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The Influence of Digital Technologies on Sustainable Supply Chain Performance in Public Procuring Entities: A Moderating Effect of Legal Frameworks

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Abstract

This study examined the impact of digital technologies on the performance of sustainable supply chains in public procuring entities, with a specific focus on Tanzania. The study was conducted using the Technology-Organization-Environment model, Resource Based Review, and Schumpeter Theory of Innovation as guiding frameworks. The study employed the positivism research paradigm and utilized the simple random sampling technique to gather data from a sample of 410 respondents. The data collection process utilized descriptive and explanatory cross-sectional survey research methods. The data were obtained by administering questionnaires and conducting a review of relevant documents. The collected data was analyzed using Partial Least Squares Structural Equation Modeling with the assistance of SmartPLS 4 software for inferential statistics analysis. For descriptive statistics analysis, IBM SPSS Statistics Version 26 was utilized to examine the data collected on respondents' profiles. The results indicate that the implementation of Internet of Things, Blockchain, Big Data Analytics, and Legal Frameworks as a moderator has a beneficial impact on the performance of Sustainable Supply Chains. The study suggests that buyers, suppliers, service providers, and contractors in Tanzania and other developing countries should incorporate Internet of Things, Blockchain, Big Data Analytics, and Legal Frameworks to effectively implement Sustainable Supply Chain Performance.This study successfully addressed the need for a specific model that defines the factors influencing the performance of a sustainable supply chain, with legal frameworks acting as moderators. This paradigm is absent from the current collection of empirical and theoretical literature.

Keywords: *Digital Technologies; Internet of Things; Blockchain; Big Data Analytics; Legal Frameworks; Sustainable Supply Chain Performance*

Introduction

The impact of digital technologies on supply chain performance in developing countries has been substantial. The 4th Industrial Revolution, which involves the digitalization of supply chains and their management, has led to the adoption of digital supply chain (DSC) practices in higher education institutions (Mustaffa et al., 2023). Furthermore, the implementation of digital technology has resulted in more efficient administrative procedures and the adoption of online classes, accelerating the digitization of the education industry (Mustaffa et al., 2023).

Within manufacturing export enterprises, the process of digital transformation has yielded favorable outcomes in terms of overall performance. This includes reducing costs, increasing research and development efforts, and improving the utilization of human resources (Wang et al., 2024). The presence of the digital divide (DD) and the need for digital alphabetization (DA) have had an impact on the generation of Big Data (BD), which has the potential to be a valuable tool in the decision-making process of supply chain management (SCM) (Gravili et al., 2018).

Similarly, digital technologies have a substantial influence on the performance of sustainable supply chains in multiple ways. These technologies facilitate the attainment of organizations' sustainability objectives by enhancing efficiency, transparency, and environmental accountability. First and foremost, digital transformation (DT) and smart technologies (ST) are essential for ensuring the long-term effectiveness of supply chain operations. A study has found that these technologies have a crucial impact on improving the performance of sustainable supply chains by positively affecting strategies for sustainable development, eco-innovation, and sustainable supply chain performance (Rehman Khan et al., 2022).

For the successful attainment of SSCP, it is crucial to integrate DT (Digital Transformation) and ST (Strategic Thinking), regardless of whether organizations are implementing SDS (Strategic Decision Support) and EI (Enterprise Intelligence). Furthermore, the integration of digital technologies such as transportation management systems (TMS), the internet of things (IoT), machine learning (ML), and 3D printing can enhance circular supply chain management (CSC) and enhance the overall performance of firms (Romagnoli et al., 2023). By identifying environmentally-friendly suppliers and implementing specific environmental regulations, along with ensuring the traceability and sustainability of raw materials, a Closed-Loop Supply Chain (CSC) can be fostered.

In addition, Transportation Management Systems (TMS) and Internet of Things (IoT) are highly effective technologies for efficiently managing transportation and product flow in the supply chain. Meanwhile, Machine Learning (ML) is a powerful tool for making environmentally friendly decisions, and 3D printing has the capability to prolong the lifespan of products. Furthermore, the utilization of cutting-edge technologies and the cooperation among supply chain partners during the COVID-19 pandemic have had a substantial influence on the effectiveness of sustainable supply chain operations.

A recent study by Zekhnini et al. (2022) has shown that in disrupted environments, there is significant interest in digitalization, viability, and sustainability. Furthermore, the development of industries has seen significant progress due to the implementation of digital, lean, and green capabilities. The study introduces a roadmap model that combines lean and green principles to enhance the performance of supply chains in terms of viability, sustainability, and digitalization.

Furthermore, the implementation of blockchain technology (BCT) in the healthcare sustainable supply chain has the potential to enhance the performance of the healthcare supply chain (HSCP) (Vishwakarma et al., 2023). The study discovered that Behavior Change Techniques (BCT) have a positive impact on stakeholder involvement (SI) and Health and Social Care Partnership (HSCP)

practices, resulting in enhanced HSCP. E-Commerce has a crucial role in reducing the digital divide between developed and developing countries by enhancing access to information, knowledge, and expertise. Organizations can enhance their supply chains and participate in global trade with efficiency and effectiveness, regardless of geographical boundaries (Yadav, 2015). E-Commerce bolsters the competitive edge of developing countries and alleviates poverty by facilitating extensive global connectivity through international buying and selling transactions (Luthra et al., 2018; Rogulin et al.,2021).

The online e-commerce platform enables businesses to effectively navigate a competitive global business landscape, facilitating swift business transactions, streamlined customer service, and expedited decision-making. Nevertheless, the existing literature lacks sufficient concrete models that effectively elucidate the impact of digital technologies such as Internet of Things (IoT), Blockchain, and Big Data Analytics on sustainable supply chain performance, considering their mediation through legal frameworks (Mustaffa et al., 2023; Wang et al., 2024; Gravili et al., 2018; Rehman Khan et al., 2022; Romagnoli et al., 2023; Zekhnini et al., 2022; Vishwakarma et al., 2023).

The current literature also falls short in terms of integrating the Technology-Organization-Environment (TOE) model, Resource Based Review (RBV), and Schumpeter Theory of Innovation in these explanations. This study aimed to address the knowledge gap by examining the impact of digital technologies, specifically Internet of Things (IoT), Blockchain, and Big Data Analytics, on the performance of sustainable supply chains. The study also considered the role of legal frameworks in moderating the relationships between these digital technologies. The theoretical foundations of the study were based on the Technology-Organization-Environment (TOE) framework, Resource-Based View (RBV), and Schumpeter's Theory of Innovation.

Literature Review

The Technology-Organization-Environment (TOE) model is a theoretical framework utilized to examine the implementation of technology in different business settings, such as human resources, social media marketing, technology adoption by small and medium-sized enterprises (SMEs), electronic data interchange (EDI) adoption in small businesses, and organizational adoption of augmented reality in electronic commerce (Tornatzky & Fleischer, 1990). This study utilized the TOE model due to its ability to offer a comprehensive framework for comprehending the interplay between technological, organizational, and environmental factors in influencing the adoption and effectiveness of technology within organizations across various industries and sectors.

The TOE model has been utilized in diverse studies to examine the implementation of technology in various contexts, such as human resources, supply chain financing, sustainable supply chain performance, and technology adoption by small and medium-sized enterprises (SMEs). The TOE model has been employed to examine the impact of technology, organization, and environmental conditions on the performance of small and medium enterprises (SMEs) in enhancing supply chain financing within the framework of supply chain performance analysis (Duan et al., 2022). The study discovered that the technical level preconditions have a significant impact on the high supply chain financing performance of firms.

Regarding the performance of sustainable supply chains, researchers have utilized the TOE model to construct a conceptual model that draws upon the resource-based view (RBV) and the theories of technology, organization, and environment (TOE) (Rehman Khan et al., 2022). The study identified

significant correlations between the implementation of sustainable development strategy, eco-innovation, digital transformation, smart technologies, and the performance of sustainable supply chains.

The TOE model has been employed to examine how digital technology enhances the competitiveness of export-oriented SMEs in the context of technology adoption by SMEs (Triandini et al., 2023). The study revealed that the environmental, organizational, and technological aspects have a direct, positive, and significant impact on the adoption of technology. The Technology-Organization-Environment (TOE) model is a widely utilized framework for examining technology adoption in different settings.

Nevertheless, this model does have certain drawbacks, especially when it comes to supply chain performance. For instance, the model fails to account for the dynamic characteristics of supply chains, the difficulties related to incorporating new technologies into established supply chain operations, and the involvement of human factors. Furthermore, the TOE model is deficient in its failure to account for the dynamic characteristics of supply chains. The model assumes that technology, organization, and environment are static variables that can be examined independently, without considering the intricate interconnections and interactions among these variables in actual supply chain scenarios (Duan et al., 2022).

One additional constraint of the TOE model is its emphasis on the implementation of technology, rather than its incorporation and utilization in supply chain operations. The model does not account for the complexities involved in implementing and integrating novel technologies into pre-existing supply chain procedures, nor does it address the potential disturbances that may arise from the introduction of such technologies (Chittipaka et al., 2023).

Furthermore, the TOE model fails to consider the influence of human factors on the adoption and utilization of technology. The effectiveness of incorporating technology into supply chains is contingent upon not only the technical proficiency of the technology itself, but also the competencies, expertise, and mindsets of the individuals utilizing it. The TOE model lacks a comprehensive framework for analyzing the influence of human factors in the adoption and utilization of technology (Jana & Kaushik, 2022).

Similarly, the TOE model fails to consider the wider societal and ethical consequences that arise from the implementation of technology in supply chains. When new technologies are introduced, they can have substantial effects on workers, communities, and the environment. It is crucial to take these effects into account when analyzing the adoption and utilization of technology in supply chains. The TOE model lacks a framework for analyzing the wider social and ethical consequences, as stated by Rehman Khan et al. (2022).

This study incorporated the Theory of Constraints (TOE) with the Resource-Based View (RBV) theory, considering the existing constraints. The reason for this is that RBV theory is a strategic management framework that specifically emphasizes the internal resources and capabilities of a company as the primary drivers of competitive advantage and exceptional performance. The statement implies that a company's distinct assets, such as its skilled workforce, advanced technology, strong brand image, and extensive organizational knowledge, can empower it to attain long-lasting competitive advantages over its rivals.

The study conducted by Bao-shan and Bao-bao (2008) examines the significance of resource integration capability as a key element in connecting the relationship between resource integration process and venture performance. This aligns with the RBV theory's emphasis on utilizing internal resources to achieve superior performance. The study conducted by Chang (2015) examines the

correlation between entrepreneurial orientation, communication strategies, and the success of new hi-tech products within the RBV framework. It emphasizes how internal resources and capabilities, such as entrepreneurial orientation, can contribute to the achievement of new product success (Chi, 1994; Wernerfelt,1984). In his study, Yong (2010) constructs a comprehensive model that combines the Behavioral Perspective, Intellectual View, and RBV to explain how human resource practices can positively impact firm performance. The study highlights the crucial role of human resources as an internal resource that significantly contributes to the overall performance of an organization.

Nevertheless, the Resource-Based View (RBV) theory is subject to various limitations and weaknesses. These include its fixed perspective on resources and capabilities, disregard for external resources and capabilities, neglect of knowledge and learning, oversight of organizational culture and leadership, and inattention to innovation and creativity (Cullen & Parker, 2015). RBV is subject to criticism due to its static perspective on resources and capabilities, neglecting the dynamic nature of the business environment. Over time, resources and capabilities can become outdated or irrelevant. The Resource-Based View (RBV) does not offer a framework for effectively managing this dynamic process (Cullen & Parker, 2015). Furthermore, RBV faces criticism for its failure to consider the significance of external resources and capabilities in the development of a competitive advantage (Cullen & Parker, 2015). The theory emphasizes the significance of internal resources and capabilities, while overlooking the value that external resources, such as partnerships, alliances, and networks, can bring to the firm.

In addition, RBV is subject to criticism for its insufficient consideration of the significance of knowledge and learning in the development of competitive advantage (Cullen & Parker, 2015). The theory emphasizes the acquisition of resources and capabilities, but fails to recognize the significance of knowledge and learning in establishing and maintaining a competitive advantage. In addition, RBV is subject to criticism for its failure to consider the significance of organizational culture and leadership in the development of competitive advantage (Cullen & Parker, 2015). The theory emphasizes the acquisition of resources and capabilities, but overlooks the significance of organizational culture and leadership in establishing and maintaining a competitive advantage.

Above all, RBV is ultimately criticized for its failure to consider the significance of innovation and creativity in establishing a competitive advantage. The theory emphasizes the acquisition of resources and capabilities, but fails to acknowledge the significance of innovation and creativity in establishing and maintaining a competitive advantage. This study incorporated the Schumpeter Theory of Innovation into the existing frameworks of TOE and RBV to address their limitations and weaknesses. The aim was to develop a more comprehensive approach for effectively managing sustainable supply chain performance in a dynamic business environment. Schumpeter's theory diverges from conventional economic analyses by focusing on economic transformation and advancement in capitalist societies, rather than exclusively on business cycles (Sweezy, 1943). The theory emphasizes that entrepreneurship is a crucial factor in economic growth, specifically focusing on the willingness to take risks and introduce innovative products and services (Upadhyay, 2018).

According to Schumpeter's theory, entrepreneurs are individuals who are motivated by an inclination towards innovation and are driven by the desire for personal fulfillment through entrepreneurship, rather than solely being motivated by the pursuit of profit (Peng, 2023). The theory emphasizes the significance of leadership attributes, such as foresight, managerial proficiency, and persuasive capabilities, in enabling successful entrepreneurs to navigate unpredictable innovation environments and foster novel team innovations (Peng, 2023). The Schumpeter Theory of Innovation states that entrepreneurship and innovation are crucial factors in driving economic advancement. It highlights the significant role of entrepreneurs in shaping economic development and promoting growth in contemporary economies (Sweezy, 1943; Upadhyay, 2018; Peng, 2023).

While some critics contend that the Schumpeter Theory of Innovation overemphasizes internal factors and entrepreneurial actions, disregarding the impact of external influences such as market conditions, regulatory environments, and social factors on innovation and economic development, this limitation will be addressed by the TOE model. The TOE model considers external environments, including legal frameworks, when adopting new technologies such as Internet of Things, Blockchain and Big Data Analytics (Rehman Khan et al., 2022).

The Influence of Internet of Things (IoT) on Sustainable Supply Chain Performance

The Internet of Things (IoT) greatly impacts the efficiency of supply chains in different industries and situations, such as manufacturing, vaccine distribution, and e-health. The adoption of IoT in the manufacturing industry has a positive correlation with both supply chain performance and organizational performance, as stated by Lee et al. (2022). The study concluded that the advantages of implementing IoT, such as enhanced information sharing, improved visibility, and increased efficiency, are greater than the drawbacks, which include high expenses and security issues.

The study also emphasized the role of supply chain performance in mediating the relationship between the benefits and challenges of IoT adoption and organizational performance. IoT implementation in the distribution of vaccine supply chain has a beneficial effect on the performance of the vaccine supply chain (VSC) during the COVID-19 pandemic, as stated by Kumar et al. (2022). The study revealed that the adoption of IoT enhances product management, demand management, supply management, social behavior, and government rules and regulations, resulting in enhanced vaccine distribution. Factors such as performance expectations, healthcare hazard, trust (PHT), and perceived enabling circumstances (PFC) influence the adoption of IoT in the e-health industry (Al Moteri & Alojail, 2023). The study discovered that the adoption of IoT enhances the efficiency of supply chain management in healthcare, offering valuable understanding of the capabilities and constraints of UTAUT simulation in improving logistics in healthcare 4.0.

In general, the literature indicates that the adoption of IoT has a beneficial effect on supply chain performance across different industries and situations. Nevertheless, the implementation of IoT technologies is impacted by a multitude of factors, encompassing advantages and obstacles, Personal Health Technologies (PHT) and Personal Fitness Coaches (PFC), as well as governmental policies and regulations. Hence, it is imperative to consider these factors when integrating IoT technologies into supply chain management. The Internet of Things (IoT) greatly influences the performance of sustainable supply chains by improving efficiency, transparency, and productivity. Furthermore, the implementation of IoT in the internal supply chain has demonstrated the ability to reduce work delays, optimize time usage, and enhance overall performance and productivity (Hermawan et al., 2020).

Moreover, the utilization of the Internet of Things (IoT) to enhance the performance and productivity of the internal supply chain. The implementation of IoT allows companies to automate processes and access real-time data, resulting in the streamlining of operations, waste reduction, and optimization of resource utilization. Consequently, this leads to enhanced efficiency in the supply chain. On the other hand, the Internet of Things (IoT), in conjunction with other emerging technologies such as blockchain and RFID, enhances sustainability aspects within supply chains (Varriale et al., 2021). Research has shown that incorporating the Internet of Things (IoT) into supply chain operations improves the handling of accurate and non-compliant orders, resulting in improved sustainability performance.

For example, a study conducted by Qureshi et al. (2023) has revealed that incorporating Internet of Things (IoT) into Industry 4.0 technologies has a positive impact on the efficiency and effectiveness of

manufacturing supply chains. The Internet of Things (IoT), along with other innovative technologies, has a significant impact on different types of supply chains, such as lean, agile, and green supply chains. Integrating these processes results in enhancements in the time it takes to complete a task, reducing expenses, increasing adaptability, flexibility, and ability to respond to market needs, ultimately improving the overall performance of the supply chain. Although previous studies did not specifically examine the indirect impact of the Internet of Things (IoT) on the performance of sustainable supply chains, this study projected that the IoT would have a direct influence on Big Data Analytics (BDA) and an indirect influence on the performance of sustainable supply chains (SSCP).

H_{1a}: Internet of Things (IoT) directly and positively influences Big Data Analytics (BDA)
H_{1b}: Internet of Things (IoT) indirectly and positively influences sustainable supply chain performance (SSCP) through Big Data Analytics (BDA)

The Influence of Blockchain on Sustainable Supply Chain Performance

Blockchain technology has been discovered to have a substantial beneficial influence on supply chain performance across diverse industries. Blockchain and smart inventory systems have demonstrated a substantial beneficial effect on supply chain performance in the retail sector (Kurdi et al., 2022). Similarly, a study conducted by Jum'a (2023) has revealed that the implementation of blockchain technology in the manufacturing industry has resulted in notable improvements in productivity, lead times, customer service, and relationships with supply chain partners. These enhancements have ultimately led to an overall improvement in supply chain performance. In addition, blockchain technology has been discovered to improve hospital supply chain performance in the healthcare sector by enhancing privacy, safety, and transparency (Alyami et al., 2023).

Blockchain technology and big data analytics have been discovered to indirectly improve supply chain performance in the chemical and cosmetic industries by facilitating supply chain risk management (Ceptureanu et al., 2021). The characteristics of blockchain technology, including transparency of information, immutability of information, and smart contracts, have been found to have substantial positive impacts on the growth of partnerships and marginal impacts on the efficiency of partnerships, thereby influencing the outcomes of supply chain performance (Kim & Shin, 2019).

A study by Jum'a (2023) has shown that implementing blockchain technology in supply chain applications can enhance productivity, reduce lead times, improve customer service, and strengthen relationships with supply chain partners. This ultimately leads to improved overall supply chain performance (Jum'a, 2023). Blockchain technology has been found to have a positive impact on supply chain variables and technology transfer in medium-sized enterprises in the Information Technology and Communication (IT&C) sector. This, in turn, directly affects the performance of these firms (Ceptureanu et al., 2021).

The study conducted by Jum'a (2023) has revealed that the implementation of blockchain technology in supply chain operations has a significant impact on the efficiency and growth of supply chain partnerships, ultimately affecting the overall performance outcomes of the supply chain. In general, blockchain technology has been observed to have a substantial beneficial influence on supply chain performance across different sectors, resulting in enhanced productivity, reduced lead times, improved customer service, strengthened relationships with supply chain partners, and enhanced overall firm performance. Utilizing supply chain applications enabled by blockchain technology and implementing blockchain technology in supply chain activities has been shown to enhance supply chain performance outcomes.

Wang et al. (2023) demonstrated that blockchain, through its decentralized and secure platform, guarantees transparency, traceability, and reliability in the supply chain by recording transactions. The transparency results in enhanced operational management, decreased errors, and increased trust among stakeholders. Furthermore, blockchain has a significant influence on the performance of sustainable supply chains by encouraging environmentally friendly practices and initiatives focused on sustainability. Research has emphasized the potential of blockchain technology to transform supply chain management by enhancing sustainability through the effective monitoring of transactions and products (Wang et al., 2023).

This feature allows companies to monitor and optimize their processes, minimize inefficiencies, and improve their environmental stewardship. Likewise, the impact of Blockchain technology on the performance of sustainable supply chains extends beyond a specific industry. For example, the integration of blockchain technology in the automotive industry has shown favorable results in terms of supply chain integration and sustainability performance (Kamble et al., 2023). Additionally, blockchain technology has also had a positive impact on the tea supply chain, demonstrating enhancements in sustainable performance (Paul et al., 2021). Although the existing literature acknowledges the direct impact of blockchain on sustainable supply chain performance, this study posited that blockchain would have a direct influence on Big Data Analytics and an indirect influence on the performance of the sustainable supply chain.

$H_{2a:}$ Blockchain (BC) directly and positively influences Big Data Analytics (BDA)
$H_{2b:}$ Blockchain (BC) indirectly and positively influences sustainable supply chain performance (SSCP) through Big Data Analytics (BDA)

The Influence of Big Data Analytics on Sustainable Supply Chain Performance

The impact of Big Data Analytics on supply chain performance has been thoroughly examined in different scenarios, specifically in the manufacturing industry. Studies have demonstrated a significant correlation between Big Data Analytics Capability (BDAC) and both Supply Chain Innovation (SCI) and Supply Chain Performance (SCP). The study conducted by Al-Khatib and Ramayah (2023) found that BDAC has a positive impact on SCI, which in turn has a positive influence on SCP. This suggests that SCI acts as a mediator between BDAC and SCP. Moreover, the connection between BDAC (Big Data Analytics Capabilities), SCI (Supply Chain Integration), and SCP (Supply Chain Performance) is influenced by a data-driven culture (DDC), which amplifies the effect of Big Data Analytics on supply chain performance in the manufacturing sector (Al-Khatib & Ramayah, 2023).

Moreover, research has indicated that BDAC can enhance supply chain performance by improving supply chain resilience, supply chain innovation, green radical supply chain innovation (GRSCI), green incremental supply chain innovation (GISCI), and green supply chain performance (GSCP) (Bahrami et al., 2022; Wael AL-Khatib, 2022; AL-Khatib, 2022). The crucial factors that connect BDAC to enhanced supply chain performance outcomes in various sectors and industries are the mediating roles of supply chain resilience, supply chain innovation, GRSCI, and GISCI. The research findings highlight the substantial positive influence of Big Data Analytics on supply chain performance through the improvement of innovation, resilience, and efficiency in supply chain operations.

Utilizing Big Data Analytics capabilities has been proven to enhance supply chain performance outcomes, underscoring the significance of harnessing data-driven insights to optimize supply chain processes and gain competitive advantages in diverse business settings. Previous research has examined the role of Big Data Analytics Capabilities (BDAC) in influencing supply chain performance (SCP) in different contexts, such as the manufacturing sector (Bahrami et al., 2022; Al-Khatib & Ramayah, 2023;

AL-Khatib, 2022). The results suggest that there is a favourable correlation between BDAC and SCP, and this correlation is influenced by the presence of supply chain innovation (SCI) and green innovation. Furthermore, the level of technological advancement influences the connection between green innovation and the performance of the green supply chain (AL-Khatib, 2022).

The study by Bahrami et al. (2022) examined the impact of BDAC on supply chain performance, specifically through the mediating effects of supply chain resilience and innovation. The findings revealed that BDAC enhances supply chain performance by fostering resilience and innovation within the supply chain. In addition, Qadir (2021) conducted a study that revealed the application of predictive analytics to big data has a beneficial effect on the efficiency of supply chains, consequently leading to improved organizational performance (Qadir, 2021).

Similarly, the impact of Big Data Analytics (BDA) on the performance of sustainable supply chains is substantial, as demonstrated by numerous studies. For example, Bag et al. (2020) demonstrated that BDA has the potential to improve operational excellence and thereby enhance the performance of sustainable supply chains. Moreover, through the examination of substantial amounts of data, organizations have the ability to enhance their supply chain procedures, minimize inefficiencies, and enhance the utilization of resources (Bag et al., 2020).

Likewise, the research conducted by Edwin Cheng et al. (2022) demonstrated that Big Data Analytics (BDA) plays a crucial role in promoting the adoption of circular economy (CE) practices, which subsequently leads to the development of a flexible and sustainable supply chain (SSC). The flexibility of the system is enhanced by the capabilities of Big Data Analytics (BDA), resulting in enhanced performance of the Supply Chain System (SSC) (Edwin Cheng et al., 2022). To clarify, BDA has the ability to strengthen environmentally friendly production practices and improve the overall performance of sustainable businesses. The significance of corporate reputation and supply chain innovativeness in this context is also moderated by Waqas and Tan (2023).

Furthermore, Jalil et al. (2023) argue that Big Data Analytics (BDA) has the ability to mitigate the effects of post-COVID-19 on the management of environmentally friendly supply chains and the performance of sustainable E-commerce (Jalil et al., 2023). Similarly, the ability to analyze big data can have a beneficial influence on the effectiveness of a sustainable supply chain by means of the intermediate effects of entrepreneurial orientation, which encompasses qualities such as creativity, initiative, and willingness to take risks.

Nevertheless, the correlation between BDA capability and risk-taking is inversely proportional, suggesting that technology might not enhance the ability to take risks (Tipu & Fantazy, 2023). This study hypothesized that Big Data Analytics (BDA) would act as a positive mediator in the relationships between Legal Frameworks (LF), Internet of Things (IoT) and Sustainable Supply Chain Performance (SSCP), based on evidence from previous literature. Similarly, Big Data Analytics (BDA) was predicted to influence directly Sustainable Supply Chain Performance (SSCP).

- $H_{3a:}$ *Big Data Analytics (BDA) mediates Internet of Things (IoT) towards Sustainable Supply Chain Performance (SSCP)*
- $H_{3b:}$ *Big Data Analytics (BDA) mediates Blockchain (BC) towards Sustainable Supply Chain Performance (SSCP)*
- $H_{3c:}$ *Big Data Analytics (BDA) mediates Legal Frameworks (LF) towards Sustainable Supply Chain Performance (SSCP)*

H_{3d}: Big Data Analytics (BDA) mediates Legal Frameworks (LF) x Internet of Things (IoT) towards Sustainable Supply Chain Performance (SSCP)

H_{3e}: Big Data Analytics (BDA) mediates Legal Frameworks (LF) x Blockchain (BC) towards Sustainable Supply Chain Performance (SSCP)

H_{3f}: Big Data Analytics (BDA) directly and positively influences Sustainable Supply Chain Performance (SSCP)

The Moderating Effect of Legal Frameworks on The Relationship Between Digital Technologies and Sustainable Supply Chain Performance

The existing literature has not explicitly addressed the moderating effects of legal frameworks on the relationship between digital technologies and supply chain performance. The literature acknowledges the significance of legal frameworks in the implementation of digital technologies in supply chains. The review of digitalization in supply chains emphasizes the necessity of a legal framework to tackle concerns like data privacy and security (Ghode & Dahole, 2021). Furthermore, a comprehensive analysis of existing literature on the factors that facilitate digital manufacturing supply chains highlights legal frameworks as one of the four key perspectives that must be considered to achieve successful implementation (Weerabahu et al., 2021). Therefore, legal frameworks play a crucial role in the development of predictive models that adhere to data protection regulations in the field of predictive analytics (Kim et al., 2024).

Furthermore, the impact of digital transformation and the integration of supply chains on the overall performance of sustainable supply chains emphasizes the necessity of legal frameworks to guarantee ethical and sustainable practices in supply chains (Oubrahim et al., 2023). Furthermore, the findings of prior research fail to specifically examine how legal frameworks influence the connection between digital technologies and the performance of sustainable supply chains. Nevertheless, they offer valuable perspectives on the correlation between digital transformation, sustainable supply chain management, and performance evaluation.

The study conducted by Oubrahim et al. (2023) emphasizes the beneficial influence of digital transformation (DT) on the integration of supply chain (SCI) and the overall performance of a sustainable supply chain (OSSCP). The study also shows that spinal cord injury (SCI) plays a role in the connection between dysfunctional thinking (DT) and overall self-perceived social competence (OSSCP). This discovery implies that legal frameworks have the potential to regulate this connection by establishing guidelines and regulations for the adoption and implementation of digital technologies in supply chains.

Furthermore, the research conducted by Kumar et al. (2023) highlights the significance of sustainable supply chain management (SSCM), technology adoption (TA), and performance measurement in advancing sustainability and enhancing supply chain performance. The study presents a framework for attaining sustainable development goals through Sustainable Supply Chain Management (SSCM), which can be implemented across different industries. Legal frameworks can contribute to ensuring adherence to sustainability standards and practices, thereby improving the efficacy of the suggested framework. The study conducted by Zekhnini et al. (2022) examines the influence of Industry 4.0 technologies on the efficiency of supply chains. It also presents a roadmap model that combines lean and green practices to enhance the sustainability and digital performance of supply chains. The implementation of these practices and the integration of digital technologies in supply chains may be affected by legal frameworks. The study conducted by Stroumpoulis and Kopanaki (2022) investigates the correlation between sustainable supply chain management and digital transformation by implementing various technologies such as blockchain, big data analytics, and the Internet of Things. The objective of the study was to create a theoretical structure for elucidating the influence of these technologies on the sustainable

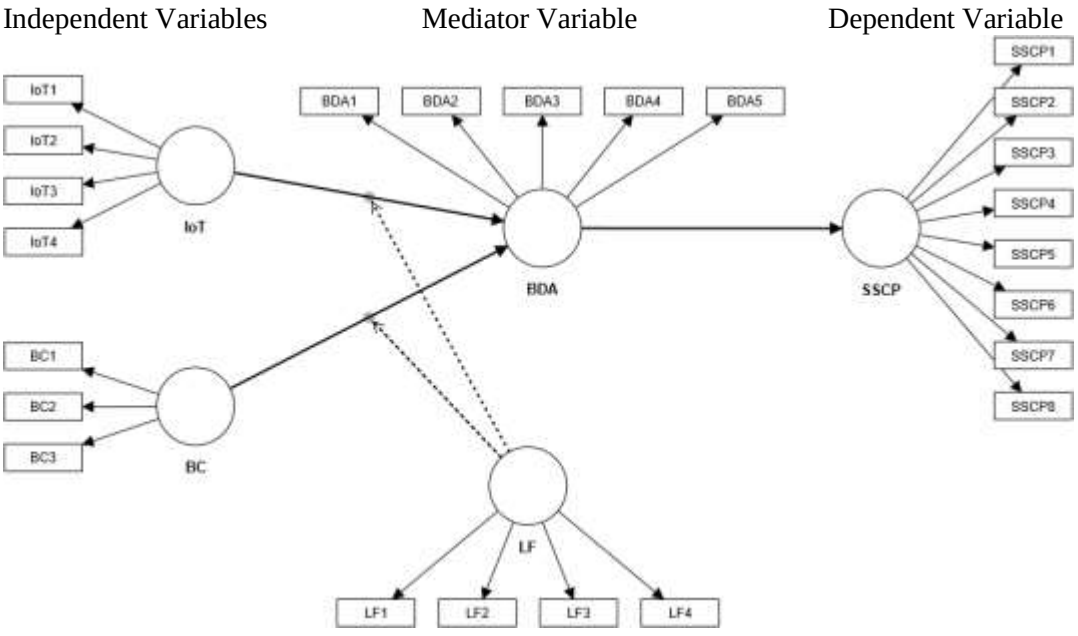
performance of supply chains. Incorporating legal frameworks into this conceptual framework would enhance the understanding of the correlation between digital technologies and sustainable supply chain performance.

Conversely, the research conducted by Jansen et al. (2024) centers around supply chain finance within a digital and sustainable context, highlighting the significance of IT platforms in enhancing liquidity, efficiency, and value generation. The design and implementation of these IT platforms may be affected by legal frameworks, which would ensure that they adhere to sustainability standards and practices. Although the specific impact of legal frameworks on the connection between digital technologies and sustainable supply chain performance has not been directly examined, this study proposed the hypothesis that legal frameworks would play a moderating role in the successful adoption and implementation of digital technologies for sustainable supply chain performance.

H_{4a}: Legal frameworks moderate the relationships of Internet of Things (IoT) and Big Data Analytics (BDA) towards Sustainable Supply Chain Performance (SSCP)
H_{4b}: Legal frameworks moderate the relationships of Blockchain (BC) and Big Data Analytics (BDA) towards Sustainable Supply Chain Performance (SSCP)

Conceptual Model of the Study

The conceptual model of this study was formulated by integrating the insights from previous empirical research and the theoretical underpinnings of the study, which draw upon the Technology-Organization-Environment (TOE) framework, Resource-Based View (RBV), and Schumpeter's Theory of Innovation. The study's conceptual model is illustrated in Figure 1.



Key
----------▶ Empirical and Theoretical Gaps
Source: Author
Figure 1: Study's Conceptual Model

The Mathematical Model of the Study

Figure 1 depicts the study's use of the mathematical equation x = lY + e to illustrate the relationships between latent variables and their visible indicators. The variable x represents the observable indication, whereas Y represents the hidden variable. The loading coefficient (l) is a statistical metric that measures the degree of correlation between the observable dependent indicator x and the latent independent variable Y. The variable e represents the stochastic measurement error (Shatta & Mabina, 2024; Sarstedt et al., 2022; Shatta, 2023).

Methodology

The necessity of testing research hypotheses drove the adoption of positivist philosophy. Furthermore, the study used descriptive and explanatory cross-sectional survey research methods to gather information from a specific sample of buyers from procuring entities, suppliers, service providers, and contractors based in Tanzania. This is because data was collected once and only a subset of this unit was examined (Creswell and Plano, 2018). Similarly, this study used a survey approach to collect data and analyze it quantitatively using descriptive and inferential statistics. Nonetheless, this study used the tenth rule proposed by Hair et al. (2019) to estimate the appropriate sample size needed to test the study model's hypotheses with PLS-SEM and SmartPLS 4 software. According to Hair et al. (2019), the tenth rule of thumb states that the minimum sample size required to evaluate the hypotheses of a given research model is ten times the highest number of exogenous construct indicators. In this study, the exogenous constructs with the most indicators were Internet of Things (IoT) and legal frameworks (LF), which each had four indicators as shown in Figure 1. According to the tenth rule of thumb, a sample size of 410 respondents was deemed sufficient for evaluating the hypotheses of this study because it exceeded the minimum number of respondents required. In addition, closed-ended questionnaires were assigned numerical values to improve the efficiency and accuracy of quantitative data processing. The quantitative data collected for the respondents' profiles was analyzed using descriptive statistics in IBM SPSS Statistics Software Version 26. To test the hypotheses, inferential statistical analysis was carried out using Partial Least Squares Structural Equation Modeling (PLS-SEM) and the SmartPLS 4 software. The SmartPLS 4 application addressed missing data by employing the extra response technique. This study substituted the value 99 for the missing values discovered in the surveys. However, this technique helped to create a structured separation of observed and unobserved data (Hair et al., 2019).

Model Evaluation

The reflecting models were evaluated using Partial Least Squares Structural Equation Modeling (PLS-SEM). This decision was made based on the constructs and indicators in the conceptual model of the study shown in Figures 1. Because all indicators were dependent on their constructs, a reflecting model was selected for this study (Hair et al., 2019). Furthermore, the measurement and structural models of the proposed research model were assessed using the criteria established by Hair et al. (2019). The evaluation of reflective measurement models involved numerous steps. First, the indicators' reliability was evaluated, with a requirement that the value be greater than 0.708. Second, the internal consistency reliability of the composite reliability of constructs was assessed using a criterion greater than 0.708. Third, the convergent validity of the constructs was evaluated using the Average Variance Extracted (AVE) value, which had to be greater than 0.5. Finally, the discriminant validity was determined using the Heterotrait-Monotrait Ratio of Correlations (HTMT) criteria, which required a value of less than 0.9. In addition, the constructs' collinearity in the structural model was assessed. According to Hair et al. (2019), VIF values should be 3 or lower. After accounting for collinearity, the key variables used to evaluate the

structural model in PLS-SEM were as follows. Path coefficients with a significance level are acceptable if the t-statistic is greater than 1.96 at a significance level of 0.05 for all paths, and p-values of 0.05 or lower are considered significant (Hair et al., 2019). Similarly, R^2 values of 0.75, 0.50, and 0.25 are considered significant, moderate, and weak, respectively (Hair et al. 2019). Overall, the evaluation results for both the measurement and structural models were positive, meeting all of the criteria set by Hair et al. (2019).

Results

Demographic Characteristics of the Respondents

Table 1 shows statistics on respondents' gender, age group, education level, and experience. roughly 57 percent of the responders were men, while roughly 43 percent were women. Furthermore, the vast majority of participants, almost 86 percent, were between the ages of 31 and 50. Furthermore, almost 60% of the respondents had a bachelor's or master's degree. However, many participants had prior experience with public procurement process as buyers or suppliers or service providers or contractors, spanning from one to ten years, accounting for around 69 percent of the total. These results imply that the data collected were genuine.

Table 1:Demographic Characteristics of the Respondents (n=410)

Characteristics		**Frequency**	**Percentage (%)**
Sex	Male	235	57.3
	Female	175	42.7
Age Group	21-30	11	2.7
	31-40	202	49.3
	41-50	151	36.8
	51-60	32	7.8
	61+	14	3.4
	Secondary Education	42	10.2
Education	Certificate Level	54	13.2
	Diploma Level	68	16.6
	Bachelor Degree	180	43.9
	Master’s Degree	66	16.1
Experience	1-10	284	69.3
	11-20	110	26.8
	21-30	14	3.4
	31+	2	0.5

Indicator's Reliabilities, R^2 Values and Relevance of the Path Coefficients

After using the PLS-SEM method with SmartPLS 4 software, it was discovered that the loadings of all indicators for the constructs exceeded the recommended threshold of 0.708, as proposed by Hair et al. (2019). The R^2 values of 0.526 and 0.584 indicate that exogenous variables (Internet of Things (IoT), Blockchain (BC), and legal frameworks (LF) can account for approximately 52.6 percent of the variation in Big Data Analytics (BDA). Furthermore, the study discovered that a significant proportion, specifically 58.4 percent, of the variation in sustainable supply chain performance (SSCP) can be attributed to the combined impact of Internet of Things (IoT), Blockchain (BC), and legal frameworks (LF), with Big Data Analytics (BDA) acting as a mediator. Furthermore, all suggested influences had positive path coefficients, indicating that a one-standard deviation increase in the exogenous constructs (Internet of Things (IoT), Blockchain (BC), and legal frameworks (LF), as well as the mediator Big Data Analytics (BDA), resulted in an increase in the level of sustainable supply chain performance (SSCP). Figure 2 depicts the indicators' reliability, R^2 values, and path coefficient relevance.

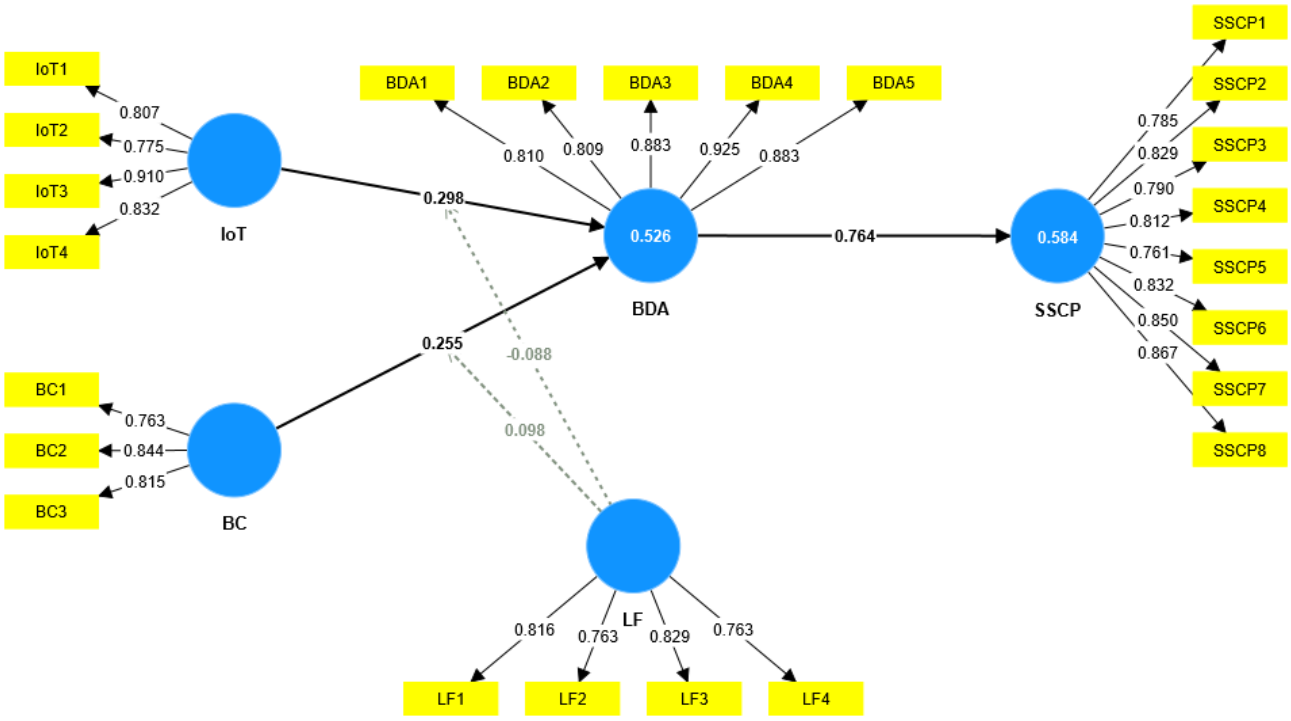


Figure 2: Indicator's Reliabilities, R^2 Values and Relevance of the Path Coefficients

Reliability and Convergent Validity Analysis Results

According to the findings of Hair et al. (2019), a construct is considered reliable if its composite reliability (CR) score exceeds 0.708. Furthermore, for a construct to have convergent validity, its Average Variance Extracted (AVE) value must be greater than 0.5. This study assessed the reliability of all constructs using composite reliability (CR) values, which were found to be greater than 0.708. Furthermore, the convergent validity of all constructs was evaluated using the Average Variance Extracted (AVE) value, which was greater than 0.5. The findings show that this study observed positive response patterns, with each component contributing to explaining the variation in its respective item (Hair et al., 2019). Table 2 shows the reliability and validity of the constructs.

Table 2: The Reliability and Validity Values of the Constructs

	Composite Reliability (CR)	Average Variance Extracted (AVE)
BC	0.849	0.653
BDA	0.936	0.745
IoT	0.900	0.693
LF	0.872	0.629
SSCP	0.941	0.667

Discriminant Validity Analysis (HTMT Results)

The HTMT values for all influences examined in the research model were less than 0.90, as shown in Table 3. The findings show that each component in the study model was empirically distinct from the other components in the structural model, as suggested by Hair et al. (2019).

Table 3: Discriminant Validity Analysis (HTMT Results)

	BC	BDA	IoT	LF	SSCP
BC	0.808				
BDA	0.606	0.863			
IoT	0.538	0.601	0.832		
LF	0.693	0.633	0.556	0.793	
SSCP	0.654	0.764	0.511	0.588	0.817

Collinearity Statistics by VIF Metric for Inner Model

Collinearity data was analyzed using the Variance Inflation Factor (VIF) metric. However, Hair et al. (2019) discovered that VIF values less than 5 indicate the absence of collinearity problems in the predictor constructs of the proposed research model. Table 4 shows the statistical findings for collinearity in the inner model of the recommended study model. The VIF metric was used, and values less than 4 indicate that there were no issues with collinearity in the predictor structures.

Table 4: Collinearity Statistics (VIF) for Inner Model

	BDA	SSCP
BC	2.115	
BDA		1.000
IoT	1.628	
LF	2.299	
LF x BC	3.284	
LF x IoT	3.436	

Statistical Significance Results for the Hypothesized Relationships

Bootstrapping from SmartPLS 4 validated all suggested relationships with p-values < 0.05, indicating that this study's conceptual research model is appropriate for management decision-making regarding the influence of digital technologies on sustainable supply chain performance. These phenomena support the existence of all hypothesized relationships. Figure 3 shows the statistical significance results for the hypotheses.

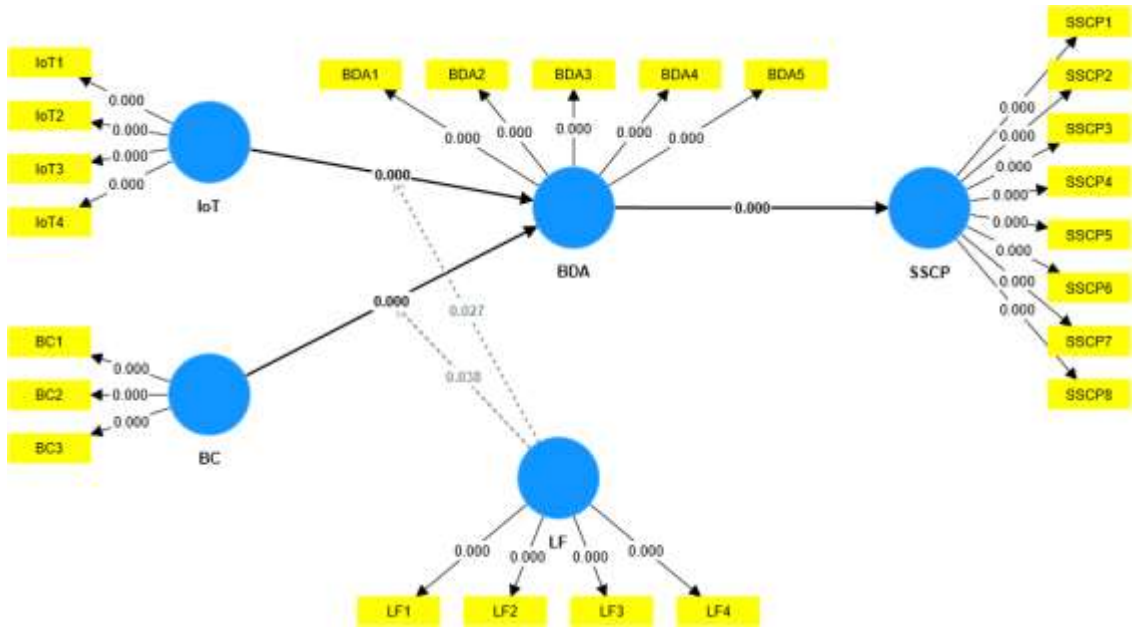


Figure 3: Statistical Significance of the Hypothesized Relationships

Indirect Statistical Significance Results of the Hypotheses

Table 5 summarizes the findings obtained by evaluating the indirect assumptions derived from the study's theoretical framework. The bootstrapping report created with SmartPLS 4 software yielded statistically significant results for all indirect predictions (p-values <0.05). This suggests that the constructs in the model especially the mediator and moderator have real-world connections, and that the validated model can be effectively applied to decision-making regarding the variables influencing the effectiveness of sustainable supply chains, especially with regard to the interactions between digital technologies and legal frameworks.

Table 5: Indirect Statistical Significance Results of the Hypotheses

	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Remark
BC -> BDA -> SSCP	0.038	5.172	0.000	Supported
LF -> BDA -> SSCP	0.042	5.190	0.000	Supported
LF x BC -> BDA -> SSCP	0.036	2.069	0.039	Supported
IoT -> BDA -> SSCP	0.051	4.496	0.000	Supported
LF x IoT -> BDA -> SSCP	0.030	2.210	0.027	Supported

Total Effects of Statistical Significance Results of the Hypotheses

A summary of the results from assessing the overall effects (direct and indirect assumptions) derived from the study's theoretical framework is shown in Table 6. It was discovered that the total effects of the predictions had statistically significant results (p values < 0.05) after the bootstrapping report was created using the SmartPLS 4 software. This implies that the connections observed in the model are present in actual circumstances and that the validated model can be effectively applied to decision-making concerning sustainable supply chain performance.

Table 6: Total Effects of Statistical Significance Results of the Hypotheses

	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P values	Remark
BC -> BDA	0.049	5.243	0.000	Supported
BC -> SSCP	0.038	5.172	0.000	Supported
BDA -> SSCP	0.026	28.901	0.000	Supported
IoT -> BDA	0.062	4.818	0.000	Supported
IoT -> SSCP	0.051	4.496	0.000	Supported
LF -> BDA	0.056	5.029	0.000	Supported
LF -> SSCP	0.042	5.190	0.000	Supported
LF x BC -> BDA	0.047	2.075	0.038	Supported
LF x BC -> SSCP	0.036	2.069	0.039	Supported
LF x IoT -> BDA	0.040	2.214	0.027	Supported
LF x IoT -> SSCP	0.030	2.210	0.027	Supported

Importance-Performance Map Analysis Results

Figure 4 shows that Big Data Analytics (BDA) is the most important and best option for implementing sustainable supply chain performance (SSCP) based on its position in the first quadrant. Because of this result, implementing Big Data Analytics (BDA) needs to be given more attention and resources in order to ensure long-term sustainable supply chain performance (SSCP). However, still, the factors of Internet of Things (IoT), Blockchain (BC), and legal frameworks (LF) are rated less important in implementing sustainable supply chain performance (SSCP) due to their position in the second quadrant. This means that these constructs don't have a big effect on the target construct supply chain performance (SSCP). When implementing supply chain performance (SSCP), these constructs are also important because they are above the average on the performance map of the main focus construct, which is supply chain performance (SSCP).

Figure 4: Importance-Performance Map Analysis Results

Discussion

The results in Figure 4 show strong proof that the proposed study model is perfect for making decisions, especially when it comes to allocating resources in Big Data Analytics (BDA) to sustainable supply chain performance (SSCP).

The Hypotheses Tested

The study's first idea was that the Internet of Things (IoT) would have a positive and direct effect on Big Data Analytics (BDA) and an indirect effect on the performance of the sustainable supply chain (SSCP). Figure 2 shows that there were path coefficients that were positive. This means that an increase of one standard deviation in the Internet of Things (IoT) caused both Big Data Analytics (BDA) and sustainable supply chain performance (SSCP) to go up, and the other way around too. The results in Table 6 also showed that there were statistically significant direct and indirect effects at a level below 0.05 (p value <0.05). Indeed, these results show that the expected relationships do exist in real life. Furthermore, these results support what other studies have found (Lee et al., 2022; Kumar et al., 2022; Al Moteri & Alojail, 2023; Hermawan et al., 2020; Varriale et al., 2021; Qureshi et al., 2023) that the Internet of Things (IoT) is a key part of achieving sustainable supply chain performance by boosting efficiency, sustainability, and overall performance through automation, real-time data insights, and better operational performance.

This research also predicted that Blockchain (BC) would have a positive and direct effect on Big Data Analytics (BDA), and it would also have an indirect effect on the performance of the sustainable supply chain (SSCP). Figure 2 showed that there were positive path coefficients. This meant that if Blockchain (BC) went up by one standard deviation, Big Data Analytics (BDA) and sustainable supply chain performance (SSCP) would get better, and the other way around. As shown in Table 6, the study's results show that Blockchain (BC) has a positive and statistically significant effect on both Big Data Analytics (BDA) and the performance of the sustainable supply chain (SSCP). This study's results agree with those of earlier ones (Kurdi et al., 2022; Jum'a, 2023; Alyami et al., 2023; Ceptureanu et al., 2021; Wang et al., 2023; Kamble et al., 2023; Paul et al., 2021). These studies show that Blockchain (BC) technology is very important for improving the performance of sustainable supply chains. It does this by making them more efficient, open, and committed to sustainable practices. It also helps with operational management across many different industries. Finally, its decentralized nature, dependability, and honesty make the supply chain ecosystem more sustainable and effective.

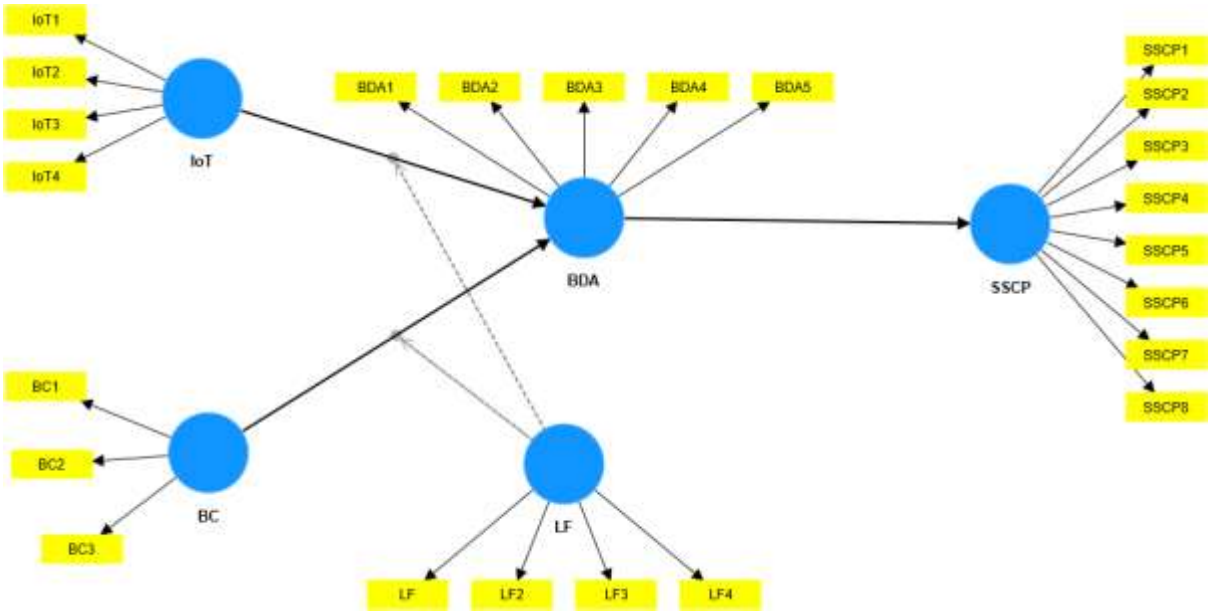
Similarly, the study thought that Big Data Analytics (BDA) would have a direct and positive effect on the sustainable supply chain performance (SSCP) and would act as a mediator between the Internet of Things (IoT), Blockchain (BC), and the legal frameworks (LF). The results in Figure 2 support a positive path coefficient, which means that a one-standard deviation rise in Big Data Analytics (BDA) will result in an improvement in the sustainable supply chain performance (SSCP), and the other way around. Additionally, Tables 5 and 6 show that Big Data Analytics (BDA) has a significant positive effect on sustainable supply chain performance (SSCP) and acts as a positive mediator between the Internet of Things (IoT), Blockchain (BC), and the legal frameworks (LF). Previous studies (Bahrami et al., 2022; Wael AL-Khatib, 2022; AL-Khatib, 2022; Al-Khatib & Ramayah, 2023; Qadir, 2021; Bag et al., 2020; Edwin Cheng et al., 2022; Waqas & Tan, 2023; Jalil et al., 2023; Tipu & Fantazy, 2023) have shown that Big Data Analytics (BDA) is a key part of improving sustainable supply chain performance by improving operational excellence and making SSC more flexible. The entrepreneurial orientation's mediating effects, such as being creative, proactive, and willing to take risks, also help BDA have a positive effect on SSCP.

Above all, this study hypothesized that the legal frameworks would directly and positively affect the connections between the Internet of Things (IoT) and Big Data Analytics (BDA). In the same way, the

study thought that the legal frameworks would directly and positively affect the connections between Blockchain (BC) and Big Data Analytics (BDA). The findings in Figure 2 support both a positive and negative path coefficient. They show that if the legal frameworks got better by one standard deviation, Big Data Analytics (BDA) would get better too, and the other way around as well. Additionally, Tables 5 and 6 show that the legal frameworks have a significant positive effect (p value < 0.05) on the connections between the Blockchain (BC) and Big Data Analytics (BDA), as well as the connections between the Internet of Things (IoT). Based on these findings, legal frameworks might be able to help balance this relationship by setting rules and guidelines for how digital technologies can be used in supply chains, making sure that sustainability standards and practices are followed, and having an impact on how IT platforms are designed and put in place. Other studies (Ghode & Dahole, 2021; Weerabahu et al., 2021; Kim et al., 2024; Oubrahim et al., 2023; Kumar et al., 2023; Zekhnini et al., 2022; Stroumpoulis & Kopanaki, 2022; Jansen et al., 2024) have found different results. These earlier studies didn't directly look at how legal frameworks affect the relationship between digital technologies and sustainable supply chain performance. They do, however, give us useful information about how digital transformation, sustainable supply chain management, and measuring performance are all connected.

Theoretical Contribution

This study successfully addressed the need for a specific model that defines the factors influencing the performance of a sustainable supply chain, with legal frameworks acting as moderators. This paradigm is absent from the current collection of empirical and theoretical literature. The study aims to analyze the influence of Big data analytics (BDA) as a mediator, along with the predictive attributes of Legal Frameworks (LF), Internet of Things (IoT) and Blockchain (BC), on the performance of sustainable supply chains (SSCP). The research employs the Technology-Organization-Environment model, Resource Based Review, and Schumpeter Theory of Innovation. However, these models currently do not have a specific framework that fully understands the role of a moderator and mediator in achieving sustainable supply chain performance (SSCP). Figure 5 illustrates a verified model that explains the function of a moderator and mediator in attaining sustainable supply chain performance (SSCP).



Key

----------▶ Empirical and Theoretical Contribution

Figure 5: Validated model.

Social Implications

In Figure 5, it was proven that Big Data Analytics (BDA) mediates the connections between legal frameworks (LF), other digital technologies (the Internet of Things (IoT) and Blockchain (BC)), and sustainable supply chain performance (SSCP). These results show that Big Data Analytics (BDA) is very important for improving the long-term performance of the supply chain. Similarly, the statistical position of legal frameworks in terms of direct and indirect effects shows that these factors are always important for implementing digital technologies and making supply chains more sustainable.

Limitation and Recommendation for Future Research

This study used a quantitative approach and a cross-sectional survey design to predict the increase in sustainable supply chain performance (SSCP) using a small number of digital technologies (Big Data Analytics (BDA) as a mediator, as well as the predictive attributes of the legal frameworks (LF), Internet of Things (IoT) and Blockchain (BC)). Figure 2 shows that the combined use of these digital technologies accounted for only 58.4% of the observed variation in sustainable supply chain performance. The current study suggests that future research take a mixed approach and include more digital technologies like Artificial Intelligence (AI), Augmented Reality (AR), Predictive Analytics, and robots. This method should be used to increase the variance of sustainable supply chain performance (SSCP) while also broadening the validated model's application. Furthermore, the study only included Tanzanian participants. Future research should include respondents from multiple countries to improve the validated model's generalizability in predicting the factors influencing sustainable supply chain performance (SSCP).

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