships within the current context (Hunziker & Blankenagel, 2024).

The manufacturing sector in Jordan is perfect for examining DSC's impact on SP and BDAC's moderating role. Its focus on digital technology and sustainability gives an insight into future challenges and trends. Industrial companies are using digital solutions and big data to streamline supply chains, which requires an examination of its relationship with results. The study targets top and middle managers in 33 industrial companies listed on the Amman Stock Exchange that manage operations and supply chains. These managers were chosen due to their centrality in digital supply chain systems, providing a perspective on sustainable performance and the impact

of big data analysis in accomplishing these goals. The study excludes non-industrial organizations, for example, service companies, due to different supply chain dynamics that are not consistent with the purpose of the study.

The purposive sampling approach relies on selecting individuals with knowledge, practical experience, and active involvement in areas such as DSC practices, SP, and BDAC, ensuring that participants are appropriate for the study. This method is ideal for research focusing on a specific population group with exceptional information or essential characteristics that contribute to answering the research questions. The sample size was determined using Yamane's (1967, p. 275) formula, Equation 1, for limited populations, which is appropriate for quantitative research that seeks to study specific groups within the specific criteria used in this study.

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where: n: the sample size, N: the target population size, e: the margin of error (usually set at 5% or 0.05).

The study had a population of around 1,000 managers, and thus a sample size of around 286 participants was needed. Consequently, the study aimed to enroll 400 managers to account for potential incomplete and invalid responses. Upon meticulous examination and verification of the responses, 92 responses were excluded due to inconsistencies or not meeting the eligibility criteria. The remaining 308 valid responses were accepted for analysis, corresponding to a response rate of 77%, which achieved the minimum sample size requirement.

The study employed a standardized questionnaire that participants self-administered to acquire full and valid research data. The questionnaire was developed from items used in prior studies to maximize reliability and validity. The items were adapted to fit the Jordanian manufacturing industry context while making sure that the target population would fully understand them. In addition, every item was measured through a 5-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree).

Demographic information collected general data about the respondents, including gender, age bracket, level of education, years of work experience, and nationality. The first part measured the adoption and implementation of DSC with 12 items adapted from (Saryatmo&Sukhotu, 2021). The dimensions used were the components of DSC, including digital suppliers, digital manufacturing, and digital logistics, with four items for each. The second part measured the effectiveness of the organization in collecting, processing, and analyzing big data to support decision-making using 15 items. The dimensions reflect the main competencies for analyzing big data, which are organizational competencies, technological competencies, and human competencies, with five dimensions for each (Bahrami &Shokouhyar, 2022). SP was assessed using 13 items. These were environmental performance using 4 items, social performance using 5 items, and economic performance using 4 items. This was borrowed from Ibrahim et al. (2023).

## **Results and Discussions**

The study utilized a series of efficient SPSS and AMOS package-based data analysis tools to analyze the survey data gathered and deduce relevant findings. Frequencies and percentages were used to determine the respondents' demographic and functional characteristics, as illustrated in Figure 2. The results demonstrate that males within the sample are 76% greater than that for females of 24%. The results point to the male dominance of the industrial economy in Jordan, conforming to traditional gender segregation and dependency needs that characterise

the historical development of the labor market. The majority of participants were aged 30-39 (42%) and 40-49 (40%). The younger and older age groups were less represented, with 11% of those aged 18-29 and 8% of those aged 50 and over. This distribution reflects that most respondents are at the peak of their careers, which entails extensive experience in the field and increasing managerial responsibilities, along with an active role in strategic initiatives.

Jordanian respondents accounted for 87% of the total, compared to 13% of other nationalities, reflecting the dominance of the local workforce in this field. This trend aligns with national employment policies and industrial labor market trends. The sector's reliance on local talent demonstrates its strong ability to implement digital solutions in the supply chain and leverage BDAC to achieve high levels of SP. 65% of respondents hold a bachelor's degree, followed by 28% with postgraduate degrees, and 8% with a diploma or less. Bachelor's degree holders tend to hold mid-level positions encompassing operational and administrative tasks, helping to adopt DSC practices and BDAC, complemented by their knowledge and skills to manage operations and support strategic initiatives.

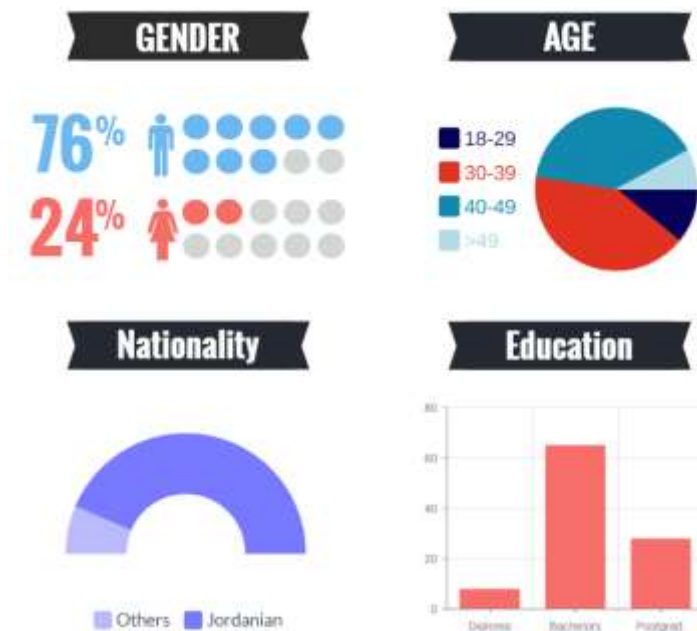


Figure 2. Demographic Profile

Furthermore, means and standard deviations were extracted to summarize the data related to the adoption levels of the study variables within the target population, as shown in Table 1. According to the results, all dimensions of the DSC were within the medium relative importance level. The digital suppliers ranked highest at 3.617, with digital manufacturing at 3.576 and digital logistics at 3.558. Thus, companies focus on digital supplier relationships and procurement before investing heavily in manufacturing and logistics. Firms tend to digitalize upstream supply chain elements first since integrating suppliers is crucial for seamless manufacturing and logistics (Ahmad et al., 2024). The moderate use of digital suppliers is consistent with Rahamneh et al. (2023). Companies are progressing in cloud procurement systems, automated sourcing, and electronic contracts, yet full supplier integration is still

developing. This may be due to the digital maturity gap, as large suppliers are more positioned to integrate technologies than small ones without infrastructure (Al-Hindi, 2022). Digital manufacturing in Jordan is moderate, as stated by Abu Lemoun et al. (2024). The majority of companies are reliant on legacy systems; thus, progress towards digitalization is slow due to the need for a skilled workforce.

For BDAC's dimensions, the organizational capability was ranked the highest at 3.68, technological capability was ranked second at 3.64, and human capability was ranked third at 3.63. Hence, companies have made advances in leadership support, building a data culture, and business objective alignment with analytics, as stated by Aburub et al. (2024). Also, companies value the capabilities of BDAC and implement it in decision-making, performance, and strategy (Alyahya et al., 2023). The study confirmed that human capability in Jordan's manufacturing industry is average, showing challenges in retaining and attracting top analytics human skills, thus, companies value BDAC but lack experience and skills (Ferraris et al., 2019). A moderate level of technological capability was also discovered in Jordan's manufacturing industry, consistent with Hamzeh and Aburub (2024). Therefore, companies do not collect and process large sets of data since they underinvest in advanced analysis tools like AI and machine learning, as Sabharwal and Miah (2021) mentioned.

SP aspects varied in their importance. Social performance led with 3.735, followed by environmental at 3.683, which were at a high level, and economic performance at 3.665 in a moderate level. Accordingly, Jordanian industrial companies give importance to corporate social responsibility, employees' well-being, community, and ethical business conduct. This indicates a growing realization that stakeholder relations, employees' satisfaction, and corporate citizenship are vital to long-term success (Abu Lemoun et al., 2024). Increased business investment in green technology, waste reduction, energy conservation, and sustainable supply chains has been observed, according to Amouei et al. (2023). This was the result of the Jordanian manufacturing sector responding to global environmental governance and pressure, as well as pressure from green consumers. However, companies can be confronted with economic challenges in maintaining profitability amidst aggressive social and environmental efforts. They realize the strategic value of sustainability but fail to balance returns and sustainable investments (Li, 2022, Chen et al., 2024). As a result, pressure from shareholders and investors tends to prioritize short-term profits ahead of long-term sustainability.

|              | M    | S    | AV   | MS   | C    | 1           | 2           | 3           | 4 | 5 | 6 | 7 | 8 | 9 |
|--------------|------|------|------|------|------|-------------|-------------|-------------|---|---|---|---|---|---|
|              |      | D    | E    | V    | R    |             |             |             |   |   |   |   |   |   |
| <b>1-D S</b> | 3.62 | 0.82 | 0.65 | 0.20 | 0.88 | <b>0.81</b> |             |             |   |   |   |   |   |   |
| <b>2-D M</b> | 3.58 | 0.83 | 0.67 | 0.21 | 0.89 | 0.28*       | <b>0.82</b> |             |   |   |   |   |   |   |
| <b>3-D L</b> | 3.56 | 0.78 | 0.64 | 0.17 | 0.87 | 0.32*       | 0.32*       | <b>0.80</b> |   |   |   |   |   |   |

|             |      |      |      |      |      |       |       |       |             |             |             |             |             |             |
|-------------|------|------|------|------|------|-------|-------|-------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>4-OC</b> | 3.68 | 0.61 | 0.54 | 0.25 | 0.85 | 0.08  | 0.08  | 0.07  | <b>0.73</b> |             |             |             |             |             |
| <b>5-TC</b> | 3.64 | 0.67 | 0.59 | 0.22 | 0.88 | 0.02  | 0.01  | 0.01  | 0.46*       | <b>0.77</b> |             |             |             |             |
| <b>6-HC</b> | 3.63 | 0.70 | 0.61 | 0.25 | 0.89 | 0.06  | 0.02  | 0.13  | 0.50*       | 0.38*       | <b>0.78</b> |             |             |             |
| <b>7-EN</b> | 3.68 | 0.65 | 0.54 | 0.16 | 0.83 | 0.34* | 0.40* | 0.37* | 0.29*       | 0.21*       | 0.19*       | <b>0.74</b> |             |             |
| <b>8-SO</b> | 3.73 | 0.68 | 0.57 | 0.24 | 0.87 | 0.29* | 0.35* | 0.41* | 0.26*       | 0.29*       | 0.35*       | 0.34*       | <b>0.76</b> |             |
| <b>9-EC</b> | 3.66 | 0.74 | 0.62 | 0.24 | 0.87 | 0.45* | 0.46* | 0.40* | 0.30*       | 0.30*       | 0.27*       | 0.33*       | 0.49*       | <b>0.79</b> |

**Note:** DS: digital suppliers; DM: digital manufacturing; DL: digital logistics; OC: organizational capability; TC: technological capability; HC: human capability; EN: environmental performance; SO: social performance; EC: economic performance; Bold fonts in table indicate to square root of AVE; \* correlation is significant at 0.05.

Table 1. Reliability and Validity Results

The study provided construct validity results of the survey items through convergent and discriminant validity, and reliability, as presented in Table 1. Convergent validity was examined by the average variance extracted (AVE) with a minimum of 0.50, indicating that the constructs explain over half of the variance in their items (Mohammad et al., 2024). All constructs had AVE values above 0.50, with the highest for digital manufacturing (0.667) and the lowest for organizational capabilities (0.539), demonstrating strong convergence. Discriminant validity results ensured that constructs capture distinct concepts using the comparison approach (Shlash et al., 2024). AVE values need to be greater than MSV values for the identical construct. All AVE values were greater than MSV values, substantiating different constructs (Cheung et al., 2024). To validate these findings, Heterotrait-Monotrait Ratio of Correlations (HTMT) was applied, which states that discriminant validity is established when square root of AVE is greater than 0.50 and superior to intercorrelations with other constructs, which this research has attained (Afthanorhan et al., 2021). Composite reliability (CR) assesses the extent to which the items in each construct consistently measure the same construct. CR ranged from 0.826 to 0.889, with most being greater than 0.85, indicating excellent reliability, well above the 0.70 cutoff (Goodboy & Martin, 2020).

Based on the findings obtained, the model developed to test the influence of the DSC on SP and the pivotal moderating function of BDAC is adequate for testing further hypotheses. The outcomes of these tests are documented systematically and presented in Table 2.

| Hypotheses          | B     | S.E.  | $\beta$ | T     | P     |
|---------------------|-------|-------|---------|-------|-------|
| DS $\rightarrow$ SP | 0.233 | 0.041 | 0.233   | 5.635 | 0.000 |

|   |        |       |        |        |       |
|---|--------|-------|--------|--------|-------|
| DM → SP   | 0.319  | 0.041 | 0.319  | 7.736  | 0.000 |
| DL → SP   | 0.241  | 0.042 | 0.241  | 5.789  | 0.000 |
| OC → SP   | 0.104  | 0.052 | 0.194  | 1.991  | 0.047 |
| TC → SP   | 0.105  | 0.041 | 0.237  | 2.596  | 0.009 |
| HC → SP   | 0.109  | 0.040 | 0.252  | 2.687  | 0.007 |
| DS × BDAC → SP  | -0.001 | 0.038 | -0.001 | -0.026 | 0.979 |
| DM × BDAC → SP  | -0.030 | 0.037 | -0.039 | -0.807 | 0.420 |
| DL × BDAC → SP  | -0.097 | 0.032 | -0.137 | -3.004 | 0.003 |
| Note: DS: digital suppliers; DM: digital manufacturing; DL: digital logistics; OC: organizational capability; TC: technological capability; HC: human capability; SP: sustainable performance; BDAC: big data analytics capabilities. |        |       |        |        |       |

Table 2. Path Coefficients Results

The results of Table 2 supported the research hypotheses H1a, H1b, and H1c, which indicate a positive impact of DSC's dimensions on SP. This highlights the importance of organizations adopting advanced digital technologies within their supply chain operations, which leads to higher levels of efficiency, transparency, and responsiveness, all of which contribute to enhancing long-term sustainability. Digitization contributes to improved decision-making, enhanced resource allocation, and reduced environmental impact, supporting the alignment of business practices with sustainable development principles, according to Joshi and Sharma (2022). The impact of digital manufacturing ( $\beta = 0.319$ ,  $T = 7.736$ ,  $P < 0.001$ ) was the most prominent. Digital manufacturing demonstrated its critical role in driving SP through adopting Industry 4.0 technologies such as the IoT, AI, and robotics. This technological integration enables companies to improve resource efficiency, reduce carbon emissions, and increase production flexibility (Shaikh & Ali, 2025). Other improvements include the use of real-time monitoring technologies, predictive maintenance, and energy-efficient production, which reduce resource waste and optimize energy consumption, contributing to tangible environmental sustainability (Shlash Mohammad et al., 2025).

Digital logistics ( $\beta = 0.241$ ,  $T = 5.789$ ,  $P < 0.001$ ) also ranked prominently as the second most influential dimension of the DSC on SP, with research findings confirming the role of digital solutions in improving transportation, warehousing, and distribution operations. Digital logistics relies on modern tracking systems, blockchain technologies to enhance transparency, and route optimization through AI, effectively contributing to reduced fuel consumption, lower transportation costs, and significantly reduced carbon footprints (Chen et al., 2023). Digital suppliers ( $\beta = 0.233$ ,  $T = 5.635$ ,  $P < 0.001$ ) had the least impact on sustainable performance compared to other components, but this does not detract from their importance as an essential part of an integrated DSC. Digitizing supplier relationships enhances supply chain collaboration, supports risk management, and ensures ethical sourcing, contributing to meeting sustainability goals (Abu Lemoun et al., 2024). By employing tools such as supplier analytics, digital sourcing platforms, and automated supplier evaluation, companies can ensure compliance with environmental legislation, ethical labor standards, and circular economy principles (Tian et al., 2025).

The results showed that Hypotheses H2a, H2b, and H2c, which emphasize the impact of the dimensions of BDAC on improving SP, were supported. Hence, organizations that leverage these capabilities can extract valuable insights, improve the efficiency of their resource use, and enhance strategic sustainability initiatives, leading to significant improvements in their overall

performance. Collecting, processing, and analyzing massive amounts of structured and unstructured data enables companies to increase operational efficiency, reduce waste, and align their business models with sustainability goals (Chong et al., 2024). Human capability ( $\beta= 0.252$ ,  $T=2.687$ ,  $P< 0.01$ ) had the strongest impact on SP, highlighting the important role of decision makers, data scientists, and analytics experts in transforming big data into an effective tool for achieving sustainable goals. Skilled employees are able to interpret complex data, provide actionable insights, and apply analytical tools to sustainability challenges, making this capability a critical factor for success (Ertz et al., 2025). The advanced skills of these professionals help them use predictive analytics to assess environmental risks, reduce energy consumption, and promote proactive sustainability strategies that reduce waste and carbon footprints (Mesquita et al., 2025).

Technological capability ( $\beta= 0.237$ ,  $T=2.596$ ,  $P< 0.01$ ) ranked second in terms of impact on SP, emphasizing the intrinsic value of advanced analytics, AI, ML, cloud computing, and IoT solutions in supporting sustainability-based decisions. Big data technologies provide companies with powerful tools to monitor energy consumption, improve supply chain efficiency, and promote circular economy practices by identifying inefficiencies and providing data-driven solutions (Ertz et al., 2025). Mesquita et al. (2025) reported that AI-powered analytics can predict potential equipment failures, contributing to reduced unplanned downtime and extended asset life, thereby reducing waste and rationalizing resource use. Although organizational capability ( $\beta= 0.194$ ,  $T=1.991$ ,  $P< 0.05$ ) had the least impact on SP compared to other dimensions, it remains a critical component for ensuring effective implementation of BDAC and linking them to sustainability goals. This type of capability refers to an organization's ability to integrate data-driven insights into decision-making processes, strengthen data governance frameworks, and develop a culture that prioritizes sustainability through analytical solutions (Alyahya et al., 2023). Strong organizational capabilities are a fundamental part of a company's overall strategy, making BDAC not just a standalone function but a solid pillar for ensuring long-term sustainable impact.

The results showed that BDAC have a moderate impact on the relationship between DSC and SP, but this effect varies across dimensions of the DSC. Hypothesis H3c was supported, indicating that BDAC play a pivotal role in enhancing the impact of digital logistics on SP ( $\beta=-0.137$ ,  $T=-3.004$ ,  $P< 0.01$ ). Conversely, Hypotheses H3a and H3b, indicating an interaction effect between digital suppliers ( $\beta=-0.001$ ,  $T=-0.026$ ,  $P> 0.05$ ) or digital manufacturing ( $\beta=-0.039$ ,  $T=-0.807$ ,  $P> 0.01$ ) and BDAC on SP, were not supported. Figure 3 illustrates the interaction between digital logistics and big data analytics capabilities and how this interaction impacts sustainable performance.

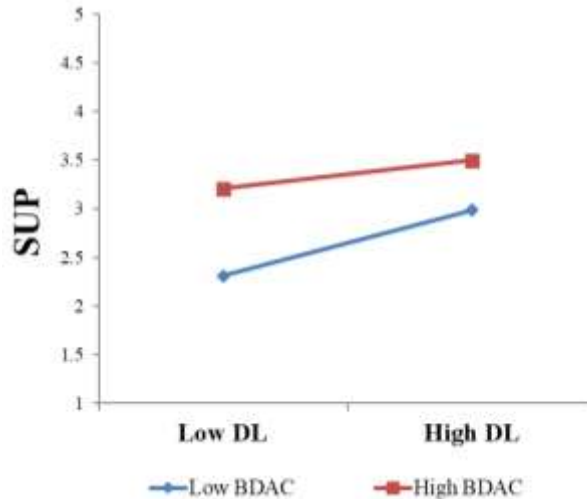


Figure 3. Simple Slope Interaction

Figure 3 illustrates that firms with high BDAC always record greater SP than those with low capability regardless of the level of their digital logistics. Additionally, the enhancement in SP is associated with a high degree of digital logistics, yet those companies with high BDAC experience an even greater improvement rate. This finding supports the fact that the integration of BDAC with digital logistics induces greater sustainable performance. BDAC, when appropriately applied alongside digital logistics, has the potential to better environmental and economic performance, optimize transport networks and supply chain visibility, and reduce emissions. Cetindamar et al. (2020) state that AI in logistics systems has the capacity to predict congestion and route changes in an attempt to decrease carbon footprints and expenses. Predictive analytics also enables forecast fluctuations in demand to avoid wastage by optimizing inventory levels to be in tandem with circular economic activities. Yet, the realization of these advantages demands large investments in data technologies, close integration of supply chain participants, and a workforce capable of using analytics to streamline logistics processes.

### Recommendations

According to the findings of the analysis, a list of recommendations of both theoretical and practical nature is proposed to enhance the positive effect of digital technologies on sustainability. To begin with, it is advisable that research and discussion at the academic level concentrate on the fusion of digital transformation models and sustainability theories, hence resulting in a better conceptualization of the interlink between digitization, BDAC, and SP. This facilitates the development of contemporary theoretical models emphasizing the contribution of digital technologies towards reaching sustainability goals in different industries. Further, the variation in the impact of DSC dimensions on SP places greater emphasis on the necessity to evolve existing models of DSC maturity. This necessitates additional theoretical analysis in terms of comprehending the distinctive phases of DSC implementation, with emphasis on the abilities that exert the greatest influence on sustainability across varying industrial settings.

Given the evidence of the impact of digital manufacturing on SP, it is imperative that industrial companies in Jordan invest in smart manufacturing technologies as a priority. These technologies include AI-driven automation, IoT-based monitoring systems, and advanced predictive

maintenance solutions. The adoption of these improvements will directly lead to energy consumption and waste reduction, while also enhancing operational efficiency to achieve sustainable environmental and economic gains. Moreover, given that digital logistics alone ensures a synergistic effect in combination with BDAC technologies, Jordanian manufacturers would do well to sharpen their digital logistics initiatives. In doing this, they ought to invest in their route optimization, demand forecasting, and real-time monitoring systems with the aim of reducing transportation expenses and carbon footprint while improving the resilience of the supply chain at the same time. Finally, Jordanian organizations must invest strategically in building advanced BDAC, with particular emphasis on human skill development, which has been central to driving SP. The Jordanian manufacturing sector is plagued by a negative lack of advanced data analytics professionals, making it necessary to increase training activities for existing employees to enhance data-informed decision-making. Furthermore, the development of instilling a data-driven organizational culture and hiring experts in data analysis should be accelerated to allow the industry to shift towards more sustainable approaches.

### **Limitations and Further Research**

This research delivers valuable knowledge regarding the influence of the DSC on SP, accentuating the position of BDAC in moderating the industrial sector in Jordan. Notwithstanding, there are limitations worth noting that can serve as a foundation for potential future research. One of the most significant limitations is the geographic and sectoral coverage, as the research was conducted only within the Jordanian industrial sector. Despite the significance and development of this sector, it may fail to capture the dynamics of other sectors or economies. Therefore, future research should be expanded to a cross-industry and cross-country comparative research to be able to further comprehend how the DSC and BDAC influence sustainability in various economic, political, and cultural contexts. Although the study employed existing indicators to quantify the concepts being examined, the complexity and dynamicity of the said concepts may hinder their entirety to be explored. Thus, future research is recommended to incorporate contemporary tools and techniques that upscale the assessment procedures of concepts, prioritizing cutting-edge digital technologies with a contribution to transforming supply chain management and sustainability strategies. Methodologically, cross-sectional design used in this research is limited to assessing relationships at one time point. With the awareness that technology development and sustainability efforts are evolving constantly, longitudinal studies are recommended. The studies above will create a platform to monitor how organizations' digital supply chain and data analytics competencies evolve over time and examine how these evolutions affect long-term performance in sustainability terms.

### **Conclusion**

This study investigates the impact of the DSC on SP, specifically BDAC as a moderator in Jordan's industrial sector. It reveals relationships that are valuable for insights and applications that underscore the importance of digital transformation and data-driven decision-making towards sustainability. Results indicate moderate DSC adoption in the Jordanian manufacturing sector, with variations in digital suppliers, manufacturing, and logistics. Companies are facing high difficulties, especially in digitalizing suppliers. The research establishes that DSC is a positive driver of sustainability with digital manufacturing as the most critical, followed by digital logistics and suppliers. Digital manufacturing processes are sustainable as they make resource efficiency better and minimize waste. BDAC in Jordan is rated as average, with organizational capability outpacing human and technological capability. Organizations have

started to put in place data-driven decision-making structures but require the development of technology and human capability. Results revealed that big data analytics positively affects SP, led by human capabilities, followed by technology and organization. This highlights the importance of the role of human capabilities and leadership in analytics in enhancing SP.

BDAC moderate the impact of DSC on SP, enhancing digital logistics. Such an effect did not appear for digital manufacturing and suppliers. This finding illustrates the strength of analytics in enhancing logistics for sustainability, for example, emissions reduction and flow improvement. However, its modest effect on digital manufacturing and supplier management suggests the need for more extensive integration approaches for advanced analytics. The study incorporates DSC, BDAC, and SP within a paradigm, contributing to the body of literature. The big data maturity model and dynamic capabilities theory are validated by the study as it reflect firms' capacity to achieve improvement in sustainability depending on digital and data-driven capability. The study illustrates how digitalization can be combined with deep analytics to achieve enhanced economic, social, and environmental performance in terms of ideas like circularity and the triple bottom line. It offers practical suggestions for supply chain managers, policymakers, and business leaders. It calls for investing in digital logistics and human-centered data analytics for sustainability. AI technology like predictive analytics and smart manufacturing has the potential to boost supply chain resilience and environmental accountability. The study demands governmental incentives and policies to facilitate businesses to digitalize and use big data for innovation and sustainability.

## References

- Abbas, J., & Sağsan, M. (2019). Impact of knowledge management practices on green innovation and corporate sustainable development: A structural analysis. *Journal of cleaner production*, 229, 611-620.
- Abdulameer, S. S., & Ibrahim, Y. M. (2023). The Moderating Role of Big Data Analytics Capabilities in the Relationship Between Supply Chain Management Practices and Sustainable Performance: A Conceptual Framework from a Metaverse Perspective. In *International Multi-Disciplinary Conference-Integrated Sciences and Technologies* (pp. 154-170). Cham: Springer Nature Switzerland.
- Abu Lemoun, A., Dellagi, H., Daoud, K., & Abusalma, A. (2024). The nexus between digital supply chain and sustainability: An empirical study in pharmaceutical companies in Jordan. *Uncertain Supply Chain Management*, 12(3), 1461-1470.
- Aburub, F. A. F., Hamzeh, R. F., Alzyoud, M., Alajarmeh, N. S., Al-shanableh, N., Al-Majali, R. T., & Aldaihani, F. M. F. (2024). The impact of big data analytics capabilities on decision making at the telecommunications sector in Jordan. In *Business Analytical Capabilities and Artificial Intelligence-Enabled Analytics: Applications and Challenges in the Digital Era, Volume 1* (pp. 339-354). Cham: Springer Nature Switzerland.
- Aćimović, S., & Stajić, N. (2019). Digital supply chain: leading technologies and their impact on Industry 4.0. *Proceedings of the 19th International Scientific Conference Business Logistics in Modern Management* (pp. 75-90), Osijek, Croatia.
- Afthanorhan, A., Ghazali, P. L., & Rashid, N. (2021). Discriminant validity: A comparison of CBSEM and consistent PLS using Fornell & Larcker and HTMT approaches. In *Journal of Physics: Conference Series* (Vol. 1874, No. 1, p. 012085). IOP Publishing.
- Ahmad, A. Y. B., Allahham, M., Almajali, W. I., Ayasrah, F. T., & Sabra, S. (2024). Blockchain's Role in Emerging Markets: Accelerating Digital Supply Chain Management and Unlocking New Opportunities. In *2024 25th International Arab Conference on Information Technology (ACIT)* (pp. 1-6). IEEE.
- Al-Darras, O. M. A., & Tanova, C. (2022). From big data analytics to organizational agility: what is the

- mechanism?. Sage Open, 12(2), 21582440221106170.
- Al-Hindi, S. M. (2022). Exploring Digital Supply Chain and Its Impact on Organizational Innovation; the Case of Private Hospitals in Jordan. Master's thesis, University of Petra, Jordan.
- Ali, A. A. A., Fayad, A. A., Alomair, A., & Al Naim, A. S. (2024). The role of digital supply chain on inventory management effectiveness within engineering companies in Jordan. *Sustainability*, 16(18), 8031.
- Ali, I. M. (2024). A guide for positivist research paradigm: From philosophy to methodology. *Ideology Journal*, 9(2), 187-196.
- AlNuaimi, B. K., Khan, M., & Ajmal, M. M. (2021). The role of big data analytics capabilities in greening e-procurement: A higher order PLS-SEM analysis. *Technological Forecasting and Social Change*, 169, 120808.
- Alyahya, M., Aliedan, M., Agag, G., & Abdelmoety, Z. H. (2023). Understanding the relationship between big data analytics capabilities and sustainable performance: the role of strategic agility and firm creativity. *Sustainability*, 15(9), 7623.
- Amouei, A. M., Valmohammadi, C., & Fathi, K. (2023). Developing and validating an instrument to measure the impact of digital supply chain activities on sustainable performance. *Journal of enterprise information management*, 36(4), 925-951.
- Bahrani, M., & Shokouhyar, S. (2022). The role of big data analytics capabilities in bolstering supply chain resilience and firm performance: a dynamic capability view. *Information Technology & People*, 35(5), 1621-1651.
- Balusamy, B., Kadry, S., & Gandomi, A. H. (2021). *Big data: concepts, technology, and architecture*. John Wiley & Sons.
- Casula, M., Rangarajan, N., & Shields, P. (2021). The potential of working hypotheses for deductive exploratory research. *Quality & Quantity*, 55(5), 1703-1725.
- Cetindamar, D., Shdifat, B., & Erfani, S. (2020). Assessing big data analytics capability and sustainability in supply chains. *Proceedings of the 53rd Hawaii International Conference on System Sciences* (pp. 208-217). University of Hawai'i at Mānoa.
- Chen, J., Wu, W., & Zhuang, Y. (2023). Impact of Digital Supply Chain on Sustainable Trade Credit Provision: Evidence from Chinese Listed Companies. *Sustainability*, 15(15), 11861.
- Chen, W., Vasudevan, A., Al-Daoud, K. I., Mohammad, S. I. S., Arumugam, V., Manoharan, T., & Foong, W. S. (2024). Integrating cultures, enhancing outcomes: Perceived organizational support and its impact on Chinese expatriates' performance in Dubai. *Herança*, 7(3), 25-39.
- Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2024). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia Pacific Journal of Management*, 41(2), 745-783.
- Chong, C. L., Abdul Rasid, S. Z., Khalid, H., & Ramayah, T. (2024). Big data analytics capability for competitive advantage and firm performance in Malaysian manufacturing firms. *International Journal of Productivity and Performance Management*, 73(7), 2305-2328.
- Covaci, F. L., & Zaraté, P. (2020). Modelling decision making in digital supply chains: insights from the petroleum industry. *Kybernetes*, 49(4), 1213-1228.
- Dahiya, R., Le, S., Ring, J. K., & Watson, K. (2022). Big data analytics and competitive advantage: the strategic role of firm-specific knowledge. *Journal of Strategy and Management*, 15(2), 175-193.
- Del Giudice, M., Chierici, R., Mazzucchelli, A., & Fiano, F. (2021). Supply chain management in the era of circular economy: the moderating effect of big data. *The International Journal of Logistics Management*, 32(2), 337-356.
- Dubey, R., Gunasekaran, A., Childe, S. J., Fosso Wamba, S., Roubaud, D., & Foropon, C. (2021). Empirical

- investigation of data analytics capability and organizational flexibility as complements to supply chain resilience. *International Journal of Production Research*, 59(1), 110-128.
- Dwivedi, A., & Paul, S. K. (2022). A framework for digital supply chains in the era of circular economy: Implications on environmental sustainability. *Business strategy and the environment*, 31(4), 1249-1274.
- Ekanayake, E. A., Al-Daoud, K. I., Vasudevan, A., Wenchang, C., Hunitie, M. F. A., & Mohammad, S. I. S. (2024). Leveraging Aquaculture and Mariculture for Sustainable Economic Growth in Sri Lanka: Challenges and Opportunities. *Journal of Ecohumanism*, 3(6), 1229-1247.
- Elkington, J. (1997). The triple bottom line. *Environmental management: Readings and cases*, 2, 49-66.
- Er, C. H., & Mosawi, T. A. (2022). Effects of big data analytics on sustainable manufacturing: A comparative study analysis. *Chinese Journal of Urban and Environmental Studies*, 10(04), 2250022.
- Ertz, M., Latrous, I., Dakhlaoui, A., & Sun, S. (2025). The impact of big data analytics on firm sustainable performance. *Corporate Social Responsibility and Environmental Management*, 32(1), 1261-1278.
- Farajpour, F., Hassanzadeh, A., Elahi, S., & Ghazanfari, M. (2022). Digital supply chain blueprint via a systematic literature review. *Technological Forecasting and Social Change*, 184, 121976.
- Feizabadi, J., Maloni, M., & Gligor, D. (2019). Benchmarking the triple-A supply chain: orchestrating agility, adaptability, and alignment. *Benchmarking: An International Journal*, 26(1), 271-295.
- Ferraris, A., Mazzoleni, A., Devalle, A., & Couturier, J. (2019). Big data analytics capabilities and knowledge management: impact on firm performance. *Management Decision*, 57(8), 1923-1936.
- Galdolage, B. S., Ekanayake, E. A., Al-Daoud, K. I., Vasudevan, A., Wenchang, C., Hunitie, M. F. A., & Mohammad, S. I. S. (2024). Sustainable Marine and Coastal Tourism: A Catalyst for Blue Economic Expansion in Sri Lanka. *Journal of Ecohumanism*, 3(6), 1214-1228.
- Goodboy, A. K., & Martin, M. M. (2020). Omega over alpha for reliability estimation of unidimensional communication measures. *Annals of the International Communication Association*, 44(4), 422-439.
- Hamzeh, R., & Aburub, F. (2024). Big Data Analytics Capabilities and Decision-Making in Jordan's Telecommunications Sector. In *2024 2nd International Conference on Cyber Resilience (ICCR)* (pp. 1-6). IEEE.
- Hijjawi, G. S., Eldahamsheh, M. M., Al-Quran, A. Z. F., Almomani, H. M. A., Alhalalmeh, M. I., & Al-Hawary, S. I. S. (2023). The mediating effect of digital supply chain management among the relationship between lean management and supply chain operations. *International Journal of Economics and Business Research*, 26(2), 146-162.
- Hunziker, S., & Blankenagel, M. (2024). Cross-sectional research design. In *Research design in business and management: A practical guide for students and researchers* (pp. 187-199). Wiesbaden: Springer Fachmedien Wiesbaden.
- Ibrahim, I., Mohammed, A., Abdulaali, H. S., Mohammad, M. M., & Ali, K. (2023). Does Digital Balanced Scorecards Lead To The Sustainable Performance Amongst The Jordanian SMEs?. *International Journal of Professional Business Review*, 8(7), 35.
- Joshi, S., & Sharma, M. (2022). Sustainable performance through digital supply chains in industry 4.0 era: amidst the pandemic experience. *Sustainability*, 14(24), 16726.
- Khan, R., Usman, M., & Moinuddin, M. (2024). The big data revolution: Leveraging vast information for competitive advantage. *Revista Espanola de Documentacion Cientifica*, 18(02), 65-94.
- Kouaib, A., Mhiri, S., & Jarboui, A. (2020). Board of directors' effectiveness and sustainable performance: The triple bottom line. *The Journal of High Technology Management Research*, 31(2), 100390.
- Lee, H. L. (2004). The triple-A supply chain. *Harvard business review*, 82(10), 102-113.
- Matarneh, R., & Mohsen, B. M. (2024). Exploring the Implementation of Digital Technologies in Supply Chain Management within the Jordanian Construction Industry. *Procedia Computer Science*, 238, 519-527.

- Li, W., Waris, I., & Bhutto, M. Y. (2024). Understanding the nexus among big data analytics capabilities, green dynamic capabilities, supply chain agility and green competitive advantage: the moderating effect of supply chain innovativeness. *Journal of Manufacturing Technology Management*, 35(1), 119-140.
- Mesquita, L. L., Lizarelli, F. L., & Duarte, S. (2025). Big data analytics and lean practices: impact on sustainability performance. *Production Planning & Control*, 36(3), 333-356.
- Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2018). Big data analytics capabilities: a systematic literature review and research agenda. *Information systems and e-business management*, 16, 547-578.
- Mohammad, A. A. S., Alolayyan, M. N., Al-Daoud, K. I., Al Nammass, Y. M., Vasudevan, A., & Mohammad, S. I. (2024). Association between Social Demographic Factors and Health Literacy in Jordan. *Journal of Ecohumanism*, 3(7), 2351-2365.
- Mohammad, A.A.S., Al-Hawary, S.I.S., Hindieh, A., Vasudevan, A., Al-Shorman, M. H., Al-Adwan, A.S., Turki Alshurideh, M., & Ali, I. (2025). Intelligent Data-Driven Task Offloading Framework for Internet of Vehicles Using Edge Computing and Reinforcement Learning. *Data and Metadata*, 4, 521.
- Mohammad, A. A. S. (2025). The impact of COVID-19 on digital marketing and marketing philosophy: evidence from Jordan. *International Journal of Business Information Systems*, 48(2), 267-281.
- Nazeer, S., Saleem, H. M. N., & Iqbal, J. (2024). Triple-A Paradigm: Examining its Role in Shaping Sustainable Performance. *Foundation University Journal of Business & Economics*, 9(1), 1-20.
- Piowar, S.K., & Iqbal, Q. (2023). Leadership styles and sustainable performance: A systematic literature review. *Journal of Cleaner Production*, 382, 134600.
- Rahamneh, A., Alrawashdeh, S., Bawaneh, A., Alatyat, Z., Mohammad, A., & Al-Hawary, S. (2023). The effect of digital supply chain on lean manufacturing: A structural equation modelling approach. *Uncertain Supply Chain Management*, 11(1), 391-402.
- Sabharwal, R., & Miah, S. J. (2021). A new theoretical understanding of big data analytics capabilities in organizations: a thematic analysis. *Journal of Big Data*, 8(1), 159.
- Sabri, E. (2019). Mastering Change Management for Successful Digital Supply Chain Transformations. In *Technology Optimization and Change Management for Successful Digital Supply Chains* (pp. 85-106). IGI Global, Pennsylvania, United States.
- Saryatmo, M. A., & Sukhotu, V. (2021). The influence of the digital supply chain on operational performance: a study of the food and beverage industry in Indonesia. *Sustainability*, 13(9), 5109.
- Sedkaoui, S. (2018). *Data analytics and big data*. John Wiley & Sons.
- Shaikh, A. R., & Ali, I. (2025). Driving Business Sustainability through Digital Supply Chains. In *Handbook of Digital Innovation, Transformation, and Sustainable Development in a Post-Pandemic Era* (pp. 34-59). CRC Press.
- Sharma, M., Kumar, A., Luthra, S., Joshi, S., & Upadhyay, A. (2022). The impact of environmental dynamism on low-carbon practices and digital supply chain networks to enhance sustainable performance: An empirical analysis. *Business Strategy and the Environment*, 31(4), 1776-1788.
- Shlash, A. A., Al-Daoud, K. I., Al Oraini, B., Mohammad, S. I., Vasudevan, A., Zhang, J., Hunitie, M. F. (2024). Using Digital Twin Technology to Conduct Dynamic Simulation of Industry-Education Integration. *Data and Metadata*, 3,422.
- Shlash Mohammad, A. A., Al-Ramadan, A. M., Ibrahim Mohammad, S., Al Oraini, B., Vasudevan, A., Turki Alshurideh, M., (2025). Enhancing Metadata Management and Data-Driven Decision-Making in Sustainable Food Supply Chains Using Blockchain and AI Technologies. *Data and Metadata*, 4, 683.
- Tian, L., Tian, W., & Guo, M. (2025). Can supply chain digitalization open the way to sustainable development? Evidence from corporate ESG performance. *Corporate Social Responsibility and Environmental Management*, 32(2), 2332-2346.
- Yamane, T. (1967). *Statistics: An Introductory Analysis*. Harper & Row, New York, United States.

- Yerpude, S., Sood, K., & Grima, S. (2022). Blockchain-augmented digital supply chain management: A way to sustainable business. *Journal of Risk and Financial Management*, 16(1), 7.
- Yin, S., Jia, F., Chen, L., & Wang, Q. (2023). Circular economy practices and sustainable performance: A meta-analysis. *Resources, conservation and recycling*, 190, 106838.
- Zhang, X., He, X., Du, X., Zhang, A., & Dong, Y. (2023). Supply chain practices, dynamic capabilities, and performance: The moderating role of Big Data analytics. *Journal of Organizational and End User Computing*, 35(3), 1-26.