"The Impact of Digital Supply Chain Implementation on Supply Chain Performance. The Mediating Role of Technology-Based Decision"

By:

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Degree: MBA (Supply Chain)

Research Supervisor: Miss JaveriaAftab

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Majors: SCM-45

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Abstract

In a time of globalization and fast technological progress, digitalization has become an important way for many industries to improve their efficiency and gain a competitive edge. The important thing to look at here is how technology is used in the decision-making process so that we can see how adopting a digital supply chain affects the success of the supply chain. Artificial intelligence (AI), the Internet of Things (IoT), and big data analytics are some technologies that, when adopted and used, will help a company make better decisions, which will lead to better supply chain performance.

A quantitative research approach and an organized questionnaire were used to get information from 196 people who work in the pharmaceutical industry in companies that make supply chain management products. We use descriptive, correlational, and regression methods to find out how strongly information technology supports digital supply chain management, how technology helps people make decisions, and how efficient and effective the supply chain is. According to Price Waterhouse Coopers, implementing a digital supply chain does not improve supply chain performance by itself, but it does improve performance when combined with technology-based decision-making. This paper shows that Technology Based Management can help balance the relationship between how digitalized a supply chain is and how well it works. It also stresses how important it is for digital supply chains to accept and use new, cutting-edge technologies.

Based on what we've learned so far, managers should think about investing in the newest technologies, making sure that technology is properly integrated into supply chains, making them safer, and more environmentally friendly, and filling any gaps in the supply chain workforce. The literature on supply chain management and related studies has been improved by these results, which have important effects on both theory and practical issues. This is

especially true as the world becomes more digital. For more research, we should focus on certain technologies, look at the top buyers and sellers of the future, do cross-industry studies, and use continuous studies to see how long digital supply chain efforts last.

Contents

The Impact of Digital Supply Chain Implementation on Supply Chain Performance. The Mediating Role of Technology-Based Decision

Chapter 1. Introduction

The global World has been experiencing changes that gulp technological improvements and globalization and thus digitization emerges as key in operation efficiency as well as competitive advantage. The incorporation of digital technology in the supply chain processes that is also referred to as Digital Supply Chain is a new era of supply chain method compared to other conventional practices of supply chain management. This revolution is not strictly seen as an adaptation to the current conditions and market imperatives but as a way to optimize the supply chain operation as a whole. This paper aims to propose how the implementation of a Digital Supply Chain Influences Supply Chain performance considering the moderating role of Technology-Based Decision-making. Integration of technologies like AI, IoT, and big data analytics helps in decision-making that is timely, accurate, and relevant in directing the supply chain processes toward better performance.

1.1. Background:

Modern paradigms of globalization and constant technology growth have placed digitalization at the core of improving business effectiveness and creating possibilities for competitive advantages across sectors. Bearing Point has established the market forecast for 2015 that currently over a quarter of the world's population shows activity on the internet and many of them use social networks including Facebook, Instagram, and Twitter. Likewise, this digital interaction trend is reflected in the business environment where nearly half the organizations are deploying advanced data analytical capabilities in their business processes (Bearing Point, 2015). In this context, it is necessary to mention that these technological advancements have had a strong impact on the supply chain sector. According to Craighead et al. (2017), human capital, especially a firm's technology capability is important in improving corporate performance in all sectors.

Digitalization of the supply chain is crucial in an attempt to address the growing consumer expectations, address the tendencies of shrinking product life cycles, and provide for the globalization of corporate operations. For instance, just-in-time inventory is common among retailers, and businesses embrace, new technologies, and digital capabilities as a way of enhancing flexibility (Roessler& Thatcher, 2021). It is important to know that supply chain digitalization is not only able to handle these operational issues but is also acting as a catalyst towards sustainable manufacturing apart from changing traditional systems to intelligent ones (Bi, 2011; Long et al., 2017; Michael, 2017). It is important because this change helps organizations address the challenges of managing supply chain networks in the modern business environment.

Thus, the industry of production and distribution of vital medicines and healthcare products — the pharmaceutical industry — demonstrates the centrality of digitalization in the effective management of complex supply chains across the world. They trigger challenges that the sector cannot overcome in the same ways that other industries can, for instance, in maintaining the quality of their products and adhering to the necessary regulations within the country and internationally; where, for example, Farooq and O'Brien (2012) have noted that many of such challenges are now being solved by adopting the appropriate information technologies. Through these technologies, the levels of compliance, traceability, and visibility from end to end, the errors that may occur are significantly minimized, and the quality that is offered through the supply chain is highly improved (Makris et al., 2019). Technological advancement also helps in supplying real-time information from several sources in assuring or expediting the supply chain. This integration model is not tied to any specific technologies and can be made effective for the required digital improvements like low costs, GxP data compliance, supply chain accuracy, and fast software product delivery (Ivanov &Dolgui, 2021).

The enhancement of the complexities of the supply chain means that there must be strong technology harnessing several operations elements. It adopts IoT, AI, and blockchain in creating digital supply chains that provide clear visibility, flexibility, and robustness. Smart products such as IoT offer precise information on stock status, transportation conditions, and product positions to enhance the programmed and anticipated results. Such incorporated features as predictive demand analysis, route optimization, or better decision-making require data analysis possible only with the help of AI algorithms. Blockchain technology provides authenticity and non-reputability of the records that support the transaction, which increases trust between supply chain members (Ivanov &Dolgui, 2021).

Second, digital supply chains are sustainable supply chains because they make optimal use of existing resources and limit wastage. For instance, the use of big data and predictive analytics can trigger warnings on when disruption is likely to occur and the best possible solutions, hence reducing interruption resulting from the environmental impact of supply chain operations. Companies can replicate their tangible assets in a virtual world using digital twinning hence preventing the need for physical trials before implementing changes; which translates to sustainable and cost-optimized solutions (Bi, 2011; Long et al., 2017).

In conclusion, the process of digitalization in supply chains is the path towards a more efficient and effective more sustainable supply chain strategy. The use of these technologies provides organizations with effective ways to boost their decision-making, manage their supply chain in the right manner, and general performance to compete effectively in the international marketplace. This research focuses on the relationship between technology-based decision-making and supply chain performance mediated by the implementation of the digital supply chain.

There are specific challenges in managing complex global supply chains that the pharmaceutical sector experiences. Digital technologies enhance the comprehensibility of

rules, product traceability, and standards which in turn enhances the efficiency and reliability of the pharmaceutical supply chains (Makris et al., 2019). This is because through the usage of blockchain technology, supply chain transactions are made to be secure and transparent thus encouraging the different parties involved in the chain to have confidence in such transactions (Kshetri, 2018).

1.2 Problem Statement:

The challenges in the supply chain sector occur due to the constantevolutionof technologies and the impact of globalization. Even though there is a wealth of evidence highlighting the positive effects of the implementation of digital supply chains, there is still a considerable deficit of knowledge about how it influences the overall supply chain performance, especially through the technology-based decision-making system. Businesses are also reluctant to adopt digital technologies because of costs, which are often steep for acquiring technologies in the initial place, security threats, and skilled personnel requirements (Ben-Daya et al., 2019; Nguyen et al., 2021; Saberi et al., 2019). More importantly, the robust trends of digitalization must be known regarding its solutions to coping with operation consideration, and sustainability to improve the performances of industries including the current pharmaceutical industry.

Current Pakistani pharmaceutical sector analysis reveals that several Pakistan supply chain factors distortthe growth and performance of the pharmaceutical industry. They include compliance with the set rules and standards, product quality, and its origin. AI, IoT, and blockchain technologies have the potential of also positively impacting these aspects by lifting the veil of the obscure, meeting compliance requirements, and supporting decision-making (Makris et al., 2019; Farooq & O'Brien, 2012). Nonetheless, the implementation of these technologies in Pakistan has major challenges due to unique financial challenges, little technological base, and skilled talent scarcity. Overcoming these barriers is vital to harnessing Digital Supply Chain support for breakthroughsin the pharmaceutical sector

performance in Pakistan (Büyüközkan&Göçer, 2018).

However, this research intends to bridge this gap by analyzing the effect of digital supply chain implementation on supply chain performance, thus investigating the significance of technology-based decision-making with special reference to the pharmaceutical segment in Pakistan. Through identifying these dynamics, this study aims to contribute the findings that might be useful for companies in the context of Pakistan and other similar countries to integrate efficient SCM into the digital environment.

1.3 Research Questions:

RQ 1: What is the impact of Digital Supply Chain on Supply Chain Performance?

RQ 2: What is the impact of the Digital Supply Chain on Technology Based Decisions?

RQ 3: What is the impact of Technology Based Decisions on Supply Chain Performance?

RQ 4: Do Technology-Based Decisions mediate the relationship between Digital Supply Chain and Supply Chain Performance?

1.4 Research Objectives:

RO 1: To study the impact of Digital Supply Chain Implementation on Supply Chain Performance.

RO 2: To examine the impact of Digital Supply Chain Implementation on Technology-Based Decision Making.

RO 3: To analyze the impact of Technology-Based Decisions on Supply Chain Performance.

RO 4: To examine the mediating role of Technology-Based Decisions between Digital Supply Chain Implementation and Supply Chain Performance.

1.5 Significance of the study:

This study is important because it gives us a framework with a lot of new information about

how digital supply chains affect the success of the supply chain by helping people make better decisions. The study adds to what is already known about the subject by exploring the relatively unexplored area of digital supply chain and how it affects supply chain performance. Specifically, it focuses on the role of technology intensity in decision-making as a moderator (Ivanov &Dolgui, 2021). This study adds to what's already been written by using poll data and coming up with a way to think about the relationship between how technologies are used in the supply chain and how well they work, which hasn't been looked at much in academic research before (Wagner et al., 2016). Finally, the study gives useful information about how AI, IoT, and Big Data analytics can be used in supply chain management to help leaders and managers better understand the subject (Choi et al., 2018). Based on the study's findings, HI should think about investing in these technologies and make sure they can work together to give the best performance, which will help a company fight better in the global market, as Wang et al. (2020) pointed out.

To fully utilize the benefits of digital supply chains, however, the important study also suggests that efforts should be made to make people more aware of privacy issues, environmental concerns, and the skills gaps in organizations (Kshetri, 2018). Because of this, this study has very high stakes for the pharmaceutical business. The business is marked by a strict legal environment, strict product quality standards, and the inability to see the whole supply chain (Farooq & O'Brien, 2012). Makris et al. (2019) say that digital supply chains can improve compliance, track and trace solutions, and safe transactions that are in sync with what's happening on the production line in real-time. The allowed pharmacy lines, make it easier for people to get the drugs and health goods they need (Ben-Daya et al., 2019). Overall, this study's results are important for moving forward academic research and improving supply chain and logistics management.

Chapter 2: Literature Review

2.1 Introduction

Over the period of the last few years, there has been a great emphasis on the shift of supply chains from the manual/indirect form to the digital/online form. The digital supply chain is typified by the integration of advanced technologies such as AI, IoT, and data analytics to enhance its efficiency and gain a competitive advantage. Concerning the objectives of the paper, the aim of this literature review is to provide a comprehensive account of how the use of digital supply chain impacts the supply chain. The review is particularly restrictive in that it centers its analysis on the function of technology for decision-making as a moderator.

The digital transformation of supply chains is also a shift that opens the way to the deployment of a more efficient supply chain, more robust, and more capable of reducing its impacts on the environment. This will enable companies to gain competitive strategic advantages in the global markets by applying info technologies such as artificial intelligence, IoT, and blockchain towards making accurate business decisions and improving supply chain effectiveness. However, it also has some challenges like the significant initial costs of implementing digital supply chains, susceptibility to cyber risks, and needing skilled staff. The future direction of digitization of the supply chain will be determined by new technology and developing needs following key concepts of Business, with special reference to flexibility, speed, and ecosystem.

This paper presents a systematic synthesis of how the implementation of the supply chain technology influences the performance of the chain by drawing from the existing literature with special reference to the mediating effect of technology-based decision-making. The

information that has been identified in this study can be used to inform future supply chain management planning and policies, legislation, technology prosperity, and changes for improved intelligent and sustainable supply chain performance.

2.2 The Digital Supply Chain:

For explanation, it is essential to make two points – one, digital supply chains represent a major shift from traditional supply chain management, and two, the future of supply chains is indeed digital. Christopher (2016) defines a digital supply chain as the application of several digital technologies that aim at increasing the supply chain transparency, flexibility, and overall responsiveness of the chain. Such a shift is propelled by an increased need to address clients' expectations, the shortening of products' life span, and international business (Ivanov &Dolgui, 2021).

This can be done by employing IoT gadgets, concurrent computations with AI, and a supply chain database in the form of blockchain. In the scope of IoT devices, real-time information on transports and stock inventories contributes to enhanced visibility and fewer mistakes in forecasting (Wang et al., 2020). Big data applied by AI systems include large information arrays for determining the best routes and demand trends and improving the decision-making process (Choi et al., 2018). Blockchain is sure to provide transparency and safety in dealings, which can help inspire trust among those in the supply chain (Kshetri, 2018).

2.3 Impact of Digital Supply Chain on Supply Chain Performance

When it comes to the capabilities of the supply chain, the installation of a digital supply chain has a rich influence on the functioning of the supply chain. According to the literature review, it is evident that; digital supply chains are preferred performance identifiers because they make supply chains more efficient, responsive, and sustainable.

A measure of a given system or process whereby the performance of a particular activity in an enterprise and achievement of the intended objectives are determined by the company's resource procurement and expenditure rate. Having digital supply chains work smart in their approach helps in cutting costs and working effectively. By employing AI in analytics, firms can identify problems with existing processes, thus improving them (Ivanov &Dolgui, 2021). The IoT interconnects assets to permit constant inspection thus reducing the time considered as down and the maintenance costs (Ben-Daya et al., 2019). Again, blockchain technology lowers transaction costs by eliminating the need for intermediaries or middlemen to facilitate and secure financial transactions (Saberi et al., 2019).

It means the capability of a system or device to perform a function properly and effectively within a short time after receiving a command or sensing a change in the wake of its operation. One way digital supply chains enable increased responsiveness is by increasing the ability of the supply chain to be receptive to current or future conditions. IoT devices enable enterprises to monitor inventories and shipment information detailing the real-time inventory and shipment status to help organizations react promptly to changes in demand (Nguyen et al., 2021). Based on demand pattern evaluation, it is used by artificial intelligence systems to predict stock patterns and control the inventory levels to avert instances of stock out and situations of overstock (Wamba et al., 2020). The use of blockchain ensures the possibility to trace and apportion blameworthiness, which can lead to fast dispute resolution and product recall (Kshetri, 2018).

Through the enhancement of resources such that they do not go to waste, digital supply chains can enhance sustainability. With predictive analytics, disruptions can be foreseen and solutions can be provided for their prevention; therefore, the harm to the environment is minimized (Büyüközkan&Göçer, 2018). Digital twins can be defined as mirror images of an actual asset that allow firms to weave through complex circumstances and enhance flow

without experimenting with a physical equivalent. It also enables one to engineer more sustainable solutions (Qi & Tao, 2018).

2.4 Technology-Based Decision Making

This is the reason why the use of information technologies should be a necessary criterion when choosing the drives for digital supply chains. The most sought-after technologies with potential in today's firms include AI, IoT, and big data analytics, as they enable firms to make effective, timely decisions (Ivanov &Dolgui, 2021).

Artificial intelligence integrated with machine learning aims to analyze vast amounts of data and provide logical and helpful outputs. These technologies enable the utilization of predictive analytics, that might foresee demand tendencies, factors of potential disruptions, and inventory replenishment (Choi et al., 2018). Several authors have postulated that the use of AI in decision-making improves supply chain performance in terms of reducing uncertainty (Wamba et al., 2020).

Some of the features that make IoT smart are real-time information on current stock and inventory, the situations and environment surrounding the movement of products, and the exact location of products during the shipment process. By employing this data, enhances the flow of information and enables firms to make instant informed decisions, as noted by Nguyen et al., (2021). Sourcing of real-time data improves firm response because changes in demand or supply conditions can noted and addressed in time (Ben-Daya et al., 2019).Big data analysis involves the application of very complex models to make many calculations and find out facts that may be hidden in very large datasets. Such observations are informative when it comes to strategic management aspects such as developing the supply chain interfaces and improving organizationalutilization (Wang et al., 2020). Big data plays a significant role in the aspect of predictive maintenance, which in turn reduces time wastage

and improves the exploitation of assets (Büyüközkan&Göçer, 2018).

2.5 Mediating Role of Technology-Based Decision-Making

This highlights the significance of technology where technology-based decision-making mediates the single installation variable and the performance of the supply chain. The technologies, when integrated, can help firms across the flow of their supply networks achieve better the goals of their strategic, supply chain decision-making for improved chain performance (Ivanov &Dolgui, 2021).

Applying technology in decision-making enhances efficiency due to a reduction in activities as well as costs. Composite data collected by decision support systems and IoT appliances reveal new opportunities for optimization which AI-driven analytics identify for improvement, utilizing real-time data for the production and consumption of resources (Choi et al., 2018). The overall financial processing is made easier through the use of blockchain, thus minimizing administrative costs and improving accuracy (Saberi et al., 2019).

The integration of data received from smart devices through the Internet of Things (IoT) alongside applying the capabilities of artificial intelligence (AI) to make predictive analyses increases the level of proactivity through quick measurable responses to changes in demand and supply conditions (Nguyen et al., 2021). Increased efficiency arises from its ability to track and verify data which may help in the quicker resolution of business differences and product recall (Kshetri, 2018).

The deployment of technology to support decision-making fosters sustainable decision-making in that there is optimality in the use of resources and consequently less wastage. Predictive analytics has the potential to identify probable disruptions and suggest preventive measures that will in effect minimize the impacts on the environment (Büyüközkan&Göçer,

2018), pp. 215. This is very important because by using digital models, different cases are simulated and processes improved, thus incorporating more sustainable solutions into the real model without having to do the physical changes (Qi & Tao, 2018).

2.6 Challenges in Implementing Digital Supply Chains

Thus, despite several evident beneficial consequences stream from the deployment of digital supply chains, the implementation of any supply chain technologies cannot be without challenges. There are a lot of cons for enterprises such as huge initial costs, weak security, and the need for a skilled workforce (Wang et al., 2020).

The adoption of digital technologies requires capital investment on both tools and systems (Hardware and software), and training of the workers (Ben-Daya et al., 2019). Such expenses may be challenging for SMEs to afford because they usually have a constraint on their available capital, which could hinder the adoption of digital supply chains (Nguyen et al., 2021).

Along these lines, there is apprehension concerning cybersecurity since it threatens digital supply chains. Current IoT devices connected with blockchain technologyenhance the susceptibility to data leaks and attacks (Saberi et al., 2019). In this sense, it becomes crucial for companies to invest in securing an environment that would enhance cybersecurity in the implementation of supply chains (Kshetri, 2018).Specialist talents are required for the management and operation of digital focal points and supply chains due to the increased application of advanced technologies (Büyüközkan&Göçer, 2018). Implementers recommend that organizations should use their resources to finance training and development programs to shore up the required competencies in the people (Wamba et al., 2020).

2.7 Anticipated Developments in Digital Supply Chains

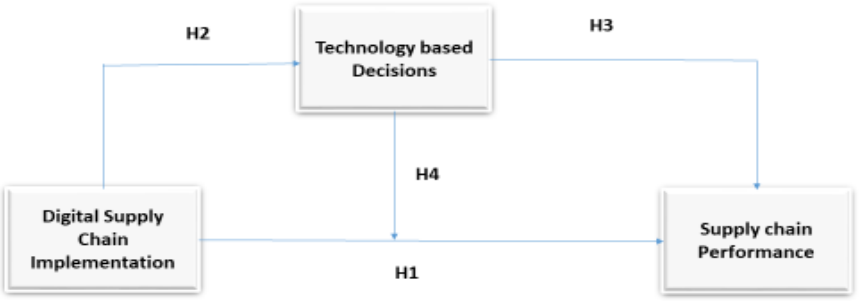
New entrants and evolving business requirements rising from digital innovation are likely to affect the next digital supply chain. Several forecasted trends are gearing up to assert their effect on the evolution and implementation of DSCs in the coming years.

The adoption rates of AI and ML technologies are also set to underpin the growth of digital supply chains. These technologies will bolster the current practices in the use of predictive analytical models, and refine decision-making, especially in the choice of strategies to adopt and enhance the overall operations (Choi et al., 2018). As observed in this paper, the advancement of artificial intelligence is expected to lead to new complex algorithms and applications that will enhance the layouts of supply chains (Wamba et al., 2020).

Hence the growth of the IoT device will enhance visibility and real-time data collection in the OF firm's supply chain (Nguyen et al., 2021) The improvement in IoT technology, on the one hand, can offer a better measure of tracking assets, the improvement of inventory, and the increase of operational effectiveness (Ben-Daya et al., 2019).Moreover, in Kshetri's (2018) view, blockchain technology will continue creating a positive impact increasing transparency and security in the supply chain. As the notion of blockchain continues to gain traction, the use of this technology in supply chains will increase as organizations seek to improve transactional transparency, increase accountability, and build trust among actors (Saberi et al., 2019).

Primarily, the role and importance of sustainability across supply chain operations is expected to increase further in the coming years (Büyüközkan&Göçer, 2018). Organizations have established efficient operations with digital technology to reduce resource wastage and conform to a smaller impact on the environment (Qi & Tao, 2018). The proposed methodology incorporating digital twins and predictive analysis in decision-making will enable the adoption of sustainable and cost-effective measures (Wang et al., 2020).

2.8. Research Model:



2.9 Hypothesis:

H1: Digital Supply Chain has a positive impact on Supply Chain Performance

H2: Digital Supply Chain has a positive impact on Technology-Based Decision Making

H3: Technology-Based Decisions have a positive impact on Supply Chain Performance

H4: Technology-Based Decisions mediate the relationship between Digital Supply Chain and Supply Chain Performance

Chapter 3: Research Methodology

3.1 Introduction

The rationale of this chapter is to present the methodology used in this study to understand how the implementation of a digital supply chain affects the supply chain performance. A mediation analysis of technology-based decision-making is proposed. Mediation analysis of the proposed conceptual model has been conducted using SPSS which is a robust econometric technique for estimating diverse kinds of relations and is particularly well-suited for handling the complex model with a larger number of observables. They offer the description of the research philosophy, the research attitude, the research paradigm, the research methodology, the data collection method, the sampling method, the target population, the sample size, and the data analysis method. The systematic approach is beneficial in the sense that the research is well conjugated in a structured format, and all methods applied can be easily replicated by another team of researchers and follow all academic guidelines.

This research work adopts a quantitative research model to analyze the influence of digital supply chain on supply chain performance about the moderating influence of technology-enabled decision making. The following sections explain the methodology of effectively developing a structured questionnaire to capture data from Supply chain professionals in different industries.

This study's target group consists of human resources of senior management, middle management, and other staff that deal with supply chain management. To effectively capture variation in responses, a convenience sampling approach is being utilized where responses will be collected from different organizational tiers as well as across sectors.

The survey has been conducted online and the population to be targeted includes supply chain specialists who has been asked to fill the survey via email or through social network invitations. The questionnaire consists of the demographic data of the respondent and their company, digital supply chain usage, technological usage, supply chain effectiveness, and efficiency of the organization. The questions posed to respondents were presented in the form of statements, and respondents has beenrequested to express their levels of agreement on a range of 1 to 5 using a Likert scale.

3.2 Research Philosophy

Research philosophy is a general approach to the research and can be defined as the theoretical framework of the study The research philosophy of the study is therefore the foundation of the research or the system of beliefs that underpin the research process. This multiple case study research work stands on the positivist epistemology that states that the universe of tangible facts is knowable. Positivism is suitable for the quantitative means of research applied in this investigation because the latter involves the collection of numerical information and the use of statistical formulas for the testing of hypotheses and arriving at conclusions (Collis & Hussey, 2013). This is because this approach facilitates accurate quantification of the variables and the establishment of cause and effect formulae between variables, which is relevant in assessing the effect of digital supply chain implementation on supply chain execution (Bryman& Bell, 2015).

Positivism was derived from the notion that any knowledge has to be established scientifically, just as science reveals the way theories can be tested. This philosophy matches the detailed approach of this study, as it aims to hypothesize and investigate the impact of Technology based decision making on the relationship between Digital Supply Chain implementation and supply chain performance (Saunders et al, 2019). In adopting a positivist

paradigm, a measure of objectivity, reliability, and validity is exercised in the results obtained in the study thus offering grounded evidence that is vital to add to the knowledge base as well as offer practical applications to the topic of study within the sphere of Supply Chain Management (Easterby-Smith, Thorpe, & Jackson, 2015).

3.3 Research Stance

Epistemology that has been adopted in the conduct of the research work. There is a need to adopt positivism as it is a research philosophy of this kind. Positivism advocates for knowledge that should be acquired to be acquired from facts that are quantifiable, coupled with the exclusion of any extra aspect of subjectivity and also the promotion of the usage of science in conducting research (Bryman and Bell, 2015). This stance is suitable for this research because the main objective of this research is to formulate and empirically validate hypotheses concerning the utilisation of digital supply chains and the first order and second order impact of this construct on the interactive supply chain performance and technology mediated decision making.

From the view point of positivism this study has adopted a clear methodology that the data collection process is conducted systematically using properly designed questionnaires while the conclusions has been provided with the help of statistical tools. In doing so, the research ensures that it holds conservative tool of operationalization which in turn, enhances the reliability and validity of the research. This is useful for generalization on conclusion of its impact on the is digital supply chain’s effects on techs decision making & supply chain performance (Saunders, Lewis, & Thornhill, 2019).

Another component of the positivist paradigm is deductive reasoning, through which, posited by literature, a theoretical frame work or a hypothesis is formulated that is then tested for empirical proof (Easterby-Smith, Thorpe & Jackson, 2015). This is particularly advantageous

in research fields, which may include Supply Chain Management, because of the need to use measurement and sound statistics to deconstruct complex relationships and find uses for measurement frameworks.

3.4 Research Approach

The research methodology part describes the direction on how to handle the research questions with regards to the research study. The current study utilizes a Quantitative Research Methodology which entails the use of numerical data to analyze such details as patterns, connections, and trends. Based on the research questions and objectives indicated above, the use of a quantitative research approach is suitable for this study, the quantitative approach is ideal as it enables quantification of variables set up hypotheses and analyze data to arrive at measurable conclusions.

3.5 Research Method

The method of research formulates the framework in respect of the approach that is to be taken to accomplish the undertaking. This specific type of research shall employ a Survey Research Method. The application of a survey within a quantitative investigation implies the use of a structured technique for receiving a significant amount of data from multiple subjects. To address the need for structure in getting information from the pharmaceutical industry, a structured questionnaire was used in order to favor precision and reproducibility of the results.

3.6 Data Collection Method

The questions require the gathering of information from respondents as part of the querent information-gathering process. In an effort to gather data for this research, the instrument that

is applied in the research is called the Online Survey Questionnaire. The questionnaires contain questions concerning demographic data, the extent to which supply chain employs digital gadgets and the technologies in supply chain, and the key performance indicators of the supply chain. These questions should be answered based on the Likert scale with a scale of 5 and the options are “I Completely Disagree,” “Very Much Disagree,” “I Disagree,” “Neutral,” “I Agree,” “Very Much Agree” and “I Strongly Agree.”

The questions used in the administration of the questionnaire where derived from standard scale used in peer research, therefore validity and reliability questionnaires was used. For example, all the items involving supply chain implementation of digitalization were adopted from Ivanov &Dolgui (2021) while the ones involving Technology based Decision were adopted by Choi et al. (2018). These SC performance items were adopted from Wamba and other colleagues’ recent research on the emerging supply chain 4. 0 outcomes. The references given above are sufficient to’, corroborate the fact that the above mentioned data has been collected most accurately through the use of a questionnaire.

3.7 Sampling Technique

The sampling technique involves selecting a subset of individuals from the target population to participate in the study. This study employs a Convenience Sampling Technique. Convenience sampling involves selecting participants who are readily available and willing to participate in the study, making it a practical and cost-effective method for data collection (Etikan, Musa, &Alkassim, 2016).

This technique is suitable for this research due to its feasibility and the ease of accessing supply chain professionals through professional networks, industry contacts, and online platforms. While convenience sampling may not provide a fully representative sample of the entire population, it allows for the efficient collection of data from a diverse group of

respondents, facilitating the exploration of the relationships between digital supply chain implementation, technology-based decision-making, and supply chain performance.

3.8 Population and Sample Size

Senior managers, middle managers, and support staff in the pharmaceutical business who work in supply chain management are the people this study is aimed at. 400managers (approx) make up the whole group of people in this study.The Morgan table was used to figure out the right sample number for the study. As shown in the Morgan table, the suggested sample size for a population is 196. So, the study wants to get answers from at least 196 people to make sure the group is a good representation of the whole community and to make the results more reliable and true. A bigger sample size also allows for stronger statistical analysis, which makes the study more rigorous all around.

3.9 Data Analysis

Data analysis is the process of organizing and making sense of collected data to find useful insights. SPSS will be used to analyze data that was received for this study Descriptive statistics will be used to make a list of the people who answered the poll questions and what they said about themselves. We will use inferential statistics, like regression analysis and mediation analysis, to test the study hypotheses and look at the connections between implementing a digital supply chain, making decisions based on technology, and the success of the supply chain.

3.10 Ethical Considerations

This invariably affects the methodology used in any study and the information gathered, hence the importance of ethical considerations in research. In this research, steps are taken to maintain the respondents' anonymity which creates are taken to maintain the respondents'

anonymity which isto minimize external bias during data collection, the study's aims and objectives are explained to the participants, and consent is sought. Again, the data gathered is used solely for research and analysis exercises, and the storage and access to the data are done securely.

3.11 Conclusion

This chapter has provided the overall understanding of the research methodology involved in this study; research philosophy and stance, approach and method, data collection procedure, sampling technique, population and sample size, and data analysis techniques. Therefore, by employing a well-developed and organized research framework,this research intends to establish efficient and accurate strategies for understanding the supply chain performance resulting from the implementation of a digital supply chain, especially about the mediating effect of technology-baseddecision-making.

Chapter 4: Data Analysis and Discussion

4.1 Introduction

This chapter includes the interpretation of the data gathered and puts emphasis on the main conclusions. The quantitative data were analyzed using the statistical technique of methods such as, multiple regressions in SPSS in a view to exploring the proposed relationships with regards to its objective of to identify the role of technology based decision making in mediating the relationship between the implementation of digital SCM framework and the overall improvement in SC performances. Both frequency distribution and inter-variable correlation, as well as regression test were applied in a bid to determine the extent of relationship between the set variables.

4.2 Demographics

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	140	71.4	71.4	71.4
	Female	53	27.0	27.0	98.5
	Others	3	1.5	1.5	100.0
	Total	196	100.0	100.0	

In this study, we examined the gender distribution among a sample of 196 participants. The

data revealed that 140 individuals (71.4%) identified as male, while 53 participants (27.0%) identified as female, and 3 participants (1.5%) identified as others. These findings highlight a male predominance within our sample.

4.3 Designation

Designation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Senior Manager	36	18.4	18.4	18.4
	Middle Manager	80	40.8	40.8	59.2
	Support Staff	20	10.2	10.2	69.4
	Others	60	30.6	30.6	100.0
	Total	196	100.0	100.0	

The data revealed that 36 individuals (18.4%) held the position of Senior Manager, 80 participants (40.8%) were Middle Managers, 20 participants (10.2%) were Support Staff, and 60 participants (30.6%) fell under the category of Others. These findings highlight a predominance of Middle Managers within our sample.

4.3 Experience

Experience				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	0-5 Years	77	39.3	39.3	39.3
	5-10 years	63	32.1	32.1	71.4
	10-15 years	46	23.5	23.5	94.9
	15 Years and above	10	5.1	5.1	100.0
	Total	196	100.0	100.0	

The data revealed that 77 individuals (39.3%) had an experience of 0-5 years, 63 participants (32.1%) had an experience of 5-10 years, 46 participants (23.5%) had an experience of 10-15 years, and 10 participants (5.1%) had an experience of 15 years and above. These findings highlight a predominance of individuals with 0-5 years of experience within our sample.

4.4. Age

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-25 years	57	29.1	29.1	29.1
	25-30 years	77	39.3	39.3	68.4
	30-35 years	15	7.7	7.7	76.0

	35-40 years	3	1.5	1.5	77.6
	40 years and above	44	22.4	22.4	100.0
	Total	196	100.0	100.0	

The data revealed distinct patterns across different age groups.The **20-25 years** group had 57 individuals, representing 29.1% of the total sample. These individuals are likely in the early stages of their careers or higher education. **25-30 years** group was the largest group with 77 individuals, accounting for 39.3% of the total. The **30-35 years** group included 15 individuals, making up 7.7% of the total. **35-40 years** group was the smallest group with only 3 individuals or 1.5% of the total. **40 years and above** group had 44 individuals, accounting for 22.4% of the total. These individuals may belong to the senior workforce or have retired, bringing unique perspectives and experiences.

4.5 Descriptive Statistics

Descriptive Statistics					
	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
DGSC	196	-.228	.174	-.058	.346
Tech	196	-.297	.174	1.245	.346
SCPerf	196	-.278	.174	1.104	.346
Valid N (listwise)	196				

The normality test can be defined as an arithmetic process performed to ascertain whether or not the samples and/or groups of data are likely to belong to the normal distribution family. It defines the degree to which the given data set is well ngered by a normal distribution. Chi square and Mann Whitney U tests are used to test the normality of the study based on kurtosis and skewness respectively. Kurtosis is defined as the measure normality that is used as a guide to determine the peak of the distribution and its tails (Kim, 2013).

This means that Kurtosis value equal to 3 is normal and the range of Kurtosis extends from +3 to - 3. Here all the three variables have 3+ to -3+ signifying a normal distribution of data. Skewness measures the degree to which the data is skewed or that is, the degree of asymmetry. This scale has a range of -1 to 1 wherein a negative value signifies left skewness and a positive value right skewness. From the table itself, it is evident that all the values are within the boundaries of skewness i. e. between the value of negative 1 and that is positive 1 which enables to infer that all the observed data of all the variables is normally distribute.

4.6 Reliability

	Cronbach Alpha	*N of Items*
Digital Supply Chain Implementation	.620	5
Technology Implementation	0.763	5
Supply Chain Performance	0.833	5

To test the reliability, the reliability test was conducted in order to assess the item-to-total reliability of each assessment items of the questionnaire for each variable of this study. As stated by Taber in 2018, the Cronbach's alpha values are as follows: coefficient alpha,

coefficient theta, and the standardized alpha all ranging from 0. above 9 depict an excellent aspect of reliability and the lower end of the scale which is 0. 70-0. 9 depict the degree of reliability while coefficients between 0. 60 and 0. 70 is regarded moderately reliable while the values below 0. 50 represent low reliability. From the results of the Facet Reliability Test conducted via the SPSS system, all the variables employed within this research bear acceptable levels of reliability in line with the values indicated in the tables below.

4.7 Correlation

Correlations

		DGSC	Tech imp	SC Perf
DGSC	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	196		
Tech imp	Pearson Correlation	.458**	1	
	Sig. (2-tailed)	.000		
	N	196	196	
SC Perf	Pearson Correlation	.524**	.504**	1
	Sig. (2-tailed)	.000	.000	
	N	196	196	196

**. Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation coefficient between DGSC and Technology based Decision is approximately 0.458.This positive correlation suggests that as DGSC increases, Technology based Decision tends to increase as well. The p-value (0.000) indicates that this correlation is

statistically significant at the 0.01 level., There's strong evidence that this relationship is not due to random chance. The Pearson correlation coefficient between Digital Supply Chain and Supply Chain Performance is approximately 0.524.This positive correlation implies that as Digital Supply Chainincreases, Supply Chain Performance tends to increase. The p-value (0.000) confirms the statistical significance of this relationship. The Pearson correlation coefficient between Technology based Decision and Supply Chain Performance is approximately 0.504.Once more, this positive correlation indicates that as Technology based Decision increases, Supply Chain Performance tends to increase. The p-value (0.000) reinforces the statistical significance.

4.8 Regression

```
Model  : 4
Y  :SCPerf
X  : DGSC
M  :Techimp

Sample
Size:  196

**************************************************************************
OUTCOME VARIABLE:
Techimp

Model Summary
          R         R-sq          MSE            F          df1          df2
p
      .4578         .2096         .3445      51.4409       1.0000     194.0000
.0000

Model
coeff         se          t          p       LLCI       ULCI
constant     1.4152      .3308     4.2784      .0000      .7628     2.0675
DGSC          .5935      .0827     7.1722      .0000      .4303      .7566

**************************************************************************
OUTCOME VARIABLE:
SCPerf

Model Summary
          R         R-sq          MSE            F          df1          df2
p
      .5176         .2679         .3319      35.3125       2.0000     193.0000
.0000

Model
coeff         se          t          p       LLCI       ULCI
constant     2.3492      .3396     6.9175      .0000     1.6794     3.0190
DGSC         -.1773      .0913    -1.9416      .0536     -.3575      .0028
Techimp       .5749      .0705     8.1582      .0000      .4359      .7138

***************** DIRECT AND INDIRECT EFFECTS OF X ON Y ****************

Direct effect of X on Y
```

```
    Effect         se          t          p       LLCI       ULCI
    -.1773      .0913    -1.9416      .0536    -.3575      .0028

Indirect effect(s) of X on Y:
            Effect     BootSEBootLLCIBootULCI
Techimp      .3412      .0793      .1811      .4907
```

The regression model with DGSC predicting Technology based decision is significant (p < .0001), with an R-squared of .2096. This means that DGSC explains about 20.96% of the variance in Technology based Decision. For every unit increase in DGSC, Technology based Decision increases by .5935 units. The regression model with Digital Supply Chain Implementation and Technology based Decision predicting SC Performance is significant (p < .0001), with an R-squared of .2679. This means that Digital Supply Chain Implementation and Technology based Decision together explain about 26.79% of the variance in SC Performance. For every unit increase in Digital Supply Chain, Supply Chain Performance decreases by .1773 units, controlling for Technology based Decision. However, this effect is marginally significant (p = .0536). For every unit increase in Technology based Decision, Supply Chain Performance increases by .5749 units, controlling for Digital Supply Chain.

4.8.1 Direct and Indirect Effects of X on Y

As stated above, the direct impact of Digital Supply Chain Management to Supply Chain Performance is negative. 1773 which is again almost reaching the significant level (p < 0. 05) with an actual value of 0. 0536. Thus, the mediated relationship between Technology and SC Performance through the lens of Digital Supply Chain. is the indirect effect of Digital Supply Chain on Supply ChainPerformance through Technology based Decisionis. 3412. It is noticeable that bootstrap confidence interval is not zero based at which bootstrap estimate is 3813, confidence interval is at. 1811 to 4907.

The results of the study reveals that the extent of Technology based Decision strongly moderated the relationship between the variables; that is, Degree of Group Support for Change Digital Supply Chain and System/Service Performance (Supply Chain Performance).

The negative coefficient of Direct effect indicates that Digital Supply Chain is associated with a decrease in Supply Chain Performance and the implementation of Technology negates it. Nevertheless, findings reveal a positive indirect effect of Technology based Decision on Supply ChainPerformance through Digital Supply Chain, postulating that Digital Supply Chain is facilitating Technology based Decision thus improving Supply Chain Performance. This may be due to suppression effect, where the inclusion of Technology based Decision as a mediator in the model show the positive relationship between of Digital Supply Chain on Supply Chain Performance that may not be evident if Technology based Decision is excluded from the model.

In the conversation where the bootstrap confidence interval does not encircle zero, it means that there is a statically significant mediation effect of Technology based Decision in mediating the relationship between Digital Supply Chain and Supply Chain Performance. The findings also reveal that Supply ChainPerformance has a significantly and positively indirect relationship with Digital Supply Chain through Technology based Decision, which verifies that Technology based Decision partially mediates the existing relationship between the variables.

4.8.2 Findings

H1: Digital Supply Chain Implementation has a significant impact on Supply Chain Performance.

The direct effect of Digital Supply Chain Implementation (DGSC) on Supply Chain Performance (SC Perf) is -0.1773 with a p-value of 0.0536. Since the p-value is slightly above the common alpha level of 0.05, this hypothesis is not supported. The negative coefficient suggests that as DGSC increases, SC Perf decreases, but this effect is not statistically significant at the 0.05 level.

H2: Digital Supply Chain Implementation has a significant impact on Technology based

Decision.

The effect of Digital Supply Chain on Technology based Decision is 0.5935 with a p-value of 0.0000. Since the p-value is less than 0.05, this hypothesis is supported. The positive coefficient suggests that as Digital Supply Chain increases, Tech implementation also increases.

H3: Technology based Decision has a significant Impact on Supply Chain Performance.

The effect of Tech implementation on Supply ChainPerformance is 0.5749 with a p-value of 0.0000. Since the p-value is less than 0.05, this hypothesis is supported. The positive coefficient suggests that as Tech implementation increases, Supply Chain Performance also increases.

H4: Technology based Decisions mediate the relationship between Digital Supply Chain Implementation and Supply Chain Performance.

The indirect effect of Digital Supply Chain on Supply ChainPerformance through Technology based Decision is 0.3412, and the bootstrap confidence interval is (0.1811, 0.4907). Since this confidence interval does not contain zero, this hypothesis is supported. This suggests that Technology imp significantly mediates the relationship between Digital Supply Chain and Supply Chain Performance.

	Hypothesis	**Result**
H1	Digital Supply Chain Implementation has a significant impact on Supply Chain Performance	Rejected
H2	Digital Supply Chain Implementation has a significant impact on Technology based Decision.	Accepted

H3	Technology Implementation has a significant Impact on Supply Chain Performance.	Accepted
H4	Technology Implementations mediate the relationship between Digital Supply Chain Implementation and Supply Chain Performance	Accepted

4.9 Summary

The research also establishes a course that indicates that Digital Supply Chain has a positive correlation with SC Perf with the option of using Technology based Decision as a moderating factor. Therefore, it is possible to conclude that while working in the Digital Supply Chain area does not directly contribute to the optimization of Supply Chain Performance, it can be observed that positive changes are relevant to this area with special emphasis on the application of technologies. This suggests that, in a effect to developing and maintaining their strategic digital supply chains, organizations should adopt new technological solutions in their supply chains to improve on the behavior of those supply chains.

In conclusion, this chapter makes a range of recommendations with the potentiality to further bolster the response of the chapter to digital supply chain initiatives that can be used to promote the development of superior performance of organizations and thus expand the existing body of knowledge on supply chain management in the digital age while also offering a number of certain practical implications for practical supply chain managers and executives who are searching for ways to advance the supply chain processes of their institutions.

Chapter 5: Conclusion, Recommendations, Limitations, and Future Implications

5.1 Conclusion

This study aims to work towards the following objectives: to explore the relationship between Technology based decision making and supply chain performance, and the moderating effect of Technology based decision makingon the implementation of digital supply chain performance. The conclusion deduced was that, channel digitalization has no positive effects on supply chain performance incases where supply chain implementation is looked at in isolation. At the same time, the advantages are achieved provided that this is connected with technological decision-making. It, therefore, goes to show the need to embrace advanced technological innovations including AI, IoT, and big data to improve the probabilities of achieving the best and optimum results in the digital supply chains. As a result, one can conclude that one of the sufficient factors for the effective application of technologies that form the basis of the digital supply chain is the approach to technology deployment as a step in decision making for supply chains that ultimately improves competitiveness in the global market.

5.2 Recommendations

The following recommendations can be made to improve chain performance based on the knowledge and goals established by adopting digital supply chain and information technology-based decision-making. Investments in new advanced technologies should be done as AI, IoT, and big data analytics should be made to optimize the decision-making systems and the supply chain as a whole. Therefore, it is crucial to ensure that such technologies are integrated properly within supply chain flows; the efforts should involve the development of supply chain strategies that involve providing adequate training to the staff and procurement of proper equipment. Due to the existing risks that are prevalent in the supply of such services and products, organizations need to ensure that their business incorporates measures that are effective in preventing cyber threats that are inherent to these technologies. Furthermore, a specific focus of the digital supply chain should be its use for sustainability. Er's Six supply chain resources contain analytics and digital twins, and they can be applied to improve supply chain sustainability by minimizing resource consumption. Third, there must be a focus on the talents and skills of workers engaged in supply chain management by ensuring adequate training programs for the enhanced use and management of digital supply chains, including a technical aspect of learning new technologies as well as the decision-making aspect when it comes to digital supply chains.

5.3 Limitations of Study

As useful as this study may turn out to be, it is also important to note its limitations, which present interesting avenues for further research. Regarding the limitations concerning the number of responses received from the participants, it is worth emphasizing that 196 people completed the survey, which makes it difficult to consider the results representative of the overall supply chain spectrum. First, future researches should try to include a twice larger sample and make the sample more heterogeneous to enhance external validity. As mentioned in the antecedent research section, the antecedent research of this study was mostly with the pharmaceutical industry. However, this sector should not lag behind in the digital supply chain implementation research; future studies should explore other industries so as to obtain a

more comprehensive view of what happens in different industries that may have different circumstances from this particular sector. The study type involved here was a cross-sectional one in which data was taken only at a one time with the population concerned. The further studies need to study what extent and how the effects of executing a digital supply chain and technology-driven decision-making can exert over the supply chain in a certain period of time. Overall the data collections were a self-reported questionnaire whereby respondents are likely to present a response that conforms to the social norm. The future work should focus on combining with thousands of other data sources and Methods described in this paper were used to verify the result.

5.4 Future Implications

The implication for this research study includes the following: The implication of this study lies in its contributions to future research, the result of this study is as follows. Other future research could explore the impacts that specific technologies on multiple aspects of the supply chain and bring out more elucidation on which of the emerging technologies would be most advantageous to particular segments of the supply chain management. According to the argument of Pelicek et al. (2019), such comparative findings in studies across different industries would give the sectorial concern or pattern of the implementation of the digital supply chain to direct the sectorial strategies.

This lack of embeddedness longitudinal studies or lack of temporal depth unduly leaves far better possibilities for better understanding the procedures underneath DSM preparations for their fixity and permanency in favor of much improved and sustainability-focused supply chain management programs. Additionally, the moderating impact of external managerial factors such as the recently marked change in regulation and market forces that mediate the relationship between digital supply chain and firm supply chain performance should also be the direction of future research so that the firms can meet the impact of these forces

effectively. Lastly, the linking of the gathered findings to actions, strategies and measures stemming from real life empirical studies may assist the firms in specifying the practical advices on how to manage with the described challenges and can open up the pros of using the potentials of digital supply chains.

Currently, the described challenging represents the supply chain digitalization as a change for the Better, concerning the Supply Chain Improvement, Reliability, and Sustainability. Specifically, this research contributes to the literature by identifying that Technology based decision making plays a mediating role in the relationship between the use of digital SCM and supply chain performance. Altogether, it means that the practical use of applications based on new technologies may help to make better decisions and prevent the negative consequences of supply chain problems to occur, and therefore to be competitive in the world markets. The implication being deduced on the recommendation, limitation, and future works carried in this chapter offer direction to scholars and practitioners who want to place the study of supply chain management to the next level in the digital domain.

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Appendices

A-Questionnaire

Impact of Digital Supply Chain Implementation on Supply Chain Performance. The Mediating Role of Technology-Based Decision

This questionnaire has been designed for the sole purpose of collecting data for the MBA thesis. The data collected will be treated with a very high degree of confidentiality and it is meant for academic purposes only. You are kindly asked to fill out this questionnaire by

circling appropriate answers.

Regards,

Section 1

Name: …….

Gender

1. Male
2. Female
3. Other

Age:

1. 20 – 25 years
2. 25-30 years
3. 30-35 years
4. 35-40 years
5. 40 years and above

Designation:

1. Senior Manager
2. Middle manager
3. Support Staff
4. Other

Experience:

1. 0-5 Years
2. 5-10 years

3. 10-15 years

4. 15 years and above

Section 2

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Digital Supply Chain Implementation						
DG1	I believe that digitalization helps our company to increase its SCM flexibility					
DG2	I believe that digitalization helps our company to lower the inventory and warehousing costs					
DG3	I believe that digitalization helps our company to lower the supply chain risk					
DG4	I believe that digitalization helps our company to lower the supply chain complexity					
DG5	I believe that digitalization helps our company to lower the transport and logistics administration costs					

Technology Based Decisions						
TI1	The technology is very significant to be implemented in our company in 3D printing and additive manufacturing					
TI2	The technology is very significant to be implemented in our company such as E-platforms for direct carrier selection and transaction					
TI3	The technology is very significant to be implemented in our company in the processing of paperless freight documents					
TI4	The technology is very significant to be implemented in our company i.e., New innovative computer software and robots					
TI5	The technology is very significant to be implemented in our company in Radio tagging and tracking of goods, packaging, and containers					
Supply Chain Performance (Flexibility)						
SCP1	Our company can respond and accommodate the demand variations, such as seasonality					
SCP2	Our company can respond and accommodate to periods of poor manufacturing performance such					

	as machine breakdown					
SCP3	Our company can respond and accommodate to the periods of poor supplier performance.					
SCP4	Our company can respond and accommodate the periods of poor delivery performance					
SCP5	Our company can respond and accommodate new products, new markets, or new competitors.					

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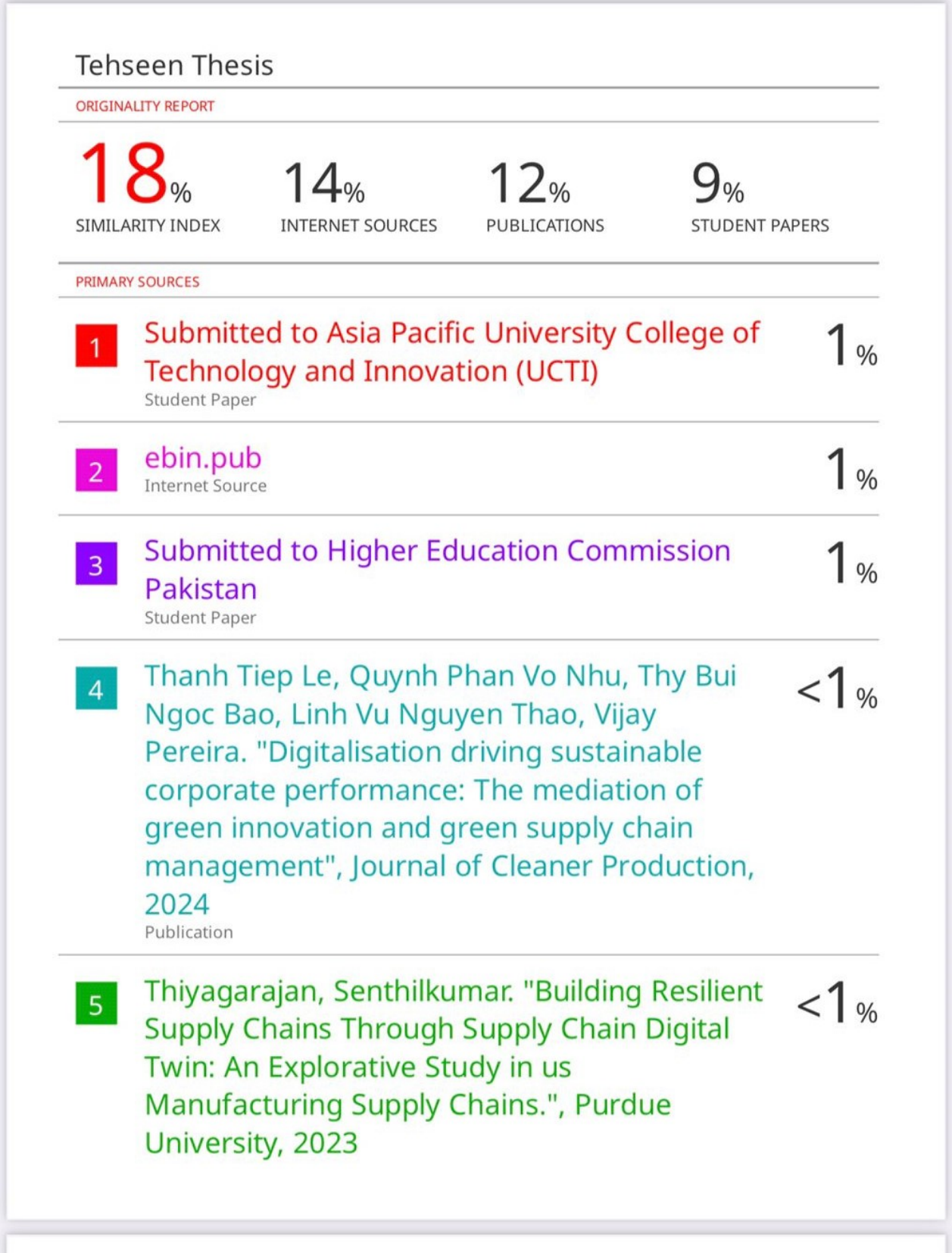

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