



Department of Management

**The Impact of Supply Chain Digitalization on Supply Chain
Resilience: The case of Jordanian Pharmaceutical industry**

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Table of Contents

<i>Table of Contents</i>	<i>ii</i>
<i>List of Tables</i>	<i>iv</i>
<i>List of Appendices</i>	<i>v</i>
CHAPTER ONE Introduction	1
1.1 Background	1
1.2 Problem Statement	2
1.3 Research Questions	3
1.4 Research Purpose and Objectives	4
1.5 Significance of the Research	5
1.6 Research Hypotheses	6
1.7 Conceptual Framework	8
1.8 Definitions of Terms	8
1.9 Research Limitations	9
1.10 Delimitation of the Research	9
CHAPTER TWO Literature Review	10
2.1 Introduction	10
2.2 Supply Chain Digitalization	12
2.3 Supply Chain Resilience	14
2.4 Relationships between Supply Chain Digitalization and Supply Chain Resilience	21
Chapter THREE Research Methodology	22
3.1 Introduction	22
3.2 Research Methods	23
3.3 Research Approach	23
3.4 Population and Sample	24
3.5 Unit of Analysis	25
3.6 Data Collection Procedure	25
3.7 Questionnaire	26
3.8 Descriptive Statistic	27

3.9 Demographic analysis	27
3.10 Validity and Reliability	31
3.10.1 Validity	31
3.10.2 Reliability	32
3.11 Summary.....	32
<i>CHAPTER Data Analysis.....</i>	<i>33</i>
4.1 Introduction	33
4.2 Descriptive Statistics	33
4.2.1 The Descriptive Statistics Analysis of Supply Chain Digitalization	34
4.2.2 The Descriptive Statistics Analysis of Supply Chain Resilience.....	36
4.2.3 The Descriptive Statistics Analysis of Flexibility	37
4.3 Relationship between Variables	41
4.4 Research Hypotheses Test.....	43
4.5 Summary of the Chapter.....	46
<i>CHAPTER FIVE Discussing Findings and Recommendations.....</i>	<i>47</i>
1.1 Discussing Research Hypothesis.....	47
1.2 Conclusion.....	49
1.3 Recommendation for Academic and Future Research	50
<i>References</i>	<i>68</i>
<i>Appendices.....</i>	<i>75</i>

List of Tables

Table No.	Table Caption	Page No.
3.1	Frequency Distribution by Gender	35
3.2	Frequency Distribution by Age	35
3.3	Frequency Distribution by Education Level	36
3.4	Frequency Distribution by Year of Experience in Same Company	36
3.5	Frequency Distribution by Job Position	36
3.6	Frequency of Distribution Year of Experience	37
4.1	Supply Chain Digitalization	40
4.2	Flexibility	42
4.3	Adaptability	43
4.4	Recovery	44
4.5	Agility	45
4.6	Bivariate Pearson Correlation Analysis	46
4.7	Simple Regression Analysis test result of the main hypothesis	48

List of Appendices

Appendix No.	Appendix Caption	Page No.
1	Panel of Referees Committee	62
2	Questionnaire	63

CHAPTER ONE

Introduction

1.1 Background

Covid-19 pandemic has caused many disruptions and problems that have disrupted the ability of companies to produce and distribute products, which has led to increased awareness among companies and academics towards reducing the negative impacts of dynamic changes in the business environment and developing supply chain resilience (Tukamuhabwa et al. 2015).

Remko, (2020) stated that based on a published survey, 86 percent of supply chains have been influenced due to coronavirus pandemic, And according to the institute for supply management, the number of enterprises reporting supply chain impact increased from 80 to 95 percent between early march and late march. And this situation has led to frequent calls for worldwide greater development of more resilient supply chains (Linton and Vakil, 2020).

A company's ability to respond to these challenges depends mainly on improving the supply chain, and one of the advised approaches that increase resilience efficiency is technology implementation (Van Hoek and Lacity, 2020).

Supply chain resilience refers to "a complex, collective, adaptive capability of companies in the supply network to maintain a dynamic equilibrium, react to and recovery from a disruptive event, and to regain performance by absorbing negative impacts, responding to unexpected changes, and capitalizing on the knowledge of success or failure" (Yao & Fabbe-Costes, 2018). Mainly, supply chain resilience involves: flexibility, adaptability, agility, recovery, (Pettit et al., 2010).

Today, given the impact of dynamic changes in the business environment of the pharmaceutical supply chain, pharmaceutical manufacturing companies have to successfully shift their supply chains to generate growth and manage expenses. However, unless companies examine and plan for the risks associated with these developments, they risk incurring massive losses. (Wang, Han, & Beynon-Davies, 2018).

Different studies investigated the development of supply chain resilience from different perspectives. Furthermore, preparing for disruptions by enhancing supply chain resilience (SCRES) has lately gained significant academic support (Murino, Romano, and Santillo 2011; Brandon-Jones et al. 2014; Geng, Xiao, and Xu 2014). Lastly, building resilient supply chains assume the ability of companies to deal with the disruptions faced by companies and supply chains, and this research looks at the role of digitalization in developing supply chain resilience in the Pharmaceutical Industry. Thus, it investigates the impact of supply chain digitalization on supply chain resilience.

1.2 Problem Statement

The COVID-19 pandemic has caused many problems in the global supply chains, resulting in delivery delays and product shortages (Tietze et al., 2020). since companies must improve their supply chains to provide a specific level of safety stocks to offset the detrimental impact of covid-19 pandemic on their operations (Ye, et al. 2022), as well as the company's ability to plan with disruptions to recovery and adapt is essential to ensure the function and success of the supply chain.

The pharmaceutical sector is one of the most rapidly developing economic sectors, During 2017 the pharmaceutical market has expanded at annual growth rate of 5.8%., while global revenues exceeding 1228.45 billion in 2020 (Hole, Hole, &McFalone-Shaw, 2021). Despite all the successes that the pharmaceutical sector has shown, it still faces some challenges, such as the continuous changes in the rules and regulations

imposed by the Jordanian Food and Drug Association, global crises, shifts in demands, and the emergence of new diseases such as coronavirus. These dynamic changes has affected the operations of pharmaceutical manufacturing.

Pharmaceutical industry has been resistive to digitalization, due to the lack of experience and the complexity of the manufacturing and development procedure involved. (Hole, Hole, & McFalone-Shaw, 2021). Despite this, there is an obvious need to digitalize pharmaceutical industry

However, with the covid-19 crisis causing exceptional worry and creating a continuing threat, digitalization appears to be the most effective strategy to ensure that everyone should have access to safe medicines (Hole, Hole, & McFalone-Shaw, 2021).

Nevertheless, technological advances have contributed to solving and managing this crisis by managing supply chains and dealing with unexpected changes. In the wake of covid-19, digitalized technology is more crucial than ever in helping companies of all sizes to increasing manufacturing productivity, enhancing competitive skills, ensuring financial viability and improving planning and forecasting accuracy (Faraj et al.,2021)

Consequently, the problem of this research revolves around the Research of supply chain digitalization and exploring the contribution of supply chain digitalization to supply chain resilience in Jordanian Pharmaceutical Manufacturing Companies.

1.3 Research Questions

The Research attempts to examine the impact of supply chain digitalization on supply chain resilience (flexibility, adaptability, recovery and agility) in Jordanian Pharmaceutical Manufacturing Companies.

Sub -Questions:

- 1- What is the impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies?
- 2- What is the impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies?
- 3- What is the impact of supply chain digitalization on recovery of Jordanian Pharmaceutical Manufacturing Companies?
- 4- What is the impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies?

1.4 Research Purpose and Objectives

The primary purpose of this Research is to investigate the impact of supply chain digitalization on supply chain resilience in Jordanian Pharmaceutical Manufacturing Companies. This Research aims to achieve the following objectives:

Main Objectives

To investigate the impact of supply chain digitalization on supply chain resilience in Jordanian Pharmaceutical Manufacturing Companies.

Sub -Objectives

- 1- To investigate the impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies.
- 2- To investigate the impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies.
- 3- To investigate the impact of supply chain digitalization on recovery of Jordanian Pharmaceutical Manufacturing Companies.
- 4- To investigate the impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies.
- 5- To suggest recommendations for supply Pharmaceutical chain managers in the process of advanced resilience capability based on supply chain digitalization.

1.5 Significance of the Research

These days, the issue of digitization and how to apply it to gain a competitive advantage is gaining increasing importance to keep pace with development and thus maintain the competitive position of the company and its growth in the market.

Given the significance of supply chain resilience, there have been steady calls for more theoretical and empirical research on supply chain resilience (Remko,2020).

Theoretical contribution: According to recently published Scholten et al. (2020), there is limited empirical research on supply chain resilience.

Managers in this industry can use the result to make the right decision.

The Research's findings can be used to inform future academic studies on report writing.

Therefore, Researching the impact of digitization on the resilience of supply chains for the pharmaceutical sector is essential.

This Research Lies In:

- 1- This research contributes to the current knowledge in the field of supply chain resilience. According to previous research, few studies have measured the impact of supply chain digitization on supply chain resilience (in Jordanian pharmaceutical manufacturing companies).
- 2- Because of the dynamic business environment in the pharmaceutical industry, supply chain flexibility is essential, and supply chain competitiveness is increasing.
- 3- This Research helps the managers and decision-makers in their planning and decision-making that are intent on developing supply chain digitalization to improve supply chain resilience.
- 4- The results can be used not only for the health sector in Jordan but in many other countries and sectors that are trying to keep pace with technological development and achieve a competitive advantage through it.
- 5- This Research will discuss the most important economic sector in Jordan, which is the pharmaceutical sector, which plays an important role in the national economy.

1.6 Research Hypotheses

The above questions will be answered by testing the following hypothesis:

Main Hypothesis

H0: There is no significant impact of supply chain digitalization on supply chain resilience combination (flexibility, adaptability, recovery, agility) in Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

Based on supply chain resilience, the main hypothesis can be divided into the following **sub-hypotheses**:

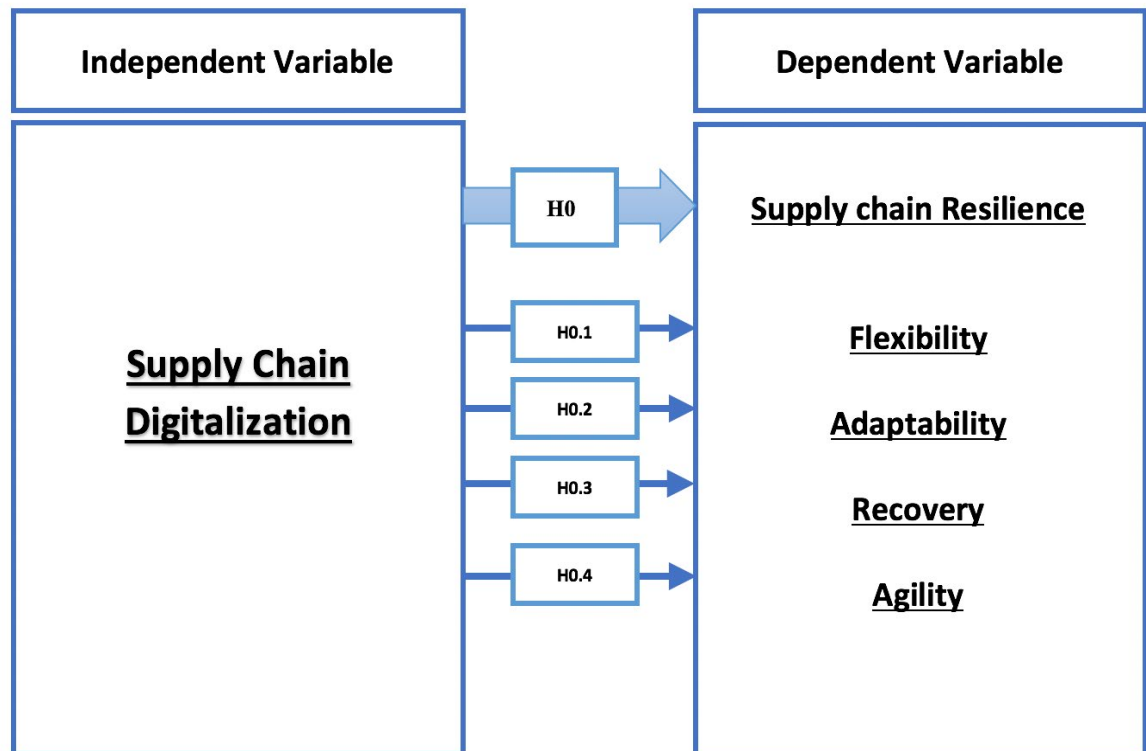
H0.1: there is no significant impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

H0.2: there is no significant impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

H0.3: there is no significant impact of supply chain digitalization on recovery of Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

H0.4: there is no significant impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

1.7 Conceptual Framework



1.8 Definitions of Terms

Supply chain digitalization: the adoption of advanced technologies and technical framework focused on providing smart data, which enhance the integrated supply chain, and boost productivity, thereby improving customer perceived value.

Supply chain resilience: is the supply chain's adaptive ability to prepare for unexpected events, respond to disruptions, and recovery from them while maintaining operational continuity at the desired level.

Flexibility: the capacity of a firm to react swiftly and efficiently to changing demands from its environment and stakeholders.

Adaptability: The capability of changing operations in response to the challenges or opportunities, Redistribution of resources, reduced setup time, taking advantage of opportunities that arise from disturbances.

Agility: the capability to respond swiftly to unpredictably change in supply or demand and the capability of the firm to adapt to any change in the marketplace to strengthen the agility of the extended supply chain.

Recovery: The capability to revert to a normal operational state rapidly.

1.9 Research Limitations

Human limitation: This Research carried out on supply chain executives' managers in the Jordanian Pharmaceutical industry.

Place Limitation: The Research consider Jordanian pharmaceutical manufacturing companies in Amman.

Time Limitation: This Research was implemented during the academic year 2022.

1.10 Delimitation of the Research

Because this research will be conducted on Jordanian pharmaceutical manufacturing companies, generalizing the findings to other industries is unlikely. Furthermore, the research will be conducted in Jordan; extrapolating Jordanian findings to other countries may be problematic. It's possible that the variables' examined aspects and measures need to be fine-tuned. Despite the fact that the majority of the variables in this Research have excellent measurement reliability and validity, certain variables may benefit from additional instrument improvement.

B

CHAPTER TWO

Literature Review

2.1 Introduction

The goal of this chapter is to demonstrate the main concept of supply chain And supply chain digitalization and supply chain resilience, as well as the relationship between supply chain digitalization and supply chain resilience.

The concept of supply chain:

Supply Chain is one of the most contemporary management approaches for dealing with the issues of the information and technology era. This Chain encompasses a wide range of functional operations and is built on the development of accesses in order to create efficient supplier-customer integration, with goods produced and distributed in the proper quantities.

The value of the Supply Chain, which is at the base of adopting an integrated, coordinated, disciplined, and structured framework for managing an company's services or products, is that it allows impactive communication among business stakeholders (Raghavendra and Nijaguna,2015). On the other hand, as global competition and the need for broader inter-companyal cooperation became more obvious in recent decades, companies were forced – and continue to be forced – to take actions to improve their supply chains and make them more flexible and responsive to changing conditions (Surowiec, 2013).

As a result, the Supply Chain has been regarded as one of the most significant components in preserving competitiveness and companyal success for the previous two

decades. This is because businesses know the value of the supply chain and how it impacts their overall relationships with customers and suppliers. (Taylor, 2014).

Since the mid of 1980s supply chain research has been important, According to Thomas and Griffin (1996), the supply chain has three key stages: procurement, production, and distribution, each of which has its own management. They depicted the components of the supply chain in their model.

The concept of supply chain developed throughout the time and According to Chopra and Meindal (2007), the supply chain includes all parties participating directly or indirectly in meeting customer demand, as well as all services involved in receiving and fulfilling requests. Manufacturers and suppliers, warehouses, transporters, merchants, and end customers are among these functions.

The goal of every supply chain, according to Chopra and Meindal (2007), is to maximize the overall value created.

According to Naslund and Williamson (2010), a supply chain is made up of an upstream network of suppliers and a downstream network of customers, all of which are connected by a structured information flow. Lastly, Krajewski et al. (2013) defined a supply chain as "the interconnected sequence of activities within a firm and across other firms that generate a product or service to customer satisfaction."

To summarise, the concept of the supply chain was recently developed, and going by previous definitions of the supply chain, the Research concludes that the supply chain plays an essential role in the operations of various companies. As a result, the supply chain is a set of interconnected operations that work together to provide customer satisfaction.

2.2 Supply Chain Digitalization

After the fourth industrial revolution, supply chain digitalization has become the industry's newest buzzword (Büyüközkan& Göçer, 2018). The interest in technology increased as the ecosystem became more interconnected within the company's functional areas. Starting with digital transformation, the industrial revolution encouraged companies to develop more flexible supply chains, which led to the creation of new values. (Büyüközkan& Göçer, 2018).

The process of digital transformation is not only about using digital data and digital technology to improve procedures, functions, and events also requires changing processes to achieve a specific goal. (Hagberg et al. 2016).

Digitization has opened up great opportunities for supply chains, including improved B2B logistics, increased information availability, immediate and timely access to information, efficient operations, efficient inventory management and collaboration, and innovation in product design (Khajavi et al., 2015; Porter and Heppelmann 2015), As well as Digitisation, has helped the interdependence of activities and information flow between the company and its suppliers (Kache and Seuring 2017).

Digitization in supply chains creates a competitive advantage to meet the changing needs of customers efficiently; digitizing supply chains means the way that supply chains are managed regardless of whether the products are digital or physical; the goal is to increase revenue streams and open new opportunities in the market (Hagberg et al. 2016), Most of the successful companies in the world are characterized by distinct supply chains where digitization has helped to distinguish supply chains, Almost every DSC has its own set of characteristics.

Some of the primary aspects that DSC aims to attain are compiled from these various advantages: Flexibility, Real-time inventory, Speed, and Transparency (Büyüközkan,& Göçer,2018).

There are often critical differences between digitalization and transformation in business practice. Digitalization is a process that can transform a business, but only after it has been successfully carried out correctly. This is usually achieved by converting various products and information (Ehie & Ferreira, 2019). By converting existing processes, these resources can be used to improve and streamline operations. This can be particularly helpful during times of crisis. The evolution of Industry 4.0 has brought about new technologies that can completely change the way supply chains operate. One of the most significant advantages of digitalization is its ability to reduce costs and improve operational efficiency. It can also help companies make more strategic decisions faster. (Seyedghorban et al., 2020).

One of the most critical steps that supply chain operators can take to achieve significant efficiency gains is end-to-end transparency. This can be achieved through the use of digital processes, which can provide real-time visibility into the operations. During the COVID-19 pandemic, many supply chains were severely affected by the lack of reliable systems. This can happen due to various factors, such as the closure of certain network parts (Deepu & Ravi, 2021).

According to Accenture Consulting, digitalization has the potential to change supply chains by increasing the value, accessibility, and affordability of services. As a result, a new viewpoint on digital technology is required to develop new supply chain opportunities.

According to the Digital Supply Chain Initiative, the DSC is a customer-centric platform that collects and maximizes the use of real-time data from a variety of sources. They say that DSC allows for demand stimulation, sensing, matching, and management, resulting in improved performance and reduced risk.

Also, the digital supply chain is defined as a smart, customer-centric, system-integrated, globally linked, and data-driven process that uses emerging technology to deliver essential goods and services that are more available and affordable. (Bhargava, Ranchal, and Othmane 2013; Büyüközkan & Göçer, 2018).

2.3 Supply Chain Resilience

The dynamic and highly competitive world of the twenty-first century generally requires a fundamental reconsidering of how modern supply chains work; both competitors and customers put pressure on modern supply chains to manufacture more customized and complicated products at low prices, high quality, and with a global customer range (Ponis, & Koronis, 2012). According to Bakshi and Kleindorfer (2009), the main reason for the increased interest in supply chain resilience and vulnerability aspects is the growing realization of the magnitude of losses (directly and indirectly) caused by supply chain disruptions aided by recent research.

The expression "supply chain resilience" was first used in the literature a few years ago, and it has recently acquired popularity (Falasca, Zobel, & Cook, 2008). As cited in (Tukamuhabwa, et al, 2015).

Resilient supply chains are defined in this field of Research as absorbing or avoiding disruptions totally or recovering considerably more quickly after a disruption (Adobor & McMullen, 2018). Earlier, vulnerability and risk were the most widely

studied terms in the literature when it came to the resilience concept. According to Christopher and Peck (2004), the risk is defined as the likelihood of a given event versus its unfavorable business consequence.

The four formative aspects of resilience identified by Juttner and Maklan (2011) are a) flexibility, b) velocity, c) visibility, and d) cooperation and they are the most frequently referenced and encompass the conceptual substance of all ideas in current SCRes research. And the most widely stated strategy is enhancing flexibility, establishing redundancy, forming collaborative supply chain partnerships, and improving supply chain agility. (Tukamuhabwa et al. 2015).

Resilience is one of the most critical factors that can help companies respond to market variability. It can also be obtained through various strategies and processes. The author also talked about the case of the HP printer, which was designed ad-hoc due to the delays in the completion of the units due to the orders from different European countries (Fonseca & Azevedo, 2020).

Resilient supply chains rely on the diversity of their partners to reduce operational complexity and improve their bottom line. In 2020, Gartner stated that the increasing frequency of supply chain disruptions has caused businesses to rethink their strategies for improving their supply chain resilience.

Modern supply chain technologies can help companies improve their supply chain resilience by allowing them to manage their partners' complex contracts and procedures even in distant regions. Resilient supply chains rely on the use of capacity and inventory buffers to minimize their surpluses and keep their costs low. Supply chain managers

have traditionally carried out this strategy to keep their costs low (Lim-Camacho et al., 2017).

Flexibility: The capability of an company to respond swiftly and impactively to changing needs of its environment and stakeholders. (Tukamuhabwa et al., 2015).

And flexible supply chain is one that can adapt to changing customer demands. Increases or decreases in product quantities, a need for customized products for particular consumers, demand for new products, and the addition of new customer locations are all examples of these changes. As a result, supply chain flexibility requires internal flexibility at each node, as well as flexibility among supply chain members.

Supply chain flexibility can be achieved broadly by applying digital technologies through a flexible system that allows for the integration of intelligent supply chain features.

Unfortunately, constraints on resources can also affect the resiliency of a supply chain. This is why it is essential to manage these issues carefully. Although resilience and continuity are two different concepts, they can be essential for managing a supply chain's risk. A comprehensive business continuity strategy can help ensure that the company can operate seamlessly following a significant disruption.

Similarly, supply chain resilience ensures that the company's supply chain is strong enough to withstand unforeseen events. It also involves establishing long-term relationships with its suppliers (Bag et al., 2019)

The literature has found several flexibility techniques that help improve SCRES, including delay, a flexible supplier base, flexible logistics, flexible labor agreements, and product delivery flexibility. (Tukamuhabwa et al., 2015))

Define five significant types of supply chain flexibility; 1) product, 2) volume, 3) launch, 4) access, and 5) responsiveness (Vickery et al., 1999).

Adaptability: Supply chain adaptability refers to a company's ability to change its supply chain design in response to market structural adjustments and modify its supply network to reflect changes in technology, products, and strategies (Erol, Sauser, & Mansouri, 2010). and responding to change by flexibly altering the supply chain's structure (For example, outsourcing, transferring manufacturing facilities, and establishing new supply bases). One of the most critical factors that a company must consider when developing a resilient supply chain is having the ability to access working sources that can grow with it. Proactively adopting technology can help companies keep track of their data and communicate with their suppliers and customers. This can be done through the use of collaborative tools. (Eckstein et al., 2015).

Supply chain adaptability, according to Ketchen and Hult (2007), is the readiness to rebuild supply chains as needed, without regard for legacy difficulties or previous operations; and According to Stevenson and spring (2007), supply chain adaptability is a characteristic of a supply chain that allows its members to react with supply chain dynamics. As a result, we propose that supply chain adaptability allows supply chain participants to respond to changing conditions and achieve the competitive advantage they desire.

A supply chain's ability to respond quickly to changes in demand is one of the most critical factors that a company should consider when developing a resilient supply chain. Despite the importance of digitization, many companies still have manual processes related to their supply chains. (Ivanov et al., 2021). Redesigned and improved supply chains can respond to changes in the internal environment and external factors such as customer preference and demand. They can also manage their inventory and logistics to maximize their business performance. They can also develop and implement new supply chain execution capabilities. Redesigned supply chains can be achieved through digital technology, which is already starting to have a real impact on the way businesses operate. (Ivanov et al., 2021).

Recovery: The capability to revert to a normal operational state rapidly. It is particularly crucial since, even in the event of a disruption, customer needs and corporate demands must be addressed. Using buffer stock could be the most impactful approach to handle an interruption.

More importantly, a supply chain structured for speedy recovery has a better possibility of developing reaction plans in the case of disruption by utilizing adaptive behaviors and system-wide cooperation. During a disruption, a supply chain with poor recovery capability and thus reduced business and customer fulfillment are less likely to foster system-wide collaboration and recovery. As the economy worsens, more companies are starting to look at risk mitigation as a long-term strategy to minimize the impact of supply chain disruptions. They realize that a coordinated approach to planning and execution will allow them to respond to unforeseen challenges. Before

implementing a recovery strategy, companies should first analyze their channel performance. (Chen, Das, & Ivanov, 2019)

They should also look into the possibility of shifting their sales from one channel to another. For instance, if the demand for certain products has changed due to the pandemic, then a recovery strategy should be developed for that industry (Ivanov et al., 2021). Before going through with a recovery plan, companies should also analyze their internal operations to determine if they can still function efficiently. This step should be done based on the availability of raw materials, demand, and their capacities. Today's economic conditions require companies to take various risk mitigation measures to prepare for the changes that will affect their operations in the future. These include the need to re-evaluate their supply chains to accommodate new business conditions (Seyedghorban et al., 2020).

Agility: Because of the changing nature of market conditions, agility is a necessary component of a company's long-term success; according to Christopher & Peck (2004), agility is characterized as the ability to adapt faster to unpredictably changing demand or supply; this could be accomplished, by making quick modifications to administrative processes and technology (Erol et al. 2010). As cited in (Tukamuhabwa, et al , 2015)

Supply chain agility enables businesses to respond to unexpected situations more quickly. Furthermore, agile supply chains are more market-oriented because they can better align supply with demand. The presence of agile partners upstream and downstream of the focal firm is essential to agile responsiveness.

Moreover, mass customization, or the capacity to make customer-customized items at or near mass manufacturing costs, drives the need for supply chain agility. (Swafford, Ghosh, Murthy, 2008) as cited in (Ponis & Koronis, 2012).

The best companies have the ability to respond to market changes by developing and implementing impactful supply chains. This is very important because, in most industries, both supply and demand fluctuate rapidly. Through continuous innovation, Zara has become Europe's most profitable apparel brand. One of its key initiatives is creating an agile design process, which allows designers to spot trends and order fabrics quickly (Gölgeci & Kuivalainen, 2020).

Supply chain agility is defined as a company's ability to sense short-term, temporary impacts on the supply chain and market environment (e.g., demand volatility, supply shocks, changes in suppliers' time delivery) and respond to all of those changes flexibly and quickly through using existing supply chain (For example, minimizing material replacement periods, manufacturing throughput times, and adjusting delivery capacities). As a result, supply chain agility emphasizes change (Eckstein, et al. 2015). Supply chain agility has been considered as a promising strategy for companies seeking superior performance and long-term competitive advantage (Li et al. 2008, Gligor, and Holcomb 2012a).

Agility allows a company to achieve a competitive advantage in a high volatile operating environment (Swafford et al., 2006,2008; Ngai et al., 2011; Blome et al., 2013; Yusuf et al., 2014; Brusset, 2016). Supply chain agility can benefit with cost performance in a variety of ways, it allows companies to deal with supply chain disruptions in a smooth and cost-impactive way (Blome, et al. 2013). Supply chain

agility allows companies to better align supply and demand. Lowering the cost of inventory and transportation, postponement can result in lower inventory, production, and transportation costs. (Eckstein et al , 2015), Also Some authors defined supply chain agility as a company's ability to change its techniques and operations inside its supply chain in response to environmental changes, opportunities, and threats (Gligor, et al. 2013; Gligor, and Holcomb, 2014; Eckstein et al. 2015).

2.4 Relationships between Supply Chain Digitalization and Supply Chain Resilience

Recently, some researchers investigated the relationship between supply chain digitalization and supply chain resilience (Ivanov and Dolgui, 2019b; Pettit et al., 2019; Lezoche et al., 2020). According to Ivanov and Dolgui (2019b), the impact of digitalization on the resilience of operations and supply chain resilience is a complex issue. They emphasize the importance of descriptive and predictive data analysis in gaining visibility and improving forecast accuracy, as well as improving contingency plan activation. Similarly, Zhang and Zhao (2019) demonstrate that big data improves supply chain resilience by increasing visibility. Cloud computing and blockchain technology improve visibility, predictability, and adaptability, which can promote SCR (Pettit et al., 2019).

The adoption of information technology has gained significant importance due to the advancements in digital technologies. In 2020, Carpinetti and Lima-Junior explored the link between information sharing and impactful operational coordination. The ability to connect across the SC can help make the most of the opportunities presented

by digitalization. A closed-loop network can help maximize profits by considering various factors such as inventory control and pricing (Seyedghorban, et al., 2020).

Due to the emergence of Industry 4.0 and digital transformation, it is becoming more important for businesses to integrate these technologies into their supply chain operations. Having the right tools and strategies can help them manage their supply chain impactively. In 2019, PricewaterhouseCoopers (PWC) stated that the importance of resilient supply chains was not only about defending against external threats, but also about finding competitive advantage through supply chain planning (Aslam et al., 2020; Min, 2019)

Chapter THREE

Research Methodology

3.1 Introduction

In this chapter, the research methodology is presented, which is defined as a systematic manner to achieve the objectives of a Research to address a research problem. It is a way in which a Research is conducted scientifically. Research methods are explained as the techniques and procedures utilized in undertaking research. Thus, this chapter offers an overview and discourse of the methods, processes, and strategies used in this research, encompassing the practice of data collection and examining the generated data in order to help with testing the formulated hypotheses with regard to the Supply Chain Digitalization Resilience relationship within the Jordanian

Pharmaceutical industry. The chapter is divided into research methods, approach, data collection, and, lastly, finishes with the descriptive statistics used for the descriptive statistics relating to the personal information, validity, and reliability of the chosen instrument.

3.2 Research Methods

Three research methods can be employed in research concerning human and social science issues: quantitative, qualitative, and mixed methods (Creswell, 2003). Generally, research strategies that are qualitative and quantitative vary in terms of two primary dimensions (Bryman, 2004). The first dimension is linked to a researcher's personal philosophical assumptions (in particular, epistemological and ontological viewpoints), which can affect the research's nature and meaning. The second correlates with the researcher's viewpoints on theory's role in research (for example, if theory is developed via research or tested via research). This kind of research concentrates on understanding a specific phenomenon through collecting and examining numerical data and completing numerical tests (Creswell, 2009). This second dimension will be utilized in order to structure the discussion of the current Research's characteristics.

3.3 Research Approach

The other primary ways of discerning among qualitative and quantitative methods of research is linked with how the research correlates with theory (Bryman, 2016). Two main approaches exist to link theory and research: deductive and inductive. This section explores these different approaches and shows how this research is rooted in the deductive reasoning method.

Deductive approaches are used to test hypotheses or theories. For this kind of research, the researcher collects data and then develops hypotheses that are able to be investigated or tested quantitatively (Schadewitz and Jachna, 2007). With a deductive approach, the Research is focused on Researching specific issues, which are linked to prior concepts and theories, and these constitute the research hypotheses. Furthermore, the deduction approach (testing of theory) is strongly linked with quantitative research (Bryman & Bell, 2007).

Inductive research begins with the building of an empirical investigation, which is then undertaken through employing an interpretivist approach, and therefore a corresponding theory can be formulated (Creswell 2003). In contrast to the deductive approach, the inductive approach intends use theory as a conclusion.

In this Research, the deductive method of reasoning was adopted. It is not feasible for this Research to be only inductive as this research is based on a deep theoretical core in management. Therefore, this research employed deductive reasoning since it drew upon long-standing theory with regard to the supply chain in order to inform the assumptions that have steered and shaped the activity and analyses of this Research.

3.4 Population and Sample

The main aim of this Research is to examine how Jordanian executives pursue (supply chain decisions) in the Jordanian Pharmaceutical Manufacturing Companies; therefore, it is important to elicit responses from a large number of Jordanian companies to generate valid and reliable information. The population for the current research is the supply chain executives in the Jordanian Pharmaceutical Manufacturing Companies.

Trying to get data from the population (supply chain executives' manager, top and middle managers in Jordanian Pharmaceutical Manufacturing Companies) for the current Research would be perfect, but for many reasons, this is almost impossible. Thus, the initial plan for this research is to select a convenience sample.

The Research's population consists of supply chain executives in Jordanian pharmaceutical manufacturing company that are registered in Jordanian Association of Pharmaceutical Manufacturers in 2022, a total of 17 companies (The Jordanian Association of Pharmaceutical Manufacturers) (JAPM). A survey of all companies is used to collect data from all these companies.

3.5 Unit of Analysis

The survey unit of analysis consisted of 211 managers from Pharmaceutical Manufacturing Companies who were available and ready to participate at the time the questionnaires were distributed, there are only 145 answers received, and a total of 139 were valid for analysis

3.6 Data Collection Procedure

For this investigation, secondary and primary data were used. Secondary data was gathered through the use of books, research, essays, dissertations, theses, working papers, journals, and the Internet. Secondary data is used to establish a powerful theoretical foundation and research direction. That once variables and Research conceptual model have already been established. Questionnaires emphasizing on the conceptual framework's core variables will be used to collect primary data.

3.7 Questionnaire

The questionnaire was created to reflect the main aim of research objective, research model, hypotheses where the initial draft was sent for evaluation by the academic jury in accordance with the requirements of the University of Petra, Faculty of Administrative and Financial Sciences. The review was carried out by seven internal faculty members and eight external reviewers from two Jordanian universities (Middle east University, and Al-Zaytoonah University).The list of auditors is presented in Appendix (1) to ensure the validity, clarity and understanding of the questionnaire and to express their opinion on the level of clarity of the questionnaire items, the level of accuracy and smoothness of the text, in addition to deleting or adding paragraphs or modifying and correcting the wording. Which is divided into two components, based on the hypothesis and the Research model.

Questionnaire Variables:

The questionnaire is divided into two parts:

The first section includes demographic information such as gender, age, attainment, job title, education, and experience.

The second section consists of independent and dependent variables, as shown below:

1. Independent Variable: (Digitizing the Supply Chain)
2. Dependent variable and it consist of four sub- variables: supply chain resilience (flexibility, adaptability, recovery, agility)

The Research used the five Likert scale, so all variables (sub-variables) were measured by appropriate questions rated from (1 to 5) to allow respondents flexibility in choosing their actual perspectives.

3.8 Descriptive Statistic

Following the development of the questionnaire based on previous studies, the researcher utilized SPSS to answer the Research's questions and evaluate the hypothesis, which included the following tests:

Simple linear regression analysis: to see if each independent variable has an impact on the dependent variable.

The one-on-one analysis of variance test is used to see if there are any significant statistical variations in the research sample's responses between a set of independent variables and the dependent variable that are related to the surveyed sample's personal and functional characteristics.

Measures of central tendency: to explain the opinions of the Research sample on the Research variables and to establish the importance of the statements contained in the questionnaire, such as the arithmetic mean, frequencies, and percentages

Cronbach Alpha Test: This is an analysis of the collecting data tool's reliability in evaluating the variables in the Research.

3.9 Demographic analysis

Once data was collected via questionnaires, this section explores the descriptive statistics relating to the demographic information, including: the respondent's age,

gender level of education, years of experience in same company, job position, and work experience.

Table 3.1 Frequency Distribution by Gender

Gender	Frequency	Percent	Cumulative Percent
Female	52	38	38
Male	85	62	100
Total	137	100	

In Table (3.1) above, it demonstrates the respondents' demographic characteristics with regard to gender. Most respondents are male, with a number of 85 (62.0%), whilst the number of female respondents is 52, which denotes (38.0%) of the sample, which illustrates that this industry has more male workers than females due to the nature of work in the Jordanian Pharmaceutical industry.

Table 3.2 Frequency Distribution by Age

Age	Frequency	Percent	Cumulative Percent
30 – 40	60	43.8	43.8
41 – 50	36	26.3	70.1
Above 50	12	8.8	78.8
Less than 30	29	21.2	100
Total	137	100	

The respondents' ages were classified into four groups: The majority of the respondents were in the first group (30-40 years old) with (n=60, 43.8%). 36 of respondents (26.3%) reported their age to be between 41 and 50 years old, and only 8.8 % of the respondents reported their age above 50. This indicates that the Pharmaceutical industry employees are youth in nature.

Table 3.3 Frequency Distribution by Education Level

Education Level	Frequency	Percent	Cumulative Percent
Bachelor's or equivalent level	100	73	73
Doctor or equivalent level	4	2.9	75.9
Master's or equivalent level	33	24.1	100
Total	137	100	

With regard to the respondents' educational level, more than half of the respondents have a bachelor's degree (N=100– 73.0%). While, (N=33- 24.1%) hold a master's degree, but only 4– 2.9% of respondents said they had a PhD degree.

Table 3.4 Frequency Distribution by Year of Experience in Same Company

Year of Experience	Frequency	Percent	Cumulative Percent
1-3 years	47	34.3	34.3
3-6 years	22	16.1	50.4
Above 6 years	51	37.2	87.6
Less than 1 year	17	12.4	100
Total	137	100	

According to table (3.4) the largest proportion had above 6 years of experience working in the same company (37.2% - N=51). While the least years of experience in same company are less than one year with 17 respondents (12.4 %).

Table 3.5 Frequency Distribution by Job Position

Job Position	Frequency	Percent	Cumulative Percent
Middle-Level manager	93	67.9	67.9
Top-Level manager	44	32.1	100
Total	137	100	

This research explores the respondents' job position in accordance with the manager's level in firms. It demonstrates that 67.9% of respondents (n= 93) are Middle-Level managers. Additionally, the data analysis shows that 32.1% (n=44) are Top-Level managers. Thus, these findings indicate that all of the questionnaires were filled in by managers, who tend to deal with decisions about the supply chain in the studied firms. Therefore, the research results could be viewed to be reliable in nature.

Table 3.6 Frequency of Distribution Year of Experience

Year of Experience	Frequency	Percent	Cumulative Percent
10 to 20 years	53	38.7	38.7
Above 20 years	32	23.4	62
Less than 10 years	52	38	100
Total	137	100	

Finally, according to table 3.6, the largest proportion had between 10 and 20 years of experience working (53- 38.7%). Followed by (52 – 38%) have a work experience less than 10 years. However, only (32 – 23.4 %) of respondents have above than 10 years' experience.

3.10 Validity and Reliability

3.10.1 Validity

Validity references an instrument's capacity to measure what it is supposed to measure (Colton and Covert, 2007). To ensure the instruments' validity, the researcher guaranteed that the questions conformed with the objectives of the Research. Quality experts were consulted in order to assess the relevance. Thus, to evaluate the data collection tool's validity in relation to its format, readability, and ability to measure the constructs of the Researchs; the researcher shared the questionnaire with academic

reviewers from Petra University and other business administration faculties, who have a specialism or expertise in the Research are of this research.

3.10.2 Reliability

The next section explores the obtained data's reliability. Reliability is related to the extent to which a scale yields consistent findings if repeated measurements are taken (Malhotra, 2004). In this research, Cronbach's Alpha was employed; therefore, reliability scores are shown numerically as a coefficient. A higher value demonstrates good internal consistency of the scale's items (George and Mallery, 2003). A coefficient score will be 1.00 if a test is completely reliable. A coefficient of at least 0.60 is necessary to show an acceptable degree of reliability (Sekaran, 2004).

	Cronbach's Alpha	N of Items
Supply Chain Digitalization	.812	7
Flexibility	.645	5
Adaptability	.821	5
Recovery	.689	6
Agility	.655	5

The values of Cronbach's alpha for the seven main constructs of this Research are 0.812 for Supply Chain Digitalization, 0.645 for Flexibility, 0.821 for Adaptability, 0.689 for Recovery, and 0.655 for Agility. These values highlight the reliability of the constructs in the questionnaire.

3.11 Summary

In this chapter, the use of quantitative analyses was justified, which was employed in order to address the research questions and test the hypotheses proposed. Moreover,

the measurement scales have been identified for every construct, in line with established and previously tested scales. A questionnaire survey will be the method utilized in order to gather the data from Jordanian respondents. Lastly, statistical techniques have been outlined.

CHAPTER **Data Analysis**

4.1 Introduction

In this chapter, this Research's results are presented, along with the exploration of the findings and analyses relating to the collection of quantitative data. Initially, the main survey's descriptive statistics and each of the variables from the main model are discussed. Data was examined through employing both descriptive and regression analyses in Statistical Package (SPSS). Furthermore, descriptive statistics, which includes measures of mean and standard deviation, were deduced for the Research's variables and individual respondents. Secondly, the data relating to the digitization of the supply chain digitalization and supply chain resilience in Jordanian Pharmaceutical industry is going to be analyzed.

4.2 Descriptive Statistics

The aim of the descriptive statistics analysis is to outline the primary components of the distributed data, which is illustrated by the mean and the standard deviation. This section will utilize the descriptive statistics analysis with regard to the two variables of the research (Supply Chain Digitalization; Supply Chain Resilience “flexibility, adaptability, recovery, and agility”) in order to demonstrate their fundamental

distribution features. Respondents were requested to score and measure all factors within the survey using a five-point Likert scale.

4.2.1 The Descriptive Statistics Analysis of Supply Chain Digitalization

The questionnaire was designed by the researcher in line with prior studies. Thus, the Supply Chain Digitalization level was calculated via a set of seven questions, constituting of five-point Likert scales. The respondents were urged to answer to what extent they agreed with disagreed with the statements provided. The scale's midpoint is (3), therefore, a mean above 3 demonstrates overall agreement with a statement, whilst a mean below 3 demonstrates overall disagreement.

Table (4.1) Supply Chain Digitalization

No	Supply Chain Digitalization	Mean	Std. Deviation	Statement Importance	Importance Degree
1	The company develops digital system to analyze data.	4.051	.9418	2	High
2	The digital system in the company helps in the impactive management of inventory.	4.190	.8620	1	High
3	The company invests in digital supply chain for enhancing the supply chain resilience.	3.971	.9621	3	High
4	The company uses digital technologies to enhance relationships with suppliers.	3.686	1.0414	6	High
5	Customers may easily access the latest product and service offerings by the digital technologies.	3.708	1.0513	5	High

6	The company invests in the digitalization of the supply chain in order to respond to the increasing demand of customers.	3.948	.9488	4	High
7	Digital tools in the company help to detect potential disruptions.	3.635	.9843	7	High
	Average	3.884	0.665		High

The table above (4.1) displays the managers at Middle-Level and Top-Levels' responses in relation to the Supply Chain Digitalization, where the mean for the Supply Chain Digitalization is 3.884, which is perceived to be high, and the means range from 3.635 - 4.948, thus all of these aspects are considered to be high agreement, implying that most respondents were in agreement on the importance of Supply Chain Digitalization.

As illustrated by the data in table 4.1, the respondents verifies the significant role of a digital system in the management of inventory for the Jordanian Pharmaceutical industry. This can be demonstrated by the responses to the statement, "The digital system in the company helps in the impactful management of inventory," which is at the higher level (its mean is 4.190) and with a standard deviation of (.8620). Moreover, the finding illustrates that firms in the Jordanian Pharmaceutical industry have concerns regarding the analysis of data, thus they have developed a digital system, "The Company develops digital system to analyze data." Which are in the next ranks with means of (4.051) and standard deviation of (.9418).

4.2.2 The Descriptive Statistics Analysis of Supply Chain Resilience

This research's second studied variable is Supply Chain Resilience. In response to the literature review and this Research's theoretical background, the primary dimensions employed to measure the Supply Chain Resilience were Flexibility, Adaptability, Recovery and Agility. The descriptive statistics relating to each of these indicators are outlined and explored in the following tables.

4.2.3 The Descriptive Statistics Analysis of Flexibility

Table (4.2) Flexibility

NO	Flexibility	Mean	Std. Deviation	Statement Importance	Importance Degree
1	The company has the ability to respond quickly to changing customer demands.	3.890	.7666	1	High
2	There is cooperation between the company and its suppliers to respond to changes in the volume of production.	3.721	1.0306	4	High
3	The company deals with suppliers that are quick to respond to the company's requests.	3.847	.9463	3	High
4	The company has the ability to respond to changes in the internal and external environment.	3.861	.7493	2	High
5	The company can easily modify its supply contracts to change specifications, quantities and conditions.	3.504	1.1384	5	High
	Average	3.765	.6004		High

Table (4-2) explains the level of significance for Flexibility, whereby the means range between (3.504 - 3.890), as compared with the general mean amount of Flexibility (3.765). It can be deduced that there is a high mean in relation to the first item, "The company has the ability to respond quickly to changing customer demands", with a mean of (3.890) and a standard deviation of (0.7666). Whereas the lowest mean

related to the item, "The company can easily modify its supply contracts to change specifications, quantities and conditions." There was an average of (3.504) and a standard deviation of (1.1384). Overall, Flexibility had a high level of importance within the Jordanian Pharmaceutical industry.

Table (4.3) Adaptability

NO	Adaptability	Mean	Std. Deviation	Statement Importance	Importance Degree
1	The company can quickly adjust the production mix using digital techniques	3.401	1.0604	5	High
2	The company has the ability to "rapidly" integrate supply chain operations through digitalization.	3.518	1.0921	3	High
3	The company can reallocate task between different production facilities quickly.	3.409	1.0816	4	High
4	The company can adjust the supply chain through outsourcing when needed.	3.574	.9861	2	High
5	The company can redesign the supply chain structure in response to structural changes in the market.	3.713	1.0880	1	High
	Average	3.523	.8092		High

Table 4.3 presents the mean score for the items employed to measure Adaptability, which was 3.523, with a standard deviation of 0.8092. The overall mean score of 3.523 suggests that the Middle-Level and Top-Level managers were in agreement with regard

to how the Jordanian Pharmaceutical companies can alter and react to different products and the market required during the digitalization process. Furthermore, the highest score was present when the respondents responded to how the company reacted to market alterations, which is illustrated via the answer to the item, “The Company can redesign the supply chain structure in response to structural changes in the market”. In comparison, the lowest score was identified when the respondents responded to the item that discussed the company quickly adjusting their production methods (mean score=3.401, SE=1.0604).

Table (4.4) Recovery

NO	Recovery	Mean	Std. Deviation	Statement Importance	Importance Degree
1	The company can immediately build a formal response team of individuals.	4.007	.6938	1	High
2	The company can quickly return to the normal operating state.	3.978	.7714	3	High
3	The company develops adaptive and cooperative behaviors in the event of disruption.	3.949	.7507	6	High
4	The company handles disruptions quickly.	3.971	.8039	4	High
5	The company has collaborative plans and strategies to recovery from disruption.	3.971	.9070	5	High

6	The company has a reserve stock to meet customer requirements in the event of disruptions.	4.007	1.0675	2	High
	Average	3.981	0.482		High

Table (4.4) illustrates that the means of Recovery ranges between item from 3.978 to 4.007, with standard deviation ranges between 0.9070 and 1.0675, meaning that strong agreement exists among respondents in terms of the greater importance of said items. The average mean of Recovery is 3.981, with a standard deviation of 0.482, meaning that agreement exists on the high importance of Recovery.

Table (4.5) Agility

NO	Agility	Mean	Std. Deviation	Statement Importance	Importance Degree
1	The company can benefit from the advantages of synchronizing supply and demand in terms of reducing inventory costs.	4.000	.9156	2	High
2	The company makes supply chain decisions quickly.	3.964	.9268	4	High
3	The company has the ability to quickly deliver products on time.	4.088	.7120	1	High
4	The company identifies possibilities and challenges at the appropriate time.	3.985	.7764	3	High
5	Supply chain changes are implemented “quickly” by the company.	3.964	.9188	5	High

	Average	4.000	.5541		High
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Table (4.5) demonstrates that the means of the respondents' perspectives regarding the implementation of agility items ranges from 3.964 to 4.088, with a standard deviation that ranges from .7120 to .9268. These findings show that there is consensus on the high significance of agility. The third item (The company has the ability to quickly deliver products on time) demonstrates the highest mean (4.088), alongside the highest standard deviation (.7120). This illustrates that Jordanian Pharmaceutical firms are focused on timely decisions and they concentrate on the delivery of products in a fast and timely manner. Whilst, the second item (The company makes supply chain decisions quickly) has the lowest mean (3.964) and a standard deviation of (0.9268). The general mean (4.000), however, reinforces the impact of agility on the supply chain with regard to the viewpoint offered by the Research's sample.

4.3 Relationship between Variables

The Bivariate Pearson Correlation Test was employed to assess the relationship among variables.

Table 4.6: Bivariate Pearson Correlation Analysis

		Supply Chain Digitalization	Flexibility	Adaptability	Recovery	Agility
Supply Chain Digitalization	Pearson Correlation	1	.485**	.459**	0.143	.292**
	Sig. (2-tailed)		0	0	0.095	0.001
	N	137	137	137	137	137

		Supply Chain Digitalization	Flexibility	Adaptability	Recovery	Agility
Flexibility	Pearson Correlation	.485**	1	.470**	0.128	.341**
	Sig. (2-tailed)	0		0	0.136	0
	N	137	137	137	137	137
Adaptability	Pearson Correlation	.459**	.470**	1	.235**	0.13
	Sig. (2-tailed)	0	0		0.006	0.129
	N	137	137	137	137	137
Recovery	Pearson Correlation	0.143	0.128	.235**	1	.440**
	Sig. (2-tailed)	0.095	0.136	0.006		0
	N	137	137	137	137	137
Agility	Pearson Correlation	.292**	.341**	0.13	.440**	1
	Sig. (2-tailed)	0.001	0	0.129	0	
	N	137	137	137	137	137
**. Correlation is significant at the 0.01 level (2-tailed).						

Table (4.6) presents the Bivariate Pearson Correlation Test, illustrating that the correlations among Supply Chain Resilience sub-variables are strong, and the correlations among supply chain Digitalization and Supply Chain Resilience sub-variables are also strong.

4.4 Research Hypotheses Test

In this section, the simple linear regression is used to test the research hypotheses, which test the impact of supply chain digitization on supply chain resilience that were developed in the first chapter. After conducting a bivariate Pearson correlation test to check the relationship between the research variables. The researcher used simple linear regression for each hypothesis. In brief, this technique examines the relationships between the independent variable and a number of different dependent variables. The results of this method will depend on the level of statistical significance ($P \leq 0.05$), (F) test, R^2 , and the T value.

Table 4.7: Simple Regression Analysis test result of the main hypothesis

	Flexibility			Adaptability			Recovery			Agility		
	R ²	F	Sig.	R ²	F	Sig.	R ²	F	Sig.	R ²	F	Sig.
	.235	41.572	0.000	.210	35.948	0.000	.020	2.823	0.095	.085	12.564	0.001
	B	t	Sig.	B	t	Sig.	B	t	Sig.	B	t	Sig.
(Constant)	2.064	7.711	.000	1.357	3.701	.000	3.578	14.724	.000	3.056	11.310	.000
Supply Chain Digitalization	.438	6.448	.000	.558	5.996	.000	.104	1.680	.095	.243	3.545	.001

H0.1: there is no significant impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

In order to test the first hypothesis, a simple regression analysis was used to test the impact of supply chain digitalization on flexibility, as outlined in Table (4.7).

The previous table illustrates the impact of Supply Chain Digitalization on Flexibility from a viewpoint of a sample. The findings of the statistical analysis demonstrated that there was a statistically significant impact of Supply Chain Digitalization on Flexibility at the level of significance ($\alpha \leq 0.05$). The coefficient of determination R² was reached (0.235), thus meaning that the value of 23.5% of changes in the Flexibility was the result of changes in the Supply Chain Digitalization and reinforces this conclusion. The F Value was calculated, which was (41.572). Thus, it is evidenced that the Jordanian Pharmaceutical Manufacturing firms should give due attention to these dimensions.

In line with the above, the null hypothesis is rejected and the alternative hypothesis on the statistical significance level less than ($\alpha \leq 0.05$) is accepted. In other words, an

impact is present in terms of Supply Chain Digitalization on Flexibility in relation to Jordanian Pharmaceutical Manufacturing.

This finding is expected as supply chain digitalization orientation exists to facilitate the companies' response in an efficient way with regard to the external context, for instance, customers, suppliers, etc.

H0.2: there is no significant impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

To test the second hypothesis, a simple regression analysis was employed in order to test the impact of supply chain digitalization on adaptability, as presented in Table (4.7).

Table (4.7) illustrates that there is a positive direct impact of supply chain digitalization on adaptability, which is represented by (Beta=0. 1.357, t=3.701, sig. 0.000, $p < 0.05$). Thus, the null hypothesis is rejected and the alternative hypothesis is accepted, indicating that supply chain digitalization has an impact on adaptability at ($\alpha \leq 0.05$).

H0.3: there is no significant impact of supply chain digitalization on the recovery of Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

To test the third hypothesis, a simple regression analysis was employed in order to test the impact of supply chain digitalization on recovery, as outlined in Table (4.7).

Table 4.7 illustrates that the F Value is equal to 2.823, which is not significant ($p \leq 0.05$). This demonstrates that no impact exists for supply chain digitalization in terms of recovery; therefore, the null hypothesis is accepted. The Beta value (3.578)

shows that the impact of supply chain digitalization on recovery is positive and not significant at ($p \leq 0.05$). Moreover, based on the value of adjusted R^2 , supply chain digitalization constitutes only .020 % of the variance in recovery. This finding is unexpected and counterproductive since in times of disruption, the implementation of the supply chain digitalization is anticipated to streamline the workflow and help with a more rapid return to normal operations.

H0.4: there is no significant impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

Table 4.7 demonstrates that the F Value is equal to 12.564, which is significant ($p \leq 0.05$). This shows that the model was significant at $\alpha = 0.05$ level, thus clarifying the linear relationship among agility and supply chain digitalization.

This suggests that supply chain digitalization has an impact on agility; therefore, the null hypothesis is rejected. The Beta value (3.056) shows that the impact of supply chain digitalization on agility is positive and significant at ($p \leq 0.05$). Furthermore, based on the value of adjusted R^2 , supply chain digitalization accounts for around .085% of the variance in agility.

4.5 Summary of the Chapter

This chapter presents the findings and offers an analysis of the quantitative data collected by the administration of questionnaires to Middle-Level and Top-Level managers of Pharmaceutical Manufacturing Companies.

This research was conducted in pursuit of the objective to quantitatively identify the extent of supply chain digitalization within Jordan's Pharmaceutical industry and

its impact on Supply Chain Resilience. Moreover, it was undertaken to test the hypotheses developed for this Research. In line with this, the questionnaires presented questions on the antecedents of Supply Chain Digitalization, and the Supply Chain Resilience components of flexibility and adaptability, recovery and agility. These questionnaires were completed by Middle-Level and Top-Level managers to test hypotheses H01, H02, H03, and H04. In conclusion, hypotheses H01, H02, H03 are rejected, whilst H04 is accepted.

CHAPTER FIVE

Discussing Findings and Recommendations

The main purpose of this Research is to investigate the impact of supply chain digitalization on supply chain resilience in “Jordanian Pharmaceutical Manufacturing Companies”, by analyzing the results in the previous chapter, and this presents the fifth chapter a discussion of the Research's questions, as well as to emphasize the most important recommendations that the Research community benefits from them.

1.1 Discussing Research Hypothesis

The Results of the Research Hypotheses

H0.1: there is no significant impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

The null hypothesis is rejected and accepts the alternative hypothesis that there is a significant impact of supply chain digitalization on supply chain resilience combination (flexibility) by reviewing the value of the significance level of the test, it

was found that it reached (0.000) which is less than 0.05, The Research results agreed with the results of (Zouari, Ruel, & Viale, 2020) Research (Swafford, Ghosh, & Murthy, 2008) studies.

H0.2: there is no significant impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

The null hypothesis is rejected and the alternative hypothesis is accepted, there is a significant impact of supply chain digitalization on supply chain resilience combination (adaptability) Jordanian Pharmaceutical Manufacturing Companies, by reviewing the value of the significance level of the test, it was found that it reached (0.000) which is less than 0.05. The Research results agreed with the results of (Zouari, Ruel, & Viale, 2020); (Sheel, Nath, 2019) studies.

H0.3: there is no significant impact of supply chain digitalization on the recovery of Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

The null hypothesis is accepted, that there is no significant impact of supply chain digitalization on supply chain resilience combination (recovery) in Jordanian Pharmaceutical Manufacturing Companies, by reviewing the value of the significance level of the test, it was found that it reached (0.095) which is greater than 0.05, the results of the Research did not agree with the results of (Zouari, Ruel, & Viale, 2020) Research.

H0.4: there is no significant impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

The null hypothesis is rejected and accepts the alternative hypothesis that there is a significant impact of supply chain digitalization on supply chain resilience combination (Agility) in Jordanian Pharmaceutical Manufacturing Companies, by reviewing the value of the significance level of the test, it was found that it reached (0.001) which is greater than 0.05, the results of the Research did not agree with the results of (Sheel & Nath, 2019), (Swafford, Ghosh, & Murthy, 2008) studies.

1.2 Conclusion

The current Research aims to investigate the impact of supply chain digitalization on supply chain resilience in Jordanian pharmaceutical manufacturing companies

The researcher has created a questionnaire to collect data. The questionnaire's validity and reliability have been tested. The correlation and simple regression methods were used to test the Research hypothesis.

After discussing the results of the hypotheses of this Research, the following is concluded:

The results of the analysis showed that supply chain digitalization has a statistically significant positive impact on supply chain resilience (flexibility, adaptability, agility) in Jordanian pharmaceutical manufacturing companies.

Simultaneously, the dimension of adaptability has the greatest impact, followed by the dimension of flexibility, then by the dimension of agility but there is no statistically significant impact of supply chain digitalization on supply chain recovery.

1.3 Recommendation for Academic and Future Research

- 1- The Research recommended Jordanian pharmaceutical manufacturers to enhance the use of digital supply chains
- 2- The Research suggests that more research be conducted to investigate the impact of supply chain digitalization on the supply chain resilience of Jordanian pharmaceutical manufacturing.
- 3- This Research recommends Researching the significance of developing digital supply chains, as it is a relatively recent concept.
- 4- This Research recommends Researching the impact of the digitization of supply chains on other dimensions of supply chain resilience, since supply chain resilience has multidimensional framework
- 5- This Research recommends focusing more on the dimension of supply chains recovery after the occurrence of disruptions and problems, and developing different strategies and policies to return to the normal situation.
- 6- This Research was conducted on Jordanian companies. As a result, the Research recommends conducting similar studies in different countries.
- 7- The Research recommends broadening the range of future research to include other industries, as including other industries in the same Research will allow us to generalize the results to all industries.

Summary:**Abstract:**

This Research is investigate the impact of supply chain digitalization on supply chain resilience in Jordanian Pharmaceutical Manufacturing Companies. The quantitative analytical descriptive statistical method was used, with an electronic questionnaire serving as the primary data collection tool.

In this Research, 137 questionnaires were collected and 211 questionnaires distributed to the Research population, which consists of top-level management and middle-level management from pharmaceutical companies in Amman Using the Statistical Package for Social Sciences, data were coded, analyzed, and presented in a systematic manner (SPSS ver21). The validity and reliability of the Research tool were evaluated, followed by descriptive analysis. After conducting an analysis, the correlation between the two variables was determined.

The results of the Research for the main hypothesis test showed that supply chain Digitalization has a statistically significant impact on supply chain resilience in Jordanian Pharmaceutical Manufacturing Companies, as well as the results of the sub hypotheses testing branched from the main hypothesis also showed a statistically significant impact for each of the flexibility, adaptability, and agility. The Research recommended that Jordanian Pharmaceutical Manufacturing Companies integrate digital supply chains into supply chain resilience.

Keywords: Supply Chain Digitalization, Supply Chain Resilience, Jordan Pharmaceutical Manufacturing Companies, Amman.

Introduction:

The Covid-19 pandemic has resulted in numerous disruptions and problems that have hampered companies' ability to produce and distribute goods, prompting increased awareness among businesses and academics about how to mitigate the negative effects of dynamic changes in the business environment and develop supply chain resilience (Tukamuhabwa et al. 2015).

The supply chain resilience is refers to "Resilience is a complex, collective, adaptive capability of organizations in the supply network to maintain a dynamic equilibrium, react to and recover from a disruptive event, and to regain performance by absorbing negative impacts, responding to unexpected changes, and capitalizing on the knowledge of success or failure." (Yao & Fabbe-Costes, 2018). Mainly, supply chain resilience involves redundancy, adaptability, agility, recovery, and flexibility (Pettit et al., 2010).

The pharmaceutical industry is one of the most rapidly growing economic sectors. In 2017, the pharmaceutical market grew at a 5.8% annual rate, with global revenues expected to reach \$1284.45 billion by 2020. (Hole, Hole, &McFalone-Shaw, 2021). Despite its achievements, the pharmaceutical industry still faces a number of problems, including the Jordanian Food and Drug Association's constant revisions in laws and regulations, worldwide crises, market shifts, and the advent of new diseases such as coronavirus. Pharmaceutical manufacturing operations have been impacted by these dynamic changes.

the dilemma of COVID-19 Digitalization appears to be the most effective technique for ensuring that everyone should have access to safe medicines, prompting great concern and posing a constant threat (Hole, Hole, & McFalone-Shaw, 2021).

Research Objectives and Purpose :

The main goal of this study is to see how supply chain digitization affects supply chain resilience in Jordanian pharmaceutical manufacturing firms. The following goals are the focus of this study:

Main Goals:

The purpose of this study was to see how supply chain digitization affected supply chain resilience in Jordanian pharmaceutical manufacturing companies.

The sub-objectives

- 1- To look into how supply chain digitalization affects flexibility in Jordanian pharmaceutical manufacturing companies.
- 2- To look into how supply chain digitalization affects flexibility in Jordanian pharmaceutical manufacturing companies.
- 3- To look at the influence of supply chain digitalization on Jordanian pharmaceutical manufacturing companies' recovery.
- 8- To look into how supply chain digitalization affects agility in Jordanian pharmaceutical manufacturing firms.

Significance of the Research

These days, the issue of digitization and how to apply it to gain a competitive advantage is gaining increasing importance to keep pace with development and thus maintain the competitive position of the company and its growth in the market. Given the significance of supply chain resilience, there have been steady calls for more theoretical and empirical research on supply chain resilience (Remko,2020). Theoretical contribution: According to recently published Scholten et al. (2020), there is limited empirical research on supply chain resilience.

Managers in this industry can use the result to make the right decision.

The Research's findings can be used to inform future academic studies on report writing.

Therefore, Researching the impact of digitization on the resilience of supply chains for the pharmaceutical sector is essential.

This Research Lies In:

- 1- This research contributes to the current knowledge in the field of supply chain resilience. According to previous research, few studies have measured the impact of supply chain digitization on supply chain resilience (in Jordanian pharmaceutical manufacturing companies).
- 2- Because of the dynamic business environment in the pharmaceutical industry, supply chain flexibility is essential, and supply chain competitiveness is increasing.
- 3- This Research helps the managers and decision-makers in their planning and decision-making that are intent on developing supply chain digitalization to improve supply chain resilience.
- 4- The results can be used not only for the health sector in Jordan but in many other countries and sectors that are trying to keep pace with technological development and achieve a competitive advantage through it.
- 5- This Research will discuss the most important economic sector in Jordan, which is the pharmaceutical sector, which plays an important role in the national economy.

Research Hypotheses

The above questions will be answered by testing the following hypothesis:

Main Hypothesis

H0: There is no significant impact of supply chain digitalization on supply chain resilience combination (flexibility, adaptability, recovery, agility) in Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

Based on supply chain resilience, the main hypothesis can be divided into the **following sub-hypotheses:**

H0.1: there is no significant impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

H0.2: there is no significant impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

H0.3: there is no significant impact of supply chain digitalization on recovery of Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

H0.4: there is no significant impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

CHAPTER TWO

Literature Review

Supply chain digitalization:

Following the fourth industrial revolution, as supply chain digitalization became the industry's newest buzzword, interest in technology grew as the ecosystem became more interconnected within the functional areas of the company, and starting with digital transformation, the industrial revolution encouraged companies to develop more flexible supply chains, leading to the creation of new values.

Supply chain digitization gives companies a competitive advantage by allowing them to respond quickly to changing client demands. (Khajavi et al. 2015; Porter and Heppelmann 2015), where digitization has opened up significant opportunities for supply chains, including improved inter-company logistics, increased information availability, timely access to information, efficient operations, effective inventory management, cooperation, and product design innovation. 2017 (Kache and Seuring)

Supply chain digitalization : a technical framework focused on providing smart data and collaboration between all departments and devices is being developed to support interaction between organizations, divisions, and supply chains and boost productivity.

Supply chain resilience:

The term "supply chain resilience" originally appeared in the literature a few years ago and has recently gained prominence. (Christopher and Peck, 2004; Craighead et al., 2007; Sheffi and Rice, 2005), (Christopher and Peck, 2004), (Christopher and Peck, 2004), (Christopher and Peck, 2004), (Christopher and P There has been little use of quantitative modeling methods in the expanding number of studies on supply chain resilience; most studies have instead provided qualitative insights into the topic.

Flexibility:It is described as organization's capacity to respond quickly and effectively to changing needs from its environment and stakeholders. 2010 (Erol, Sauser, & Mansouri).

Delays, a flexible supplier base, flexible logistics, flexible labor agreements, and product delivery flexibility have all been identified as ways to improve SCRES in the literature (e.g. Tang 2006b; Christopher and Holweg 2011; Pettit et al. 2013)

Adaptability: capability to adjust actions in response to new difficulties or opportunities, Redistribution of resources, Reduced setup time, taking advantage of opportunities that arise as a result of disturbances Creation of alternative technologies.

Agility: the capability to response swiftly to unpredictably change in supply or demand and the capability of the firm to adapt to any change in the marketplace, to strengthen the agility of the extended supply chain , And it is defined as the ability to respond quickly to unpredictably changing demand or supply; this could be accomplished, for example, by modifying administrative processes and technology quickly. (Erol and colleagues, 2010).

Recovery: The ability to quickly return to normal operation. It is especially important since consumer needs and company demands must be met even if there is a disruption. The most effective way to deal with an interruption might be to use buffer stock.

More crucially, by leveraging adaptive behaviors and system-wide cooperation, a supply chain designed for quick recovery has a better chance of creating reaction plans in the event of a disruption. A supply chain with weak recovery capability and hence limited business and customer fulfillment is less likely to support system-wide collaboration and recovery during a disruption.

Relationships between Supply Chain Digitalization and Supply Chain Resilience

Ivanov and Dolgui (2019b) Consider the effect of digitalization on the operations and SCs' resilience as a complicated problem. They stress the importance of descriptive and predictive data analysis in gaining visibility and improving forecast accuracy, as well as improving contingency plan activation. Similarly, Zhang and Zhao (2019) demonstrate that big data improves SCR by visibility. Cloud computing and blockchain technologies increase visibility, predictability, and adaptability, both of which will help to promote SCR (Pettit et al., 2019).

Chapter THREE

Research Methodology

The main goal of this study is to see how Jordanian executives pursue (supply chain decisions) in Jordanian Pharmaceutical Manufacturing Enterprises; as a result, eliciting responses from a large number of Jordanian companies is critical in order to obtain relevant and reliable data. The current study's participants are supply chain executives from Jordanian pharmaceutical manufacturing companies.

Population and Sample

The main aim of this Research is to examine how Jordanian executives pursue (supply chain decisions) in the Jordanian Pharmaceutical Manufacturing Companies; therefore, it is important to elicit responses from a large number of Jordanian companies to generate valid and reliable information. The population for the current research is the supply chain executives in the Jordanian Pharmaceutical Manufacturing Companies.

Trying to get data from the population (supply chain executives' manager, top and middle managers in Jordanian Pharmaceutical Manufacturing Companies) for the current Research would be perfect, but for many reasons, this is almost impossible. Thus, the initial plan for this research is to select a convenience sample.

The Research's population consists of supply chain executives in Jordanian pharmaceutical manufacturing company that are registered in Jordanian Association of Pharmaceutical Manufacturers in 2022, a total of 17 companies (The Jordanian Association of Pharmaceutical Manufacturers) (JAPM). A survey of all companies is used to collect data from all these companies.

Unit of Analysis

The survey unit of analysis consisted of 211 managers from Pharmaceutical Manufacturing Companies who were available and ready to participate at the time the questionnaires were distributed, there are only 145 answers received, and a total of 139 were valid for analysis.

Data Collection Procedure

For this investigation, secondary and primary data were used. Secondary data was gathered through the use of books, research, essays, dissertations, theses, working papers, journals, and the Internet. Secondary data is used to establish a powerful theoretical foundation and research direction. That once variables and Research conceptual model have already been established. Questionnaires emphasizing on the conceptual framework's core variables will be used to collect primary data.

CHAPTER FOUR

Data Analysis

Introduction

In this chapter, this Research's results are presented, along with the exploration of the findings and analyses relating to the collection of quantitative data. Initially, the main survey's descriptive statistics and each of the variables from the main model are discussed. Data was examined through employing both descriptive and regression analyses in Statistical Package (SPSS). Furthermore, descriptive statistics, which includes measures of mean and standard deviation, were deduced for the Research's variables and individual respondents. Secondly, the data relating to the digitization of the supply chain digitalization and supply chain resilience in Jordanian Pharmaceutical industry is going to be analyzed.

Research Hypotheses Test:

The study hypotheses, which assess the impact of supply chain digitization on supply chain resilience that were generated in the first chapter, are tested using basic linear regression. After checking the link between the research variables with a bivariant Pearson correlation test. For each hypothesis, the researcher employed basic linear regression. In a nutshell, this method looks at the correlations between the independent variable and a variety of dependent variables. The degree of statistical significance (P0.05), the (F) test, R2, and the T value will all influence the outcome of this procedure.

	Flexibility			Adaptability			Recovery			Agility		
	R ²	F	Sig.	R ²	F	Sig.	R ²	F	Sig.	R ²	F	Sig.
	.235	41.572	0.000	.210	35.948	0.000	.020	2.823	0.095	.085	12.564	0.001
	B	t	Sig.	B	t	Sig.	B	t	Sig.	B	t	Sig.
(Constant)	2.064	7.711	.000	1.357	3.701	.000	3.578	14.724	.000	3.056	11.310	.000
Supply Chain Digitalization	.438	6.448	.000	.558	5.996	.000	.104	1.680	.095	.243	3.545	.001

H0.1: there is no significant impact of supply chain digitalization on flexibility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

In order to test the first hypothesis, a simple regression analysis was used to test the impact of supply chain digitalization on flexibility, as outlined in Table (4.7). The previous table illustrates the impact of Supply Chain Digitalization on Flexibility from a viewpoint of a sample. The findings of the statistical analysis demonstrated that there was a statistically significant impact of Supply Chain Digitalization on Flexibility at the level of significance ($\alpha \leq 0.05$). The coefficient of determination R² was reached (0.235), thus meaning that the value of 23.5% of changes in the Flexibility was the result of changes in the Supply Chain Digitalization and reinforces this conclusion. The F Value was calculated, which was (41.572). Thus, it is evidenced that the Jordanian Pharmaceutical Manufacturing firms should give due attention to these dimensions.

In line with the above, the null hypothesis is rejected and the alternative hypothesis on the statistical significance level less than ($\alpha \leq 0.05$) is accepted. In

other words, an impact is present in terms of Supply Chain Digitalization on Flexibility in relation to Jordanian Pharmaceutical Manufacturing.

This finding is expected as supply chain digitalization orientation exists to facilitate the companies' response in an efficient way with regard to the external context, for instance, customers, suppliers, etc.

H0.2: there is no significant impact of supply chain digitalization on adaptability in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

To test the second hypothesis, a simple regression analysis was employed in order to test the impact of supply chain digitalization on adaptability, as presented in Table (4.7).

Table (4.7) illustrates that there is a positive direct impact of supply chain digitalization on adaptability, which is represented by (Beta=0. 1.357, $t=3.701$, sig. 0.000, $p < 0.05$). Thus, the null hypothesis is rejected and the alternative hypothesis is accepted, indicating that supply chain digitalization has an impact on adaptability at ($\alpha \leq 0.05$).

H0.3: there is no significant impact of supply chain digitalization on the recovery of Jordanian Pharmaceutical Manufacturing Companies at ($\alpha \leq 0.05$).

To test the third hypothesis, a simple regression analysis was employed in order to test the impact of supply chain digitalization on recovery, as outlined in Table (4.7).

Table 4.7 illustrates that the F Value is equal to 2.823, which is not significant ($p \leq 0.05$). This demonstrates that no impact exists for supply chain digitalization in terms of recovery; therefore, the null hypothesis is accepted. The Beta value (3.578) shows that the impact of supply chain digitalization on recovery is

positive and not significant at ($p \leq 0.05$). Moreover, based on the value of adjusted R², supply chain digitalization constitutes only .020 % of the variance in recovery. This finding is unexpected and counterproductive since in times of disruption, the implementation of the supply chain digitalization is anticipated to streamline the workflow and help with a more rapid return to normal operations. H0.4: there is no significant impact of supply chain digitalization on agility in Jordanian Pharmaceutical Manufacturing Companies, at ($\alpha \leq 0.05$).

Table 4.7 demonstrates that the F Value is equal to 12.564, which is significant ($p \leq 0.05$). This shows that the model was significant at $\alpha = 0.05$ level, thus clarifying the linear relationship among agility and supply chain digitalization.

This suggests that supply chain digitalization has an impact on agility; therefore, the null hypothesis is rejected. The Beta value (3.056) shows that the impact of supply chain digitalization on agility is positive and significant at ($p \leq 0.05$). Furthermore, based on the value of adjusted R², supply chain digitalization accounts for around .085% of the variance in agility.

CHAPTER FIVE

Discussing Findings and Recommendations

The main purpose of this Research is to investigate the impact of supply chain digitalization on supply chain resilience in “Jordanian Pharmaceutical Manufacturing Companies”, by analyzing the results in the previous chapter, and this presents the fifth chapter a discussion of the Research's questions, as well as to emphasize the most important recommendations that the Research community benefits from them.

Conclusion

The current Research aims to investigate the impact of supply chain digitalization on supply chain resilience in Jordanian pharmaceutical manufacturing companies

The researcher has created a questionnaire to collect data. The questionnaire's validity and reliability have been tested. The correlation and simple regression methods were used to test the Research hypothesis.

After discussing the results of the hypotheses of this Research, the following is concluded:

The results of the analysis showed that supply chain digitalization has a statistically significant positive impact on supply chain resilience (flexibility, adaptability, agility) in Jordanian pharmaceutical manufacturing companies.

Simultaneously, the dimension of adaptability has the greatest impact, followed by the dimension of flexibility, then by the dimension of agility but there is no statistically significant impact of supply chain digitalization on supply chain recovery.

Academic and Future Research Recommendations

- 1- The study advised Jordanian pharmaceutical companies to increase their usage of digital supply chains.
- 2- More research is needed to determine the influence of supply chain digitalization on the supply chain resilience of Jordanian pharmaceutical production, according to the findings.
- 3- Because digital supply chains are a relatively new idea, this research suggests researching the importance of creating them.
- 4- Because supply chain resilience has a multiple structure, this research proposes investigating the impact of supply chain digitalization on other characteristics of supply chain resilience.
- 5- This study suggests that more attention be paid to the aspect of supply chain recovery following interruptions and issues, and that various strategies and regulations be developed to help supply chains return to normal.

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Appendices

Appendix (1): Panel of Referees Committee

No.	Name	Qualification	Company
1	Ibrahim Yousef	Associate Prof	University of Petra
2	Firas Omar	Assistant Professor	University of Petra
3	Mohammad Alqudah	Assistant Professor	University of Petra

4	Anas Kanaan	Assistant Professor	University of Petra
5	Tala Salah Abu Hussein	Assistant Professor	University of Petra
6	Ihssan Samara	Assistant Professor	University of Petra
7	Nasem mater	Assistant Professor	University of Petra
8	Shafiq haddad	Professor Dr	Middle East university
9	Ahmed Harasis	Assistant Professor	Middle East university
10	Samir Jebali	Associate Professor	Middle East university
11	Rania Al-Zamout	Assistant Professor	Middle East university
12	Fayez Al-Badri	Assistant Professor	Middle East university
13	Asmaa amarna	Professor Dr	Middle East university
14	Mohammed Ahmed Al-Duwairi	Assistant Professor	al zaytona University
15	Firas Rifai	Associate Professor	al zaytona University

Appendix (2): Questionnaire

Questionnaire

This questionnaire is a part of a Research that the researcher undertakes to obtain a master's degree in Business Administration from the University of Petra. The Research is entitled:

The Impact of Supply Chain Digitalization on Supply Chain Resilience “The case of Jordanian Pharmaceutical industry”

This Research aims to identify the impact of supply chain digitalization on supply chain resilience (Flexibility , Adaptability , Recover , Agility) in the Jordanian Pharmaceutical industry.

I hope that you will devote 10 to 15 minutes of your time to answer the questions of the questionnaire, and please note that all data you provide are treated with strict confidentiality and used for scientific research purposes only.

Thank you for your kind help and support.

تهدف هذه الدراسة إلى تحديد تأثير رقمنة سلسلة التوريد على مرونة سلسلة التوريد (المرونة، القدرة على التكيف، التعافي، الرشاقة) في صناعة الأدوية الأردنية.

أمل أن تخصص من 10 إلى 15 دقيقة من وقتك للإجابة على أسئلة الاستبيان، ويرجى ملاحظة أن جميع البيانات التي تقدمها تعامل بسرية تامة وتستخدم لأغراض البحث العلمي فقط
شكرا لك على مساعدتك ودعمك الكريم.

Researcher: Nour Nazzal

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Section (1) Demographics

Please make (√) reference to the appropriate phrase:

1- Gender:

Male

Female

2-Age:

Less than 30
40

30 - less than

40- less than 50

Above 50

3-Education Level:

Diploma/School
level

Bachelor's or equivalent

Master's or equivalent level

Doctor or equivalent level

4-Length of employment at current company:

Less than 1 year

1-3 years

3-6 years

Above 6 years

5- Position:

Top-Level manager

Middle-Level manager

6- Work Experience:

Less than 10 years

10 to 20 years

Above 20 years

Section (1): Independent Variable- Supply Chain Digitalization

No.	Item	Strongly agree	agree	Neutral	Disagree	Strongly Disagree
1.	The company develops digital system to analyze data.					
2.	The digital system in the company helps in the impactive management of inventory.					
3.	The company invests in digital supply chain for enhancing the supply chain resilience.					
4.	The company uses digital technologies to enhance relationships with suppliers.					
5.	Customers may easily access the latest product and service offerings by the digital technologies.					
6.	The company invests in the digitalization of the supply chain in order to respond to the increasing demand of customers.					
7.	Digital tools in the company help to detect potential disruptions.					
Dependent Variable : Supply Chain Resilience						
Dependent Sub-Variable “Flexibility”						
8.	The company has the ability to respond quickly to changing customer demands.					
9.	There is cooperation between the company and its suppliers to respond to changes in the volume of production.					

No.	Item	Strongly agree	agree	Neutral	Disagree	Strongly Disagree
10.	The company deals with suppliers that are quick to respond to the company's requests.					
11.	The company has the ability to respond to changes in the internal and external environment.					
12.	The company can easily modify its supply contracts to change specifications, quantities and conditions.					
Dependent Sub-Variable “Adaptability”						
13.	The company can quickly adjust the production mix using digital techniques.					
14.	The company has the ability to “rapidly” integrate supply chain operations through digitalization.					
15.	The company can reallocate task between different production facilities quickly..					
16.	The company can adjust the supply chain through outsourcing when needed.					
17.	The company can redesign the supply chain structure in response to structural changes in the market.					
Dependent Sub-Variable “Recover”						
18.	The company can immediately build a formal response team of individuals.					
19.	The company can quickly return to the normal operating state.					

No.	Item	Strongly agree	agree	Neutral	Disagree	Strongly Disagree
20.	The company develops adaptive and cooperative behaviors in the event of disruption.					
21.	Disruptions are handled quickly by the company.					
22.	The company has collaborative plans and strategies to recover from disruption.					
23.	The company has a reserve stock to meet customer requirements in the event of disruptions..					
Dependent Sub-Variable “Agility”						
24.	The company can benefit from the advantages of synchronizing supply and demand in terms of reducing inventory costs.					
25.	The company makes supply chain decisions quickly.					
26.	The company has the ability to quickly deliver products on time.					
27.	The company identifies possibilities and challenges at the appropriate time.					
28.	Supply chain changes are implemented “quickly” by the company.					

Any other comments or suggestions:

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