UNIVERSITY OF EDUCATION, WINNEBA.

THE MODERATING ROLE OF IT CAPABILITIES IN THE RELATIONSHIP BETWEEN DIGITAL INNOVATION AND OPERATIONAL RESILIENCE

SEIDU ALHASSAN

(7231740012)

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DECLARATION

I hereby declare that this dissertation is the result of my original work towards my MBA and to the best of my knowledge, it neither contains material published by another person nor materials which have been accepted for the award of any other degree in this University or elsewhere, except where due acknowledgments have been made in the text.

Seidu Alhassan	……	……..……
(7231740012)	Signature	Date

Supervisor's Certification

Alhassan Salifu Bawah	……	……..……
	Signature	Date

DEDICATION

This study is dedicated to the Almighty God and my wife and children.

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I am most grateful to the Almighty God for His grace, guidance and protection throughout my life and for seeing me through this programme. I wish to express my deepest gratitude to my supervisor for the constructive criticisms, comments, suggestions, advice and guidance.

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DC	Digital Innovation
RBV	Resource Based View
ITC	IT Capabilities
OR	Operational Resilience
DC	Dynamic Capabilities

ABSTRACT

In the fast-paced, constantly-changing modern world, gaining and maintaining logistics excellence demands more effort. The main objective of the study is to investigate the moderating role of IT capabilities on digital innovation on operational resilience. Data was collected and analyzed using Statistical Package for Social Sciences (SPSS), version number 29.0.2 of 2024. The study sampled 100 respondents to represent the population using the convenience sampling technique. The findings of the study indicate that digital innovation is very essential to operational resilience. Also, the findings of the study show that IT capabilities have a positive and significant relationship with digital innovation and operational resilience. In addition, the findings of the study revealed that IT capabilities moderate the relationship between digital innovation and operational resilience. The study recommends that firms formulate policies that lays emphasis on strengthening digital innovation and IT capabilities, in order to impact more positively on operational resilience.

CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

Rapid technology breakthroughs have ushered in a time when digital innovation is altering industries and organizational landscapes globally (Zhang et al., 2023). Its significant influence on operational resilience an organization's capacity to adjust, bounce back, and prosper in the face of adversity makes it especially relevant (Brown et al., 2022). Operational resilience is characterized by its complexity, which includes the capacity to adapt and create in the face of hardship in addition to withstanding shocks (Smith & Jones, 2023).

Significant developments in a variety of areas have been sparked by digital innovation, which includes technologies like blockchain, cloud computing, artificial intelligence (AI), and the Internet of Things (DesJardine *et al.,* 2017; Buyl *et al.,* 2017). These advances bring new risks and complications along with the promise of increased efficiency, improved connection, and creative business models. It is imperative for businesses to comprehend the relationship between digital innovation and operational resilience in order to effectively manage the increasingly linked and rapidly changing business landscape (Brown et al., 2022).

Current research emphasizes how digital technology might improve operational resilience in a revolutionary way. For example, AI-powered predictive analytics helps businesses to foresee and reduce operational hazards before they become more serious (Smith & Jones, 2023). Similar to this, supply chain management is being revolutionized by blockchain technologies, which increase traceability and transparency and strengthen resilience against disruptions (Brown et al., 2022).

But along with these advantages, digital innovation also brings with it new difficulties. Increased digital connectivity has made cybersecurity risks worse, which emphasizes the necessity of strong defenses to protect operational continuity (Gupta et al., 2021). Furthermore, the swift advancement of technology demands flexible organizational structures that can adjust to changing environments while preserving functional consistency (Johnson & White, 2023).

The scholarly community has paid much attention to the relationship between digital innovation and operational resilience; nevertheless, one important factor that is frequently disregarded is the moderating function of information technology (IT) capabilities (Tallon et al., 2019). According to Teece (2014), an organization's IT capabilities include its capacity to efficiently manage, utilize, and integrate IT resources in order to accomplish strategic objectives (Lu et al., 2020). These qualities are crucial for improving organizational agility and responsiveness, which in turn strengthens operational resilience. They also enable digital innovation by facilitating the implementation of new technologies (Järvenpää et al., 2021).

Thus, it is essential to comprehend the moderating role of IT capabilities in order to advance theoretical understanding and direct practical strategies that aim to leverage digital innovation to improve operational resilience. By using empirical research to investigate when different IT capability levels affect the effect of digital innovation on operational resilience in various organizational contexts, this study aims to go deeper into this relationship. By doing this, the research hopes to offer practical insights that assist firms in enhancing their IT strategy, encouraging creativity, and fortifying their

resilience in a corporate climate that is becoming more and more digitalized and unstable.

1.1 Problem Statement

With the promise of increased efficiency and competitive advantage, digital innovation has become a disruptive force that is changing organizational landscapes across industries (Blackhurst *et al.,* 2011; Sheffi and Rice, 2005). But as businesses depend more and more on digital technologies to run their operations, the consequences for operational resilience—which is the capacity to tolerate setbacks and adjust to changing conditions—have grown more intricate and crucial (Brandon-Jones *et al.* 2014).

The dual nature of digital innovation in impacting operational resilience is highlighted in recent literature. On the one hand, new technologies like cloud computing, blockchain, and artificial intelligence (AI) present never-before-seen chances to boost connectivity, streamline workflows, and make better decisions (Brown et al., 2022; Smith & Jones, 2023). Predictive analytics powered by AI, for example, makes proactive risk management possible, enabling businesses to anticipate and address possible disruptions before they become more serious (Smith & Jones, 2023).

On the other hand, new risks and difficulties are brought about by the quick adoption of digital technologies. Operational continuity is seriously at danger from cybersecurity threats, which are exacerbated by growing digital connectivity and data exposure (Gupta et al., 2021). Furthermore, flexible organizational frameworks that can maintain operational stability while reacting to dynamic contexts are necessary due to the rapid speed of technology development (Johnson & White, 2023).

Even with these developments, there are still gaps in our knowledge of the complex relationships that exist between digital innovation and operational resilience (Jain *et al.,* 2017; Liu *et al.,* 2017) There are still many unanswered concerns about when best to incorporate digital technology into resilience plans, how to balance innovation and risk reduction, and what the long-term effects will be on organizational sustainability (Smith and Johnson 2022).

Organizations are becoming more and more dependent on digital breakthroughs like artificial intelligence (AI), blockchain, and the Internet of Things (IoT) to improve operational efficiency and competitiveness in today's dynamic and digitally driven business environment (; Liu *et al.,* 2017). Better decision-making, process automation, and more connection are just a few of the revolutionary advantages that these breakthroughs promise (Smith & Jones, 2023; Brown et al., 2022). On the other hand, an organization's information technology (IT) capabilities will determine how much it can use these technologies to improve operational resilience, or its capacity to foresee, adjust to, and recover from crises (Gupta et al., 2021).

The relationship between digital innovation and operational resilience has been the subject of much scholarly scrutiny. However, there are still gaps in our understanding of when IT capabilities influence this relationship. The ability of a business to efficiently manage and utilize IT resources in order to accomplish strategic goals is referred to as IT skills (Teece, 2014). According to recent research, digital innovation can improve operational resilience by increasing responsiveness and agility, but the degree to which this improvement depends on the IT capabilities of the company can vary greatly (Tallon et al., 2019). Robust IT capabilities empower enterprises to effectively incorporate digital innovations into their operating procedures, improve

data-driven decision-making, and expedite real-time monitoring and disruption response (Lu et al., 2020).

Recent research indicates that the effectiveness of digital innovation is highly dependent on IT capabilities. Zhang et al. (2023), for example, discovered that companies with sophisticated IT capabilities were more capable of utilizing digital innovation tactics to recover and adjust to supply chain disruptions. Under a similar vein, Smith and Johnson (2022) emphasized the need of data analytics skills and flexible IT infrastructure for utilizing digital technology to improve organizational resilience under challenging circumstances. Despite the importance of IT capabilities in digital innovation, little is known about when it serves as a contingency factor in the relationship between digital innovation and operational resilience.

Thus, by examining the moderating effect of IT capabilities on the relationship between digital innovation and operational resilience, this study aims to close the gap. The goal of this study is to present a thorough understanding of how businesses may improve their IT capabilities to attain greater operational resilience and maximize their investments in digital innovation.

1.2 Research Objectives

In addressing the gap identified, the primary objective of this study is to examine when digital innovation influences operational resilience

The specific objectives are:

1. To examine the relationship between digital innovation and operational resilience.
2. To evaluate the relationship between IT capabilities and operational resilience.

3. To assess the moderating role of IT capabilities the effect of digital innovation on operational resilience

1.3 Research Questions

1. What is the relationship between digital innovation and operational resilience?
2. What is relationship between IT capabilities and operational resilience?
3. What is moderating role of IT capabilities on the effect digital innovation on operational resilience?

1.4 Significance of the Study

Given the speed at which technology is developing and the degree of digitalization in today's corporate environment, it is imperative for organizational success and sustainability to comprehend the relationships between digital innovation, IT skills, and operational resilience. This study contributes to several important areas and has substantial consequences for theory, practice, and policy.

Researching the moderating effect of IT capabilities helps organizations better understand how to use digital innovations to improve their operational resilience. Through empirical analysis of these relationships, researchers can clarify the circumstances in which digital innovations positively impact resilience outcomes, which is crucial knowledge for improving theoretical frameworks that describe the interactions among technology adoption, IT capabilities, and organizational resilience.

The findings of this study can help practitioners, especially IT managers and executives, make strategic decisions about the allocation of IT resources and investments. Prioritizing the improvement of IT capabilities, including infrastructure, governance frameworks, and human capital, can help organizations optimize the resilience advantages that stem from digital innovation endeavors. Through its ability to help

firms efficiently traverse upheavals and preserve operational continuity, this strategic alignment can help them gain a competitive advantage.

The goals of many firms starting their digital transformation journeys are innovation and operational efficiency. However, how well IT capabilities are combined with digital advances will determine how successful these programs are. Empirical data on the variables that help or impede the resilience benefits of digital transformation are presented in this study. Gained knowledge can help companies optimize their digital strategy, make sure it aligns with resilience goals, and reduce any risks related to technology disruptions.

From a policy standpoint, regulations and recommendations intended to foster resilience in industries susceptible to digital disruptions (such as supply chain management and cybersecurity) can be informed by an awareness of the moderating function of IT capabilities. Empirical results can be used by policymakers to create policies that promote investments in cybersecurity, IT infrastructure, and digital skills development—all of which are essential for boosting organizational resilience in a world that is becoming more digitally dependent and networked.

In terms of academia, this work advances our understanding of IT management, organizational resilience, and digital innovation. It establishes the foundation for future research examining additional moderators and contextual factors impacting the relationship between technology adoption and organizational outcomes. It does this by offering empirical confirmation of theoretical structures and models. This advances the development of theoretical frameworks that enhance our understanding of the intricacies involved in digital transformation within organizational settings.

1.5 Research Methodology

This chapter presents the methodology that was used for the conducting the study. It examines the research philosophy, research design, study area, population, sample size and sampling technique, instrumentation, data collection procedure, data analysis procedure, ethical considerations and the timelines to complete the study. Convenience sampling technique will be used in sampling firms for the study. The target group was firms from the Kumasi Metropolis. The data collection instrument that will be employed in this study is questionnaire had both closed ended and open-ended questions. Data gathering too two months. Quantitative data approach was adopted. The quantitative data collected was analyzed using statistical package for social sciences (SPSS latest version) and SmartPLS. The main reason for analyzing data was to treat the evidence factually and fairly in order to generate good analytical conclusions and to rule out alternative interpretations. This study employed the quantitative approach to research design. The first part employed a quantitative approach to conduct the investigation on how digital innovation and IT capabilities enhances operational resilience among firms in the Greater Accra Region of Ghana.

1.6 Scope of the Study

The scope of a research can be defined as the delimitation of the study. The scope of research is aimed at setting exceptions, boundaries and reservations in research (Creswell, 2003). This section is purposed to delineate the scope and context of this research.

In an ideal situation, any assessment of supply chain must apply to several sectors rather than some of it. Due to the extensive nature of firms, this study concentrates on the effects of digital innovation on operational resilience. The study was conducted in

Central region of Ghana. 100 respondents will be selected for the study to enable easy accessibility to data collection.

The study may use quantitative research approaches to investigate the connections between digital innovation, IT capabilities and operational resilience. These methods may include surveys, data analysis, regression modeling, and statistical techniques.

With a particular focus on Ghana, the study takes into account the distinct business climate, market dynamics, legal framework, and cultural elements that affect the adoption of digital innovations, IT capabilities and operational resilience outcomes in Ghana.

1.7 Limitation of the Study

Every research is expected to encounter some form of challenges and this study is not an exception. As a result of the quantitative data approach deployed, there will be a cut off point for the sample and sample size due to time constraints. The results would have been much broader if the data was collected from different parts of the country. Even though the data will be collected from selected firms, a greater understanding would have been achieved if more firms were selected across the country.

1.8 Organization of the Study

The study is organized into five chapters. Chapter one provides an introduction to the study which comprises of the background to the study, problem statement, research objectives, research questions, justification of the study, research methodology, scope of the study, limitation of the study and organization of the study. Chapter two reviews literature of related work in the research area. The review includes definition of concepts and theory of the main components of the study. Empirical studies related to the research and the theoretical framework is reviewed. The conceptual framework of

the study is presented including an explanation of the variables under study and hypothesis developed to test the relationship between the variables. Chapter three comprises of the research methodology and organizational profile. The chapter highlights the instruments used for data collection, the study population, sample size, sampling and sampling technique, research design, data collection procedure, ethical consideration and data analysis. Chapter four presents the results from the data collected, analysis and discussion of the data. Chapter five presents a summary of the research findings, conclusion and recommendations from the research findings to serve as a guide for future research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter presents the review of related literature about the subject matter. The chapter includes a literature on digital innovation, IT capabilities and operational resilience.

2.1 Conceptual Review

This section reviews the various concepts that have been employed in this study. The concepts include digital innovation, IT capabilities and operational resilience.

2.1.1 Digital Innovation

Digital innovation is defined as the creation of new market offerings or changes in them that result from the use of digital technologies Prior research has shown how digital ventures successfully develop digital innovation (Huang et al., 2017). Much less is known about digital innovation by industrial- age incumbents. Existing research in this regard has pointed to the substantial challenges and concerns these firms experience when embracing digital innovation (Piccinini et al., 2015). Among the multiple challenges that industrial-age incumbents encounter, which include overcoming institutionalised thinking (Henfridsson & Yoo, 2014) as well as changing processes, structures or governance arrangements, capability concerns play a fundamental role (Svahn et al., 2017). Hurdles in this regard result from the peculiarities of digital innovation in industrial-age contexts. Here, digital innovation builds upon a layered modular product architecture (Yoo et al., 2010). While physical products such as cars build upon a modular architecture whereby interlocking components are assembled into a single physical entity and all innovating parties share product-specific knowledge, the

layered modular architecture comprises loosely coupled layers of devices, networks, services, and contents, each following a different functional design hierarchy in which knowledge is product- agnostic (Lusch & Nambisan, 2015; Yoo et al., 2010). Accordingly, "[T]he semantic distance of knowledge elements necessary for product innovation grows" (Lyytinen et al., 2016). For industrial- age incumbents, existing case studies illustrate that firms aim to close resulting capability gaps via internal measures (e.g., building new organizational units such as innovation hubs) and seek for external innovation partners (Svahn et al., 2017).

However, besides occasional single case evidence, to date, we have no systematic, large-scale examination of the antecedents and consequences of particular approaches to closing capability gaps for digital innovation by industrial-age incumbents the consequences of the modular layered architecture. The various components in the different layers are exchangeable, offering ample (re)combination possibilities (Henfridsson et al., 2018). Thus, digital innovations are intentionally incomplete and enduringly enable the development of new modules, a trait called "generativity." Thereby, digital innovations also merge a variety of traditional industry segments and use contexts (such as driving and entertainment), a trait called "convergence." As to these traits, new knowledge creation involving heterogeneous knowledge bases is a constant in digital innovation (Yoo et al., 2012).

However, while digital innovation has been described as building upon heterogeneous knowledge (Lyytinen et al., 2016), the consequences for knowledge bases of incumbent firms remain unclear. On the one hand, knowledge for digital innovation has been conceptually described as distributed across actors (Yoo et al., 2012). On the other hand, it also is reported to be interwoven, increasingly inseparable (Yoo et al., 2010),

and questioning the fault lines between established knowledge domains (Yoo et al., 2012). To date, the lingering question of where to locate knowledge creation and knowledge combination in digital innovation in industrial-age contexts remains unresolved.

2.1.2 IT Capabilities

The literature portrays dynamic capabilities in a hierarchal structure in which lower-order dynamic capabilities lead to higher-order capabilities. Likewise, many studies have employed the RBV and indicated the positive effects of internal resources like IT capabilities on supply chain integration (SCI) and performance. However, additional investigation is needed to explain the causal mechanism through which IT capabilities bring significant change in organizational processes and the associated performance gains (Liu et al. 2013; Wu et al. 2006; Yu et al. 2018).

According to Wei and Wang (2004), "the ability of an organization to effectively utilize its information technology resources to achieve its strategic objectives" is known as its IT capabilities (p. 75). According to Stratopoulos and Dehning (2000), "the organizational ability to recognize, manage, and leverage IT resources to achieve strategic objectives and create competitive advantage" is what is meant by IT capabilities. IT skills are defined as "the ability of an organization to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" by Bharadwaj (2000). The ability of a business to efficiently manage, deploy, and use information technology resources in line with its strategic goals is referred to as IT capabilities (Wade & Hulland, 2004).

From an organizational capability perspective, firms can capitalize on the lower-order dynamic capabilities of IT infrastructure and IT assimilation to promote the supply chain capabilities of information integration and operational coordination and improve organizational agility (Ghaemmaghami et al. 2017; Huo et al. 2014a, b). IT can expedite operations and help firms adapt to their internal and external environments. The literature that has been grounded in the RBV has suggested that IT is a resource capability and an antecedent of information integration (Huo et al. 2016), which in turn, streamlines operational processes across the value chain

(Dong et al. 2009). Likewise, IT is an internal capability that supports the development of collaborative buyer-supplier relationships (Paulraj et al. 2008). In the broader supply chain context, organizational agility is materialized through IT- enabled supply chain capabilities. IT resources provide the knowledge options and enhance the visibility and flexibility in the supply chain that enable organizational agility. In sum, IT capabilities improve a firm's processes by providing a platform that helps the firm to sense and respond to rapidly changing market conditions.

2.1.3 Operational Resilience

Resilience has been an emerging focus in different disciplines, such as ecology, psychology, engineering, management, and information systems (Müller et al. 2013). Resilience is the ability to resist and respond to a shock and to recover after a shock has occurred (Annarelli & Nonino 2016; Rose 2004). Taking an organizational perspective, organizational resilience refers to a firm's ability to operate, and even thrive, through an impairment by adapting quickly and effectively to the situation. Indeed, resilient organizations are successful in coping with crises (Suarez & Montes 2020). The concept of resilience is investigated in the context of exogenous shocks, including recent

COVID-19 studies (e.g., Sakurai & Chughtai 2020). Organizational resilience is a complex construct, which, by definition, is characterized by different elements or attributes. There are various studies on resilience (Annarelli & Nonino 2016; Bhamra et al. 2011; Rose 2004) and differentiation of its dimensions supports casting light on this complex construct. The dimensions can be roughly differentiated as resources that enable the development and maintenance of competencies, and motivation systems and processes that promote effectiveness and growth (Sutcliffe & Vogus 2003).

More detailed, the standard ISO 22316 (ISO 2017) describes nine different attributes of organizational resilience. These attributes are reflected in prior related literature (Avery & Bergsteiner 2011; Di Bella 2014; Sutcliffe & Vogus 2003; Weick et al. 1999). We also use the nine factors to grasp organizational resilience and differentiate them between the two dimensions introduced. The perspective used to describe the operational process of an organization is the commonly used systems approach, and more specifically that of complex adaptive systems (McManus et al., 2007).

In general, one can state that organizations are complex adaptive systems because they consist of many interrelated entities and are able to change and learn (implying they are adaptive). In this context, the description for resilience given by McDonald (2006) seems most appropriate: “resilience probably needs to be seen as an aspect of the relationship between a particular socio-technical system and the environment of that system”. The environment is potentially very broad, including external social and commercial factors. However, the focus of this research is on operational risks while strategic, market, financial, and legal risks are beyond the scope of this research. For this reason, the term operational resilience is introduced here. The capabilities of an organization related to operational resilience are: The ability of an organization to

prevent disruptions from occurring; When struck by a disruption, the ability to quickly *respond to* and *recover from* a disruption in the primary business processes. Operational resilience is about the ability of an organization to deal with undesired events. These events can have a high or low impact and they can have a high or low probability of occurrence. Resilience is most applicable to low-probability/high-impact events as the other combinations should have been covered either up-front (highprobability/ high-impact) or during normal operations (high-probability/low-impact) or neglected (low-probability/low-impact). This is one of the reasons that the concept of resilience has been introduced, namely as a capability to deal with low-probability/high impact events (Sheffi, 2005).

There are three main reasons that stress the need for resilient organizations. First of all, for organizations it is of utmost importance that they are able to respond quickly to low probability/ high-impact disruptions in order to minimize cost and damage. The consequences can be severe if a company is not able to deal with these disruptions: financial and human losses, critical damage to image, lost market share and the like, as illustrated by many case studies in Sheffi (2005).

Secondly, companies are faced with increased vulnerability because they are subject to more and unforeseeable risks. For example, globally distributed supply chains make companies makes companies more dependent on each other. Finally, despite the importance, the lack of business continuity plans in today's companies indicates that companies are not well prepared for disruptive events (Callagher, 2003; Chapman, 2006).

The interesting issue about resilience is about what makes companies resilient and how companies can measure their resilience. If a company should be resilient, the company

must know how it can become resilient, and how it can improve if it lacks resilience in the current situation. Several attempts have been made to address the issue of measuring (characteristics of) resilience. For example, assessing the continuity of business processes by the British Standard Institute (BSI, 2007) resulted in BS25999. Another element of resilience is measuring the safety culture in an organization as suggested by Flin (2006).

However, no comprehensive approach for assessing resilience is currently available that covers the different elements of resilience as described by various researchers. This is the basis for the research question: *How can operational resilience be assessed in a comprehensive manner?* This research attempts to develop a generic approach to measure operational resilience. Based on this approach a company will receive an indication of its resilience and indications of potential improvements so that it is better able to deal effectively with risks and disruptive events in this more turbulent world. The intention of this research is to develop an approach that assesses an organization's resilience very fast, approximately in a few hours. A precondition is that the organizational member(s) involved have preliminary knowledge of the risk management practices within the organization as well as of the approaches being used.

2.2 Empirical Review

In 2021, Dilyard et al. investigated industry 4.0 and digital innovation for global value chain resilience. With a focus on small- and medium-sized businesses (SMEs) and multinational enterprises (MNEs), this perspective piece outlines some of the major effects of the recent pandemic (Covid-19) on global value chains (GVCs) and how the pandemic can hasten the adoption of digital and industry 4.0 technologies in GVCs. In particular, it talks about how digital technology can improve GVC resilience to better

mitigate disruptions brought on by upcoming global shocks. Additionally, it suggests beneficial directions for future policy deliberations to facilitate and guide the use of digital technology among important GVC stakeholders.

Zhang et al. in 2021 assessed how digital transformation enhances organizational resilience. Academics and professionals in business have taken considerable interest in digital transformation, which has emerged as a vital avenue for businesses to increase organizational resilience.

The literature that is currently available, however, does not examine how an enterprise's digital transformation affects organizational resilience; instead, it concentrates on the ideas, causes, and effects of digital transformation. This study builds a theoretical model to investigate a path where digital transformation affects both exploitative innovation and exploratory innovation, and further affects the organizational resilience of enterprises. The model is based on the perspective of dynamic capacity and the theoretical path of "digital transformation—ambidextrous innovation—organizational resilience." This study used both structural equation modeling (SEM) and fuzzy-set qualitative comparative analysis (fsQCA) to investigate the relationships between ambidextrous innovation, digital transformation, and organizational resilience through a questionnaire investigation with 339 Chinese enterprises.

The findings demonstrate how enhancing organizational resilience is facilitated by businesses' digital transformation. Additionally, through the use of both exploratory and exploitative innovation, digital transformation has a positive effect on the organizational resilience of businesses. In conclusion, there is a complementary relationship between exploratory and exploitative innovation in organizations, and both practices have a favorable effect on organizational resilience. Three different

configurations—digital transformation and exploitative innovation, digital transformation and exploratory innovation, and exploitative innovation and exploratory innovation—can be used to achieve organizational resilience, according to additional qualitative comparison analysis. The importance of the practical significance for businesses to successfully implement digital transformation and further enhance organizational resilience is highlighted in the paper's conclusion.

A Comprehensive Approach to Assessing Operational Resilience was studied by Stolker et al. in 2021. The first attempt to apply Multi-Attribute Utility Theory (MAUT) to the idea of resilience is presented in this study. This study focuses on assessing an organization's operational resilience management performance. Operational resilience pertains to an organization's capacity to avert disruptions and promptly address and rebound from any disturbances in its core business processes. It is created a value tree with the characteristics that support resilience management in it. Understanding mission-critical processes, risk management effectiveness, reward structure, and cultural considerations are a few of the components that are covered. The resilience traits are measured by an organization using a checklist. This offers a method for calculating operational resilience. Three firms were audited, and case examples from Sheffi's work were used to validate the checklist (2005).

In the context of COVID-19, Cui et al.'s 2023 investigation explores the relationship between digital technologies, supply chain integration, and company resilience. The breakout of the COVID-19 pandemic has greatly expanded the complexity of information, adding to the obstacles that organizations have in properly digesting and understanding accurate information. As a result, during the epidemic, businesses' production unpredictability has increased significantly, interfering with their regular

operations and supply chains. Digital technologies are important tools that businesses may use to collect and analyze information, which increases their resilience to supply chain interruptions. This research uses a large-scale survey of Chinese manufacturers along with information processing theory to investigate how digital technologies impact company resilience in the context of COVID-19. Our research specifically assesses the moderating impact of information complexity and the mediating effect of supply chain integration (internal, customer, and supplier integration). The findings indicate that the impact of digital technologies on business resilience is mediated by supply chain integration, with a noteworthy mediation effect observed in the case of customer integration. Furthermore, when information complexity is great, the influence of digital technology on company resilience is stronger. The results reveal significant management implications for enhancing company resilience in the context of digital technologies and expand our knowledge of the resilience implications of these technologies.

The Impact of Industry Technologies on Operational Resilience: Adverse Effects of COVID-19 as a Moderator was studied by Nakandala (2024). Manufacturing companies are focusing on deploying a wide range of Industry 4.0 technologies in the era of Industry 4.0, believing that these technologies will protect them from disruptions. During the COVID-19 pandemic, rapid technological advancements, the adoption of new technologies, and digitalized processes were commonplace. processes were uncertain because to labor shortages, skill gaps, supply limitations, and demand concerns. This study looks into how incremental innovation and Industry 4.0 technologies affect the operational resilience of manufacturing companies in Australia that have to deal with a variety of COVID-19 difficulties. It is discovered that COVID-19 effects attenuate the association between Industry 4.0 capabilities and operations

resilience and that Industry 4.0 capabilities lead to operations resilience only through incremental improvements, based on survey data gathered from 117 manufacturing enterprises. The moderating influence of COVID-19 effects on the connection between operations resilience and incremental innovation was not supported by empirical data. We contend that, in light of the results, companies that suffer significant negative effects are more likely to benefit from Industry 4.0 capabilities in terms of operational resilience than are those that do not. According to our findings, manufacturing companies can achieve operations resilience in highly disruptive situations where their survival is at risk by investing in a wide range of Industry 4.0 technologies. It is also crucial to build capacities for incremental innovation. Our findings give manufacturing company managers confidence about the return on technology expenditures and give those considering other options a reason to consider them in order to achieve operations resilience.

Hussain and Papastathopoulos (2022) investigated the connection between financial resilience and organizational preparedness for digital financial innovation. For supply or demand-related reasons, digital financial innovations (DFIs) are widely used in businesses. Organizations must undergo a digital transition in order for DFIs to be realized successfully. The organizational or strategic antecedents of DFIs in organizations have not received much attention in research to date. To comprehend how different organizational preparation aspects (change valence, change efficacy, and contextual factors) affect DFIs, this study applies the theories of organizational readiness and strategic alignment. The study also provides information on how organizational readiness and DFIs are related, as well as how digital technology and business strategy alignment moderates this relationship. The organization's change efficacy—which includes resource, IT, and cognitive readiness—as well as contextual

factors—which include collaboration, culture, and strategic readiness—have a beneficial impact on DFIs, according to the authors. The moderation effect of digital technology - corporate strategy, however, finds little evidence. Additionally, we discover that DFIs have a favorable effect on the enterprises' resilience (toughness and adaptability) and financial success. Both practitioners and theorists can learn from the results. The study advises practitioners that reconfigurability and flexibility of IT, strategy, collaborations, and organizational culture are necessary for implementing DFIs in organizations. DFIs also give businesses the financial resilience they need to withstand disruptions to their finances. One important conclusion for theorists is that, in the context of emerging economies, digital technology-business strategy alignment does not moderate the realization of DFIs. This finding may not hold true in developed economies and calls for additional investigation.

The utilization of real-time information, industrial digitization, and operational agility were all studied by Ghouri et al. in 2022: Digital and Information Perspectives for Supply Chain Resilience. The digital business world is one where change is a constant reality. Businesses handle it based on their capacity to deal with both short- and long-term disturbances and deviations. The supply chain resilience (SCR) of businesses engaged in the Malaysian service sector is examined in this article. For this study, information was gathered from 157 managers of 59 businesses that are involved in seven sub-service industries. The authors investigated a paradigm based on Organizational Information Processing Theory (OIPT) and literature review for the conceptualization, which implies that using real-time information (URTI) improves SCR. The study also discovered a significant connection between the URTI and the industrial digital environment. The findings show a substantial association between the URTI and SCR as well as operational agility, which acts as a partly mediating factor in

the relationship. We also go over the research's theoretical, practical, and policy ramifications.

How Business Model Innovation Promotes Organizational Resilience During COVID-19 was evaluated by Schaffer et al. in 2021. Organizations and societies alike face a number of difficulties as a result of the COVID-19 epidemic, particularly in the medical field. The key to overcoming these obstacles is organizational resilience. Innovation in business models can be a technique for strengthening organizational resilience. However, it's not evident how innovative business models support organizational resilience. As a result, we carry out a long-term case study on Laboratory Inc., which adjusts to the circumstances, develops a new business strategy to enable virus testing at home, and distributes results electronically. Our findings demonstrate how innovative business models strengthen organizational resilience. The organization's new status as a result of the business model improvements is permanent and equips it to handle future crises. Simultaneously, we exhibit how digital advances promote socio-economic value and aid in overcoming crises. Our findings add to the body of knowledge about business models exposed to external threats and organizational resilience.

Zhu and colleagues (2022) conducted an empirical assessment on enterprise operational resilience using a digitalization approach during the COVID-19 pandemic. The main focus of the current study is one Chinese city that has been severely impacted by the COVID-19 outbreak and has been significantly dependent on tourism. This paper use qualitative research methodologies, namely phenomenological research techniques, to perform semistructured in-depth interviews with travel agency managers in China Highlights. This article explores the efforts of China Highlights, a local tourism business in Guilin, China, to revive the industry's growth and functionality during the

post-pandemic period by applying the tourism resilience theory to the field of tourism crisis management. Based on the findings, China's tourism sector is currently in the early phases of the rapid development stage of economic recovery. As a result, tourism-related businesses are facing a significant problem in figuring out how to make wise business decisions both during and after the epidemic. It suggests that the tourism resilience theory can act as a cutting-edge crisis management framework to help travel businesses boost their output during challenging times.

Zouari et al. (2020 investigated whether digitizing the supply chain increases its resilience. For managers looking to improve their supply chain's (SC) ability to withstand unforeseen turbulence, supply chain resilience (SCR) is a critical notion. Increased visibility, foresight, and cooperation are frequently viewed as benefits of using digital SC tools (SCR capacity factors). This research aims to explore the relationship between SCR and SC digitalization. An ordinary least squares (OLS) regression model based on a sample of 300 SC management managers was used to analyze the data. SC digitalisation is characterised by the degree of digital maturity and the adoption of digital SC tools. Both the degree of digital maturity and the adoption of digital tools have a positive impact on SCR but the degree of digital maturity is stronger, especially among the smaller companies. The results do not specify which instruments have the greatest impact on SCR. If managers want higher SCR in the current uncertain environment, they should consider the necessity of continuing to digitalize their SCs and place more emphasis on the degree of digital maturity than on the deployment of digital SC tools. This is the first study to concentrate on evaluating how digitalization affects SCR while taking into account many digital SC instruments simultaneously. The hypotheses model's validation validates the beneficial effects of SC digitalization on SCR for managers and researchers.

Organizing for digital innovation and transformation: bridging the gap between innovation management and organizational resilience was studied by Hunke et al. in 2021. While increased digitalization presents new potential for today's firms to improve client value propositions, it also presents substantial obstacles for traditional businesses. Organizations must include effective innovation management techniques and strengthen organizational resilience in order to successfully navigate the challenging path of digital transformation in this unpredictable climate. The authors of this research put out a conceptual framework that connects these two ideas. While we perceive organizational resilience as the capacity to adjust or modify an organization's business, the authors defined innovation management as the continuing activity of anticipating and responding to ongoing developments in an organization's environment through innovation. We discover evidence that a successful digital transformation requires both by examining two exemplary cases. In addition, the authors provided essential elements for constructing organizational resilience and presented a pair of instances of utilizing organizational resilience to change business models via digital innovation, thereby circumventing the innovator's problem.

Cui and colleagues, 2021 examined the connection between COVID-19, supply chain integration, and business resilience in the context of digital technology. Information is now much more complex as a result of the COVID-19 epidemic, which makes it harder for businesses to analyze and understand data in an efficient manner. Consequently, the pandemic has caused a significant increase in the production uncertainty of companies, causing disruptions to their regular operations and supply networks. When it comes to processing and analyzing information, digital technologies are important tools that help businesses become more resilient to supply chain interruptions. Through the lens of

information processing theory and a comprehensive survey, this study attempts to investigate how digital technologies effect company resilience in the context of COVID-19.

Our research specifically assesses the moderating impact of information complexity and the mediating effect of supply chain integration (internal, customer, and supplier integration). The findings indicate that the impact of digital technologies on business resilience is mediated by supply chain integration, with a noteworthy mediation effect observed in the case of customer integration. Furthermore, when information complexity is great, the influence of digital technology on company resilience is stronger. The results have significant management implications for enhancing company resilience in the context of COVID-19 and further our comprehension and acknowledgement of the resilience implications of digital technology

2.3 Theoretical Review

This section reviews the theory that is employed in explaining the relationships as indicated in the conceptual model.

2.3.1 Underlying Theory

According to information processing theory (IPT), supply chains' inherent interferences and external uncertainties treat organizations like open systems (Galbraith, 1974). (Cegielski et al., 2012; Wong et al., 2020). Premkumar et al. (2005), Wong et al. (2020), Tushman & Nadler (1978), Galbraith (1973), and other authors suggest that interference should be handled by matching the information processing requirements and capabilities associated to interruptions. This approach is based on IPT. The organization's environmental conditions dictate the extent of information processing requirements, and the firm's information processing capacity is influenced by the

distribution of resources and technical tools for information collection, processing, and management (Galbraith, 1973; Tushman & Nadler, 1978).

IPT advocates that organizations have two strategies, reducing information processing needs and improving information processing capacity, which can be used to support decision making in times of uncertainty (Galbraith, 1973). IPT has been widely used in operations and supply chain management studies (Qrunfleh & Tarafdar, 2014; Fan et al., 2017), it and has the potential to explain the effect of supply chain disruption on the development of firm resilience during COVID-19 because the uncertainty of interference boosts the demand for information processing (Modgil et al., 2021; Dubey et al., 2021).

The ambiguity and unpredictability of the environment in which the organization operates have a direct bearing on the requirement for information processing. On the other hand, the number and ambiguity of the information affect the firm's ability to process information (Bartnik & Park, 2018). Information processing demands and information processing ability should be coordinated in order to build strong resilience, according to IPT. In this instance, digital technologies are crucial to information gathering and analysis, which are key approaches to enhance information processing capacity according to research that has been done (Li et al., 2020).

Digital innovation for organizations enables real-time data collection and analysis, which is critical for enhancing situational awareness and decision-making during disruptive times. Technologies such as the Internet of Things (IoT), big data analytics, and machine learning enable the continuous monitoring of processes. By providing early warnings and predictive insights, these technologies also help enterprises respond proactively to possible disruptions (Wamba et al., 2017). For instance, IoT sensors may

monitor how well machinery is operating and foresee problems, allowing for preventive maintenance and minimizing downtime.

The seamless information sharing enabled by cloud computing, collaborative platforms, and integrated communication systems across departments and geographical borders improves the organization's ability to coordinate responses to disturbances (Cram et al., 2016). Good coordination and communication are necessary to execute backup plans and maintain operational continuity.

Automation technologies reduce dependence on manual labor, increasing productivity and reliability. Smart manufacturing systems and robotic process automation (RPA) are two examples of these technologies. When there are disruptions in the workforce, automation ensures that crucial functions may be accomplished without the need for human intervention (Ivanov & Dolgui, 2020). Furthermore, automated systems can streamline operations to reduce waste and enhance resource use.

The ability of the company to coordinate responses to disturbances is enhanced by the seamless information sharing made possible by cloud computing, collaborative platforms, and integrated communication systems across departments and geographical borders (Cram et al., 2016). To carry out backup plans and preserve operational continuity, effective coordination and communication are essential.

Automation technology increases productivity and dependability by reducing reliance on manual labor. Two examples of these technologies are robotic process automation (RPA) and smart manufacturing systems. Automation makes guarantee that important tasks can be completed without the need for human interaction when there are

disruptions in the workforce (Ivanov & Dolgui, 2020). Automated systems can also improve resource efficiency and save waste by streamlining processes.

2.4 Conceptual Framework and Hypothesis Development

Having looked at the various theories underpinning this study, this section presents the procedures for the development of the conceptual model that seek to relate digital innovation and operational resilience. The conceptual model also seeks to establish the moderating roles IT capabilities on the effect of digital innovation on operational resilience. The conceptual model of this study is presented in Figure 3.1.

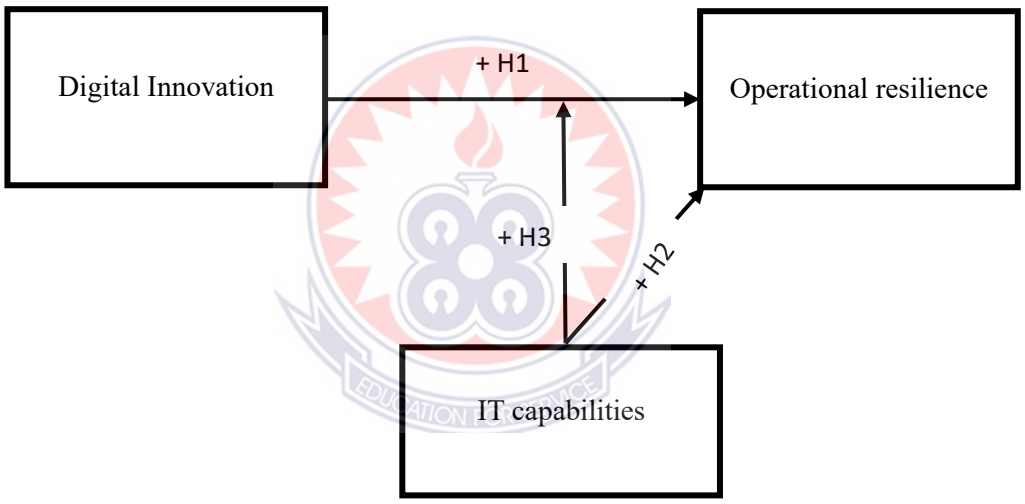

Figure 1: Conceptual model **Source: Author, 2024**

2.4.1 Digital Innovation and Operational Resilience

According to Information Processing Theory (IPT), organizations are information-processing systems created to process information reliably and efficiently in order to decrease uncertainty and enhance decision-making (Galbraith, 1974). The theory places a strong emphasis on the flow of information inside an organization, since efficient information processing can improve flexibility and the ability to react to changes in the

external environment. By boosting information flow capacity, speed, and accuracy, digital innovation improves these procedures and boosts operational resilience.

Data gathering and analysis can be done in real-time thanks to digital technologies like the Internet of Things (IoT) and sophisticated analytics tools. According to Lee et al. (2020), this capacity enables businesses to minimize operational effect by quickly identifying disturbances and taking appropriate action. For example, IoT-enabled predictive maintenance solutions can anticipate equipment faults and guarantee uninterrupted operations.

Cloud computing and collaborative platforms are examples of innovations that enhance internal coordination and communication. By facilitating smooth information exchange across departments and geographical boundaries, these technologies improve organizational agility (Yoo et al., 2022). In times of crisis, timely information sharing is essential to coordinating a successful response and preserving operational continuity.

With the help of machine learning (ML) and artificial intelligence (AI), complex decision support systems that can analyze enormous volumes of data and produce insightful conclusions are possible. According to Kache and Seuring (2017), these systems improve decision-making speed and accuracy, which is critical during disruptions. Supply chain resilience, for instance, can be ensured by AI-driven supply chain management systems' ability to dynamically modify inventory levels and delivery routes in reaction to unforeseen circumstances.

Reliance on manual procedures, which might be hampered by human variables like labor availability, is decreased by automation and robotics. Organizations can increase resilience by maintaining operations with less human interaction by automating

important activities (Ivanov & Dolgui, 2020). For example, automated warehouses are able to process orders even in the event of staff shortages or lockdowns.

Empirical evidence is available to establish the connection between operational resilience and digital innovation in recent studies. Organizations with strong digital capabilities proved to be much more robust during the COVID-19 pandemic, able to quickly pivot and maintain operations despite severe disruptions, according to a Deloitte survey from 2021. In a similar vein, a McKinsey (2022) study showed that, in comparison to their less technologically sophisticated competitors, digital leaders—organizations that have incorporated digital technology across their operations—reported better levels of resilience and quicker recovery times. By enhancing an organization's information processing capabilities, digital innovation improves operational resilience. Digital technologies facilitate more effective detection, response, and recovery from disruptions for enterprises by means of automation, improved communication, real-time data analysis, and sophisticated decision support systems. Based on the argument, it is hypothesized that

H1: Digital innovation has a positive and significant relationship with operational resilience

2.4.2 IT Capabilities and Operational Resilience

According to Information Processing Theory (IPT), organizations are information-processing machines made to process information reliably and effectively in order to minimize uncertainty and improve decision-making (Galbraith, 1974). Information must be gathered, analyzed, disseminated, and used for effective information processing. These procedures are greatly improved by IT skills, which strengthens an organization's operational resilience.

Organizations can gather, store, and analyze enormous volumes of data in real-time thanks to advanced IT capabilities like Big Data analytics. According to Wamba et al. (2017), this skill improves situational awareness and predictive analytics, enabling firms to foresee problems and take proactive measures to address them. Predictive analytics, for example, can spot possible bottlenecks in the supply chain before they happen, guaranteeing seamless operations.

Through integrated platforms like cloud computing and collaborative applications, IT skills enable smooth communication and cooperation. According to Cram et al. (2016), these tools facilitate real-time information exchange and coordination among various organizational divisions, which is crucial for prompt and efficient decision-making in times of disruption. The ability to execute backup plans is improved and response times are decreased when there is effective communication.

Large datasets are processed by artificial intelligence (AI) and decision support systems (DSS) technologies, which are driven by strong IT capabilities and offer vital insights and recommendations. According to Chen et al. (2015), these systems improve decision-making speed and accuracy, which is essential for managing complicated and quickly changing scenarios. AI-powered supply chain management systems, for instance, are able to continuously operate by dynamically modifying logistics plans in response to real-time data.

With the use of technologies like robotic process automation (RPA) and the Internet of Things (IoT), IT skills allow for the automation of important and regular activities. According to Ivanov and Dolgui (2020), automation lowers the possibility of human error and guarantees consistency and dependability in processes, especially under

challenging circumstances. Automated systems are resilient against workforce disruptions because they may continue to run without human interaction.

The relationship between IT capabilities and operational resilience is emphasized by empirical investigations. For instance, a 2019 study by Fenech et al. showed that companies with sophisticated IT infrastructures were more robust in times of crisis, exhibiting quicker recovery times and continuous operations. In a similar vein, an Accenture (2021) analysis discovered that during the COVID-19 pandemic, businesses with superior IT capabilities, known as digital leaders, demonstrated greater operational resilience and quickly adapted to remote work and digital service delivery. IT capabilities increase an organization's capacity to process information, which strengthens operational resilience. IT skills help firms detect, respond to, and recover from disturbances more efficiently through automation, better communication, and advanced data analytics. As a result, strengthening operations' resilience in a world of growing unpredictability requires investing in IT capabilities.

H2: IT capabilities has a positive and significant relationship with operational resilience

2.4.3 Moderating Effect of IT Capabilities

By advancing real-time data collecting, predictive analytics, and automated decision-making, digital innovation—which includes technologies like artificial intelligence, the Internet of Things (IoT), and big data analytics—improves operational resilience (Wamba et al., 2017). By using these technologies, businesses may keep operations running smoothly by anticipating disturbances, acting swiftly, and recovering efficiently.

IT capabilities make it possible for data from different digital breakthroughs to be seamlessly integrated, enabling thorough data analysis and better decision-making. For example, integrating IoT data with big data analytics through a strong IT infrastructure can yield actionable insights that improve operational resilience (Chen et al., 2015). By ensuring that the data gathered through digital technologies is efficiently processed and utilized, this integration increases the influence of that data on resilience.

IT talents guarantee seamless integration across various digital platforms and systems. An organization's entire information processing capacity can be increased by effective interoperability, which is made possible by IT skills. This enables for seamless communication and coordination amongst various digital advances (Cram et al., 2016). Because of this enhanced interoperability, digital technologies can contribute to operational resilience more successfully by enabling prompt and coordinated reactions to disruptions.

The scalability and flexibility required to adjust digital advances to shifting operational needs is made possible by IT capabilities. Businesses with cutting-edge IT skills can adjust the size of their digital solutions in response to demand in real time, guaranteeing uninterrupted business operations even in the face of disruptions (Fenech et al., 2019). since of its scalability, digital innovations have a greater effect on operational resilience since they enable firms to dynamically modify their operations in reaction to disturbances.

The security and dependability of digital innovations are improved by advanced IT skills, which guarantee that these technologies function properly even under challenging circumstances. Robust IT infrastructure guarantees the ongoing operation of digital technology, while robust IT security measures shield digital systems from

cyberattacks (Accenture, 2021). By guaranteeing that vital systems continue to function, this dependability increases the contribution of digital advances to operational resilience.

The moderating influence of IT capabilities on the relationship between operational resilience and digital innovation is empirically supported by recent studies. For instance, a Deloitte study from 2021 discovered that during the COVID-19 pandemic, businesses with strong IT capabilities were better equipped to use digital technologies to increase their operational resilience. In a similar vein, McKinsey (2022) research revealed that, in comparison to their less technologically proficient peers, digital leaders—organizations possessing sophisticated IT capabilities—were more adept at preserving operational continuity and recuperating from disruptions.

The relationship between operational resilience and digital innovation is significantly moderated by IT capabilities. IT capabilities make sure that digital advances are used to improve operational resilience by improving data integration, system interoperability, scalability, flexibility, security, and reliability.

H3: IT capabilities positively and significantly moderate relationship between digital innovation with operational resilience

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methodology for the study. It looks at the research purpose, research design and strategy, study's population, the sampling technique and sample sizes, data gathering instruments and the operationalization of constructs. In addition, it discusses measurement of variables, data collection procedures, data analysis, quality of the study, ethical considerations and the profile of the study area.

3.1 Research Philosophy

The manner in which we think about research influences our research approach and our views on judgements in society suggest that we perceive some factors and events as more significant and relevant than others (Saunders et al., 2011). There are several research philosophies like the positivism, subjectivism, and pragmatism among other. However, this study adopts the pragmatism research philosophy.

According to Leavy (2017), pragmatism asserts that there is no allegiance to any set of rules instead rather suggest that any relevant tool can be crucial in different research context. The objective of this type of research philosophy is to reveal what works for a given research problem (Creswell, 2014). According to Creswell (2014), pragmatism concentrates on the findings of the research that is the actions or situations instead of antecedent conditions as in postpositivism. Therefore for the purposes of this study, which explored and tested an already existing theory, positivists research philosophy views was espoused.

3.2 Research Purpose

According to Cavana et al. (2001), any type of research can be grouped based on its purpose (exploratory, explanatory and descriptive). The study is aimed at obtaining new thoughts into happenings in and around the world. This type of study is quite flexible and easily adaptable to changes. Descriptive study on the other hand, seeks to disclose an accurate profile of objects, persons, situations and events. Explanatory research seeks to study situations and problems by trying to establish a causal relationship between the variables which is being studied.

The purpose of this study is to investigate supplier relationship management and how it customer loyalty. Thus, establishing a relationship among digital innovation, IT capabilities and operational resilience, the research intends to address the issues of supplier relationship management among firms in Ghana. The study is explanatory research because it seeks to examine or explain whether or not if IT capabilities influences the effect of digital innovation on operational performance.

3.3 Research Design and Strategy

The type and nature of every study determine to a large extent the choice of design and the right strategy to be employed. Research design according to (Saunders et al, 2009) is a plan that determines the collection, measurement and how data would be analyzed. Several types of research strategies are in place for researchers. Some of the strategies include experiment, case study, action research, grounded theory, survey, archival and ethnography.

With reference to this current study, the researcher has chosen to employ the use of the survey strategy. The survey approach is normally associated with the deductive approach, it is commonly called and seen as a means that enables the collection of large

quantitative data. A data collection instrument for instance is a questionnaire that makes it possible to use either descriptive or inferential statistics or both in analyzing (Saunders et., 2009).

3.4 Population of the Study

Population is the whole group of people, elements or events of things that are of interest to the researcher (Cavana et., 2001). The study focuses on manufacturing and service organisations in the Ashanti Region with the aim of empirically testing the theoretical framework that has been proposed. The proposed model is universal and therefore findings could be generalized.

Due to the kind of concepts which is being investigated, there will be the need to further narrow the population and make it more homogenous which will aid the researcher to get access to the relevant information or data required. This will help in addressing the objectives of the study due to the fact that the study concentrates on selected firms.

3.5 Sample Size and Sampling Technique

3.5.1 Sample Size

Saunders et al. (2009) posits that quality of every study is not only influenced by how appropriate the method and instrument is but also how suitable the strategy for sampling is. Every research is limited by some factors and this is a main challenge to the researcher as he/she is not able to study all the factors within the given target population. In such instances, the researcher is obliged to pass through a process which is systematic and this is called the sampling process with the aim of getting a representation of the entire population.

According to Singh (2006), there is no single acceptable rule for determining the sample size which is appropriate for a study. Several authors (e.g Pallant, 2007; Field, 2009; Hair et al., 2014) have suggested that the appropriateness of sample size should be influenced by the statistical analysis or tools to be used in the study. The sample size for this study is 100 respondents. The calculation of the sample size was carried out using the simplified formula developed by Yamane in 1970. The calculation of the sample size was carried out using the simplified formula developed by Yamane in 1970. The sample size for this study using Yamane (1970) formula is 100 respondents.

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

where,

n: Sample size

N: Population size

e: The acceptable sampling error (0.5)

$$n = \frac{5000}{1 + 5000(0.05)^2}$$

$$n = 100$$

3.5.2 Sampling Technique

In this study, the researcher used convenience sampling technique to obtain the sample that is representative of the population. Hence the researcher employed the use of convenient sampling technique. Convenience sampling aims at targeting a small sample of a population that has been specially chosen by the researcher. This is because it is easier to get the data and easily accessible (Trochim and Donnelly, 2008; Bhattacherjee,

2012). The researcher chose this technique because it is less expensive and fast compared with other sampling technique**.**

3.6 Research Method

This part is aimed at examining the various sources of data and the processes that were used in collecting the data.

3.6.1 Sources of Data

There are two kinds of data for every research which are primary data and secondary data. Primary data refers to the information that is collected by the researcher by means of systematic observation, interviews, results of questionnaires and case study compiled. Secondary data refers to that kind of data that has already been collected and accessible from other sources. Looking at the flaws that can characterize the usage of secondary source of data, the researcher used the primary source of data. Hence a questionnaire would be used. The questionnaire will be used to solicit responses from the research respondents to obtain in order to help address the research objectives.

3.6.2 Data Collection Technique

The only instrument that was used in collecting the data was through a well-structured questionnaire with measures adopted from an already existing literature.

The items in the instrument were grouped into two parts (Part A-B). Section A looked at the respondent's background information and information regarding the organisations in which the respondents were employed. The part B looked at the constructs in the theoretical framework of the study. This includes supply chain disruption and supply chain performance. The purpose was to help respondents to provide responses to the questions and also help the researcher. This will help the researcher to easily code the responses for the analysis.

3.6.3 Data Gathering Procedure

3.6.3.1 Preliminary Procedures

Despite the fact that the instruments were adapted for various constructs, the study has been validated in previous studies, it was therefore important for the researcher to review them in order that they serve as manifest variables for their appropriate constructs. To assist this, the researcher's supervisor had to probe the instrument that was to be used. Corrections were made in order to make the questionnaire ready for administration.

In like manner, the targeted respondents for the study includes some selected firms in Ghana. This is because such people are believed to have enough knowledge about the firm's internal and external relationships and processes. Therefore, an individual respondent was made to represent the firms.

3.6.3.2 The Field of Study

The researcher employed the use of two approaches in gathering the responses for the study. First of all, key firms who fall within the population and meet the criterion as a respondent were approached and questionnaire will be given to them.

In addition to the above, other responses were collected by personally going to the premises of the identified schools. Their consent will be sent and a letter of introduction from the department will be attached. Firms that accepted to participate in the study were given a maximum of two weeks to provide responses to the study. Out of 100 questionnaires, the researchers administered hundred and thirty within the study's time frame.

3.6.4 Operationalisation of Constructs

This section looks at an in-depth discussion on how the variable that was employed was measured and made available in this subsection.

Digital innovation is operationalized using five items. This was measured on a five-point Likert scale (1= strongly disagree to 5= strongly agree). The items measured the extent to which the some selected under study agreed with the statements. These items measured the extent to which digital innovation has improved the operational resilience of selected firms in Ghana.

3.7 Data analysis

This study employed quantitative data analysis techniques which is explained below.

3.7.1 Unit of Analysis

According to Cavana et al. (2001), several units of analysis exist and any of them can be used in a research work. They consist of individual, dyad (two-person interaction), group, organisations (organizational level) or cultures. The one to be used is dependent on the level of data gathered.

This study employed individual (organizational level) as its unit of analysis. Due to this, individuals who were made to answer the questionnaire were key persons who represented the views of their various firms.

3.7.2 Data Analysis Procedure and Techniques

In the quest to analyse the data gathered, the researcher used the procedures below

i. Generation of preliminary results (demographic information on the respondents and organization and addressing the study's objectives
ii. Validity and reliability testing of the data collection instrument

iii. Model estimation and evaluation of hypotheses

3.8 Quality of the Study

The quality of the current study was assessed on the following parameters; respondent's competency, knowledge level and truthfulness; reliability of the measures, validity of the scales used and method bias. The carrying out of these tests were necessitated by the need of the researcher to ensure that the data collected was suitable for the various analyses that were required to be used.

3.8.1 Informants' Competency, Knowledge Level and Truthfulness

This section looks at respondents' knowledge and comprehension on the issues being investigated. Furthermore, the level of their confidence in responding to the matters were analysed using the means, standard deviations to ensure accuracy as all firms have different experience about the concerns which are at hand. Refer to chapter four for more details.

3.8.2 Validity and Reliability

Validity and reliability are two unique characteristics that every researcher must recognize in the process of designing, analyzing and judging the quality of a study or research especially with regards to quantitative studies. It is therefore necessary that every design adopted, data gathered and assessment techniques that are used are reliable and valid or else the study is considered futile. Conducting several tests (eg internal consistency, discriminant validity, convergent validity etc), the researcher made sure that the data that has been collected was suitable for the intended study. See chapter 4 for more details.

3.9 Ethical Consideration

Ethical issues are of much significance in every research that is conducted and this study is not an exception.

In making the respondents to understand and sign the consent form to this study, an introductory letter was obtained from the head of department. Copies of the introductory letter were given to the heads of various firms selected for this study. That being said the respondents were briefed about the purpose of the study and the time needed to complete the questionnaire before they endorse the consent forms. The respondents were assured of confidentiality in the data collection. By these arrangements, the rights of the respondents were respected. At any given time, the respondents were allowed to opt out of the process if one wanted to do so. The participants that were interviewed were allowed to do so voluntarily and were not forced in answering questions.

Also, the researcher should not fill the questionnaire himself. The researcher did not also manipulate the data to suit the stated hypotheses and objectives. Uncompleted forms were not be filled by the researcher.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF RESULT

4.0 Introduction

The purpose of this research is to examine the relationship between digital innovation and operational resilience making reference to the moderating role of IT capabilities. This chapter begins with a descriptive statistic of the data to illustrate the scope and patterns of the topics being discussed. Furthermore, the chapter centers on the validity and dependability of the used instruments. Because they address questions regarding the accuracy of the measurement tools and the quality of the data collected, validity and reliability are essential. This chapter analyzes data using statistical techniques such as regression analysis, correlation, exploratory component analysis, and descriptive statistics.

4.1 Demographics Characteristics of Respondent

Most of the data was acquired using surveys. One hundred and ten (100) people completed the questionnaires and sent them back, making one hundred (120) total. 35% of the responders are women and 65% of men. This suggests that there was no discrimination based on gender.

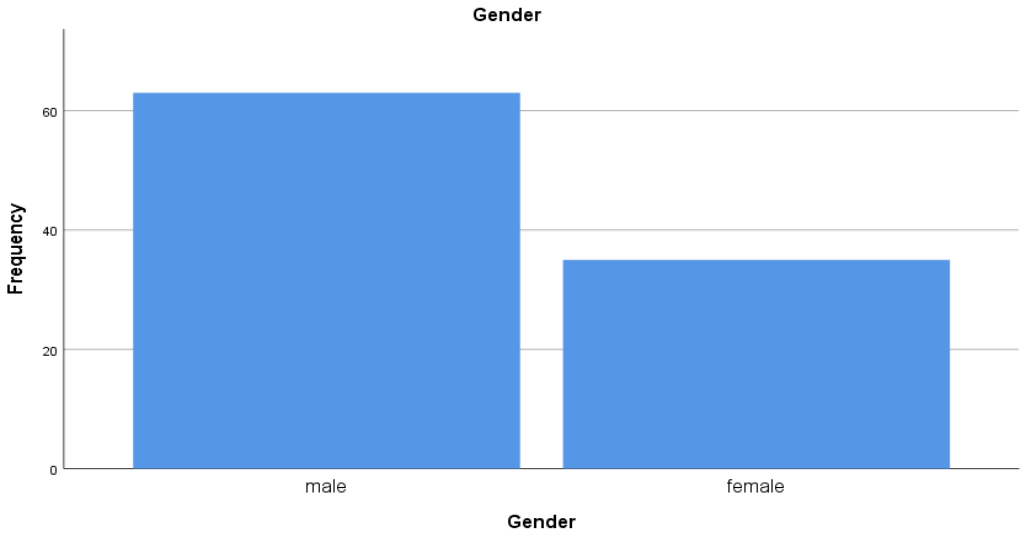

***Figure 2**: Gender Distribution*

In terms of respondents' ages, 10% were under 23 years old, 20% were between 24 and 29 years old, 50% were between 30 and 35 years old, 12% were between 36 and 40 years old, and 4% were 41 years old and older. This indicates that the participants were of the appropriate age to reply to the inquiries.

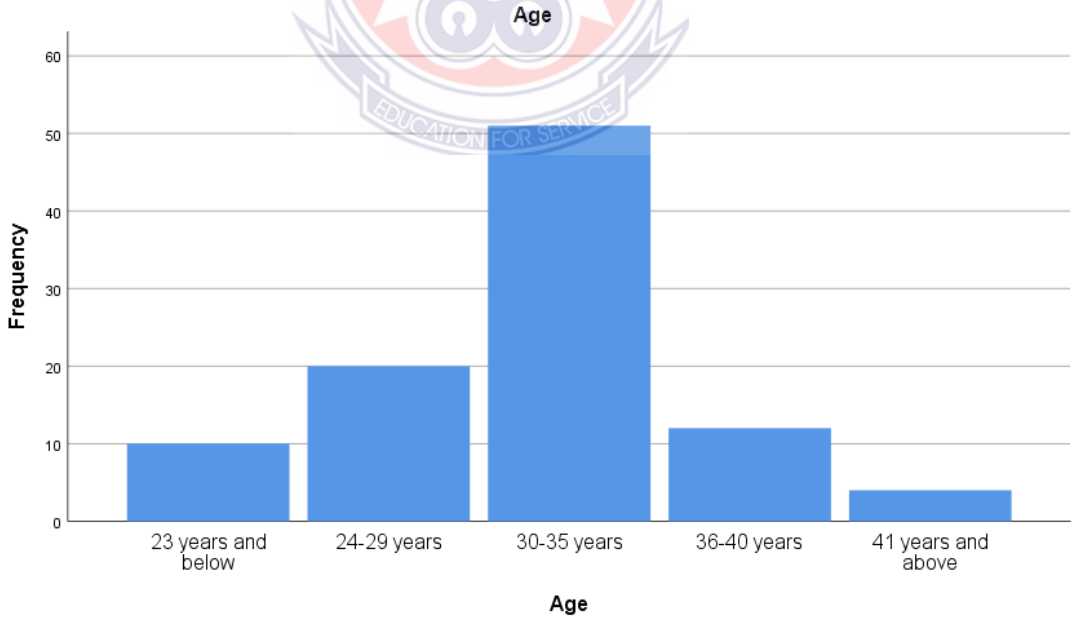

***Figure 3**: Age Distribution*

Regarding to the educational background of the respondents, 39% had bachelor's degree, 33% had master's degree and 3% PhD level. This indicates that respondents were well educated to respond to the questions.

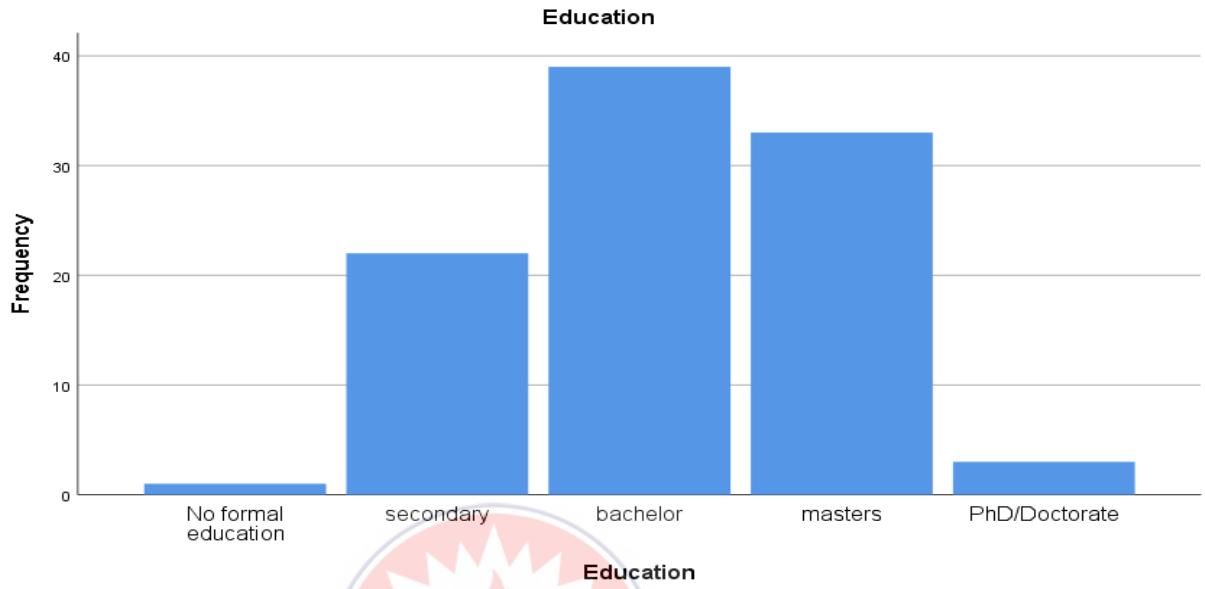

***Figure 4**: Level of Education*

Moreover, with regard to the work experience of the respondents, 1% of them were less than one year, 21% were 1-5years of work experience, 31% of them had 6-10 years of work experience, 12% of them had 11-15 years and above working experience. 29% of them had 16-20 years and above working experience. 6% of the respondents have worked for more than 21 years. This finding indicates that respondents had the industry experience to respond the questions.

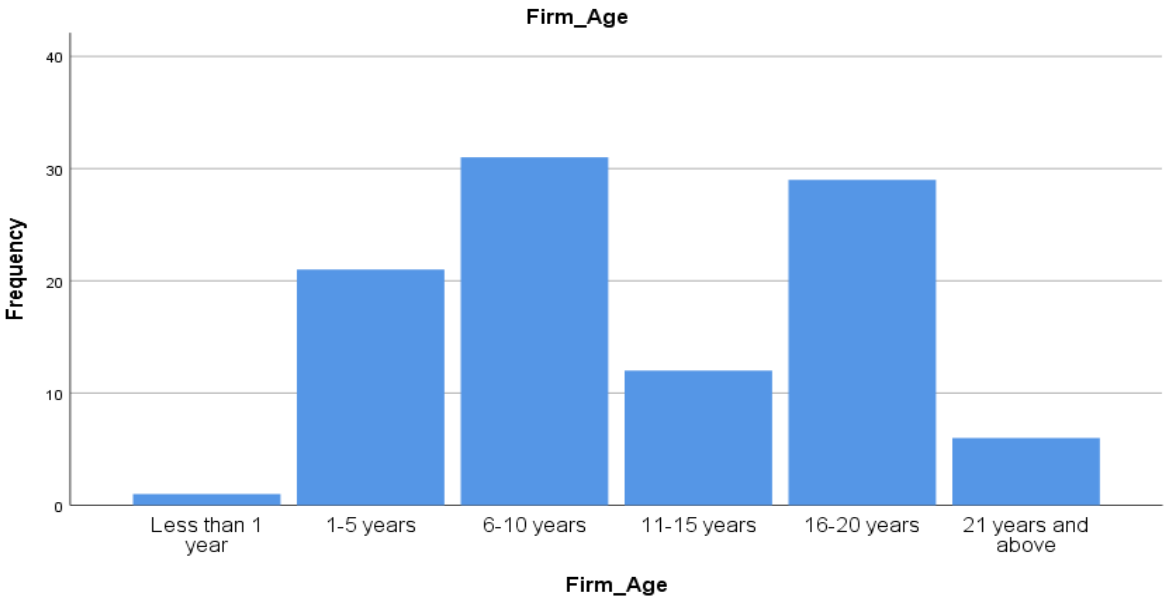

***Figure 5**: Firm Age*

Again, with regard to the number of employees in each firm, 10% of the firms have less than 6 employees, 17% have 6-9 employees, 29% had 10-29 employees, 5% had 30-50 employees and 39% had employees more than 50. This indicates that the organisations that were considered had the experience to respond to the questionnaire

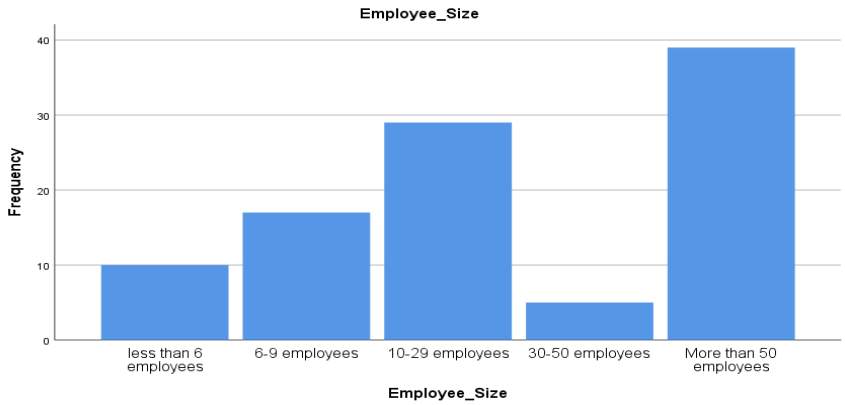

***Figure 6**: Employee Size*

Based on their firms' ownership type, 53% are fully locally owned, 21% are foreign owned, 26% are jointly Ghanaian, and foreign owned. This indicates that there is fair selection of organizations based on the ownership type.

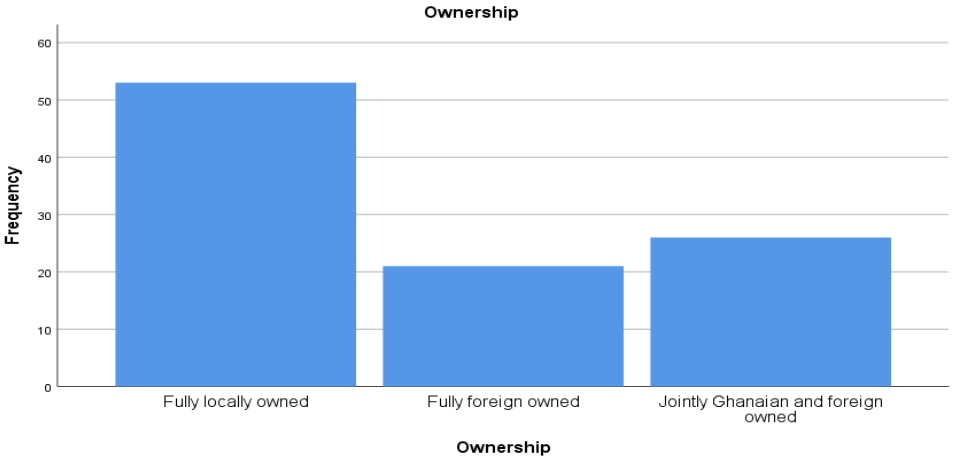

***Figure 7**: Ownership*

With regard to the positition of respondents, 45% of the respondents are procurement managers, 30% are logistics managers and 24% are at the warehouse officers. This indicates that the right respondents answered the questions.

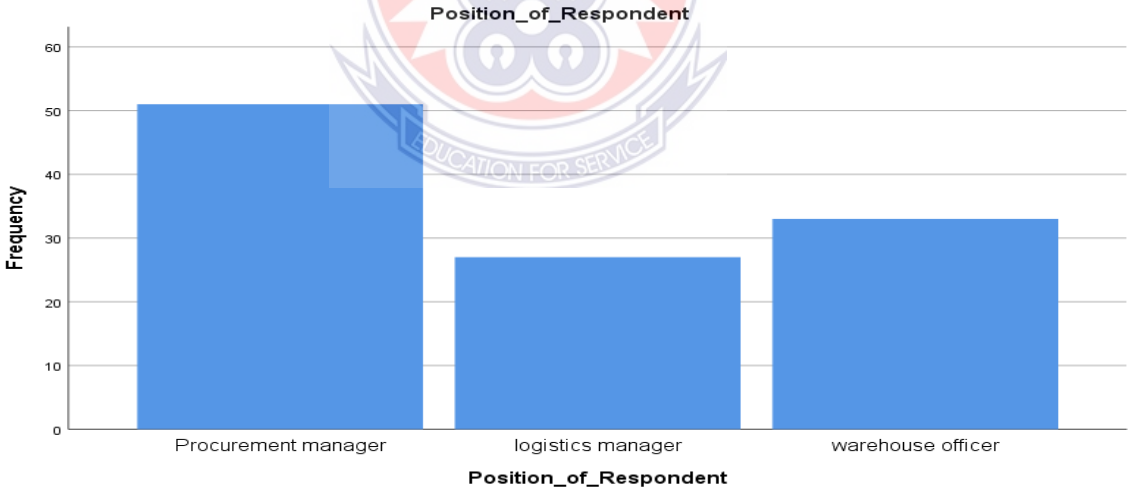

***Figure 8**: Position of Respondents*

Table 1: Background Characteristics of Respondents

	Frequency	Percent	Valid percent	Cumulative percent
Gender				
Male	63	63.0	64.3	64.3
Female	35	35.0	35.7	100.0
Total	**98**	**98.0**	**100.0**	
Age				
23 years and below	10	10.0	10.3	10.3
24-29 years	20	20.0	20.6	30.9
30-35 years	51	51.0	52.6	83.5
36-40 years	12	12.0	12.4	95.9
41 years and above	4	4.0	4.1	100.0
Total	97	97.0	100.0	
Educational background				
Bachelor's degree	39	39.0	39.8	63.3
Master's degree	33	33.0	33.7	96.9
Total	3	3.0	3.1	100.0
Less than 1 year	21	21.0	21.0	22.0
1-5 years	31	31.0	31.0	53.0
6-10 years	12	12.0	12.0	65.0
11-15 years	29	29.0	29.0	94.0
Total	6	6.0	6.0	100.0
Less than 6 employees	10	10.0	10.0	10.0
6-9 employees	17	17.0	17.0	27.0

10-29 employees	29	29.0	29.0	56.0
30-50 employees	5	5.0	5.0	61.0
More than 50 employees	39	39.0	39.0	100.0
Total	100	100.0	100.0	

Ownership type				
Fully locally owned	52	52.0	52.0	52.0
Fully foreign owned	21	21.0	21.0	73.0
Jointly Ghanaian and foreign owned	26	26.0	26.0	99.0
Total	**111**	**100.0**	**100.0**	
Position_of_Respondent				
Procurement manager	45	45.0	45.5	31.7
logistics manager	30	30.0	30.3	78.3
warehouse officer	24	24.0	24.2	100
Total	**99**	**99.0**	**100.0**	

4.2 Test of Normality

This section presents item-by-item descriptive statistics of the study's constructs. All items were measured on a 7- point scale and details of the scale anchors have been provided in the last row of each table. The descriptions here are the full list of items used in the questionnaire, before exploratory and confirmatory factor analysis. The main variables are from tables 5.7 to 5.10, followed by the control variables. All composite scores used in the OLS regression estimation were calculated after the EFA and CFA procedures, and may not reflect the means in the descriptive tables provided

in this section (for constructs that have items dropped). The tables presented in this section indicate the minimum and maximum values on each construct and the mean and standard deviation per item.

Normality is one of the key assumptions of multivariate statistics, and it is important to check metric variables early for normality (Kline, 2011; Tabachnik and Fidell, 2013). Multivariate normality means that all variables are univariate normally distributed, the distribution of any pair of variables is bivariate normal, and all pairs of variables have linear and homoscedastic scatterplots (Harrington, 2009). Even though there are several aspects of normality and checking impractical to assess all aspects of multivariate normality, checking for univariate normality (skewness and Kurtosis) and outliers will detect most cases of non-normality (Harrington, 2009; Kline, 2011). Hair et al., (2014) argue that even though univariate normality does not guarantee multivariate normality, if all variables meet this requirement, then any departures from multivariate normality are usually inconsequential. A normality test for each item, using skewness and Kurtosis statistic generated using SPSS is also presented in the table below. Skewness is the tendency of the deviations from the mean to be larger in one direction than in the other, whiles kurtosis is a measure of the relative peakedness or flatness of the curve defined by the frequency distribution (Malhotra et al., 2017).

Skewness, for instance, can cause r to underestimate the magnitude of relationships (Nunnally and Bernstein, 1994). To check for normality, this study follows considers both item-by-item checks of skewness and Kurtosis and a check for composite scores. The results presented in the tables indicate that the distribution of scores on each item is satisfactorily normal as both the skewness and the kurtosis indices obtained are very

much within the recommended thresholds of "less than |4|" and "less than |8|" respectively.

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation		Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
DC1	57	1.00	7.00	4.0000	2.35281	-.153	.316	-1.597	.623
DC2	41	1.00	7.00	3.6341	2.00943	.046	.369	-1.362	.724
DC3	58	1.00	7.00	4.4483	2.07890	-.325	.314	-1.342	.618
DC4	57	1.00	7.00	4.3860	1.97985	-.304	.316	-1.166	.623
ITC1	57	1.00	7.00	4.2807	2.21806	-.165	.316	-1.477	.623
ITC2	56	1.00	7.00	4.1786	2.30499	-.134	.319	-1.559	.628
ITC3	56	1.00	7.00	4.6250	1.93120	-.433	.319	-1.149	.628
ITC4	55	1.00	7.00	4.2182	2.12299	-.309	.322	-1.305	.634
OR1	56	1.00	7.00	4.4821	2.00899	-.419	.319	-1.042	.628
OR2	56	1.00	7.00	4.4821	2.13193	-.313	.319	-1.281	.628
OR3	57	1.00	7.00	4.4386	2.09606	-.357	.316	-1.283	.623
OR4	57	1.00	7.00	4.4912	2.05394	-.429	.316	-1.185	.623
OR5	57	1.00	7.00	4.3158	1.95629	-.210	.316	-1.156	.623
Valid N (listwise)	36								

4.3 Reliability Test of Measurement Scales

Two tests of reliability – Cronbach's Alpha and composite reliability have been used in this study. Results of the Cronbach's Alpha test are presented in table 5.17 below,

whereas the composite reliability is reported in the CFA table in the later parts of this section. The alpha values for all constructs are above the threshold of 0.7, indicating that the constructs demonstrate good internal consistency.

Table 3: Reliability Analysis

Construct	*Number of items*	*Cronbach's alpha*
1. Digital innovation	4	0.928
2. IT capabilities	4	0.889
3. Operational resilience	5	0.914

4.4 Exploratory Factor Analysis

Given that most of the indicators in the study were adapted from extant literature and through interviews with key informants, I first used exploratory factor analysis (EFA) to understand the underlying structure and unidimensionality of the data (Hair et al., 2019). I performed EFA on all multi-item indicators using principal component and Varimax as factor extraction and rotation methods, respectively (Hair et al., 2019). Bartlett's test of sphericity reached a statistically significant level ($\chi 2 = 5065.953$, df = 325, $p < 0.00$) while Kaiser–Meyer–Olkin (KMO) index was 0.87, suggesting that factorability and sample size are not concerns in the study (Hair et al., 2019). As shown in Table 3, the EFA extracted six factors that correspond to the number of latent constructs in the study. The Eigenvalues ranged from 1.79 to 8.41 while the percentage of variance explained values ranged from 5.98% to 28.03%. Importantly, the indicators load high (above 0.60) only on their theoretical constructs, with the highest cross-loading being 0.32. These results offer initial evidence of unidimensionality, convergence, and discriminant validity.

Table 4: Exploratory Factor Analysis

	1	2	3
DC1			.649
DC2			.699
DC3			.693
DC4			.672
ITC1	.663		
ITC2	.637		
ITC3	.614		
ITC4	.638		
OR1		.827	
OR2		.820	
OR3		.817	
OR41		.832	
OR52		.083	

The KMO value should be greater than or equal 0.70. hence the sample is adequate for the analysis. Barlerts must be significant at 0.05. this means that the variables are unrelated.

Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.870**
Bartlett's Test of Sphericity	Approx. Chi-Square	5065.953
	Df	325
	Sig.	**.000**

4.5 Key Descriptive Statistics and Inter-Construct Correlation

The key variables in the study are digital innovation, IT capabilities and operational resilience. This section examines the means scores of these items and their correlation with other variables. Details are provided in the table below

4.5.1 Digital Innovation

From the table below, the average scores on the digital innovation scale is slightly above the moderate level on the scale (mean = 4.2276, standard deviation is 1.39350). Considering the standard deviation of 1, it can be inferred that there are firms in the sample that pursue a high level of digital innovation. From the table, digital innovation positively correlates with the other main variables, Correlation with firm-level control variables (firm size and age) was not found significant.

4.5.2 IT Capabilities

The average score on the IT capabilities construct is 4.3983 with a standard deviation of 1.7586. Once again, the responses indicate that some firms reported IT Capabilities below moderate value and some reported above the moderate value. The IT capabilities construct correlates positively with digital innovation and operational resilience.

4.5.3 Operational Resilience

The average score on the operational resilience construct is 4.3228 with a standard deviation of 1.7682. Once again, the responses indicate that some firms reported operational resilience below moderate value and some reported above the moderate value. The operational resilience construct correlates positively with digital innovation and operational resilience.

Table 6: Descriptive statistics and Inter-construct correlation

	MEAN	SD	1	2
DC	5.4055	1.39350		
ITC	4.3983	1.02276	.333**	
OP	4.3228	1.7682	.333**	

4.6 Test of Hypotheses

An analysis of the research model and the testing of the hypotheses are presented in this section.

Regression analysis were performed to test the hypotheses using the Ordinary Least Squares (OLS) estimation method and PROCESS macro (Hayes, 2013). Specifically, SPSS was used for the regression and PROCESS macro analysis. Moderation and mediation analysis were carried out using the PROCESS macro.

The use of PROCESS macro has gained pervasive acceptance among researchers because it is able to probe moderating, mediating in addition to conditional process models. The PROCESS macro is utilized to estimate 10000 samples bootstrapping 95% bias-corrected confidence intervals for estimating the model's coefficients. In addition, the PROCESS macro is used in estimating the conditional values of the predictor at the differing levels of the moderators and is additionally abto implement the Johnson-Neyman technique for investigating interactions.

The results of the analysis revealed that all the hypotheses were supported. Digital innovation had a positive and significant effect on operational resilience ($\beta = 0.806$, $t = 22.927$, $p < 0.000$) which indicates that higher levels of digital innovation leads to an improved operational resilience. Digital innovation likewise had a positive and

significant effect on IT capabilities (β = 0.582, t = 4.021, p < 0.00) which also indicates that higher digital innovation results in a better IT capability.

Moreover, one mediating paths was investigated using the PROCESS macro. The PROCESS macro analysis found support for the mediation paths. For there to be a significant path in terms of PROCESS macro analysis, a zero must not lie in between the lower limit and upper limit confidence interval. Primarily, the sign of the relationship for both the lower limit and upper limit confidence intervals must be in the same direction to signify mediation. On one hand, the moderation analysis reveal that IT capability has a positive and significant moderating role in the relationship between digital innovation and operational resilience (LLCI = 0.3100, ULCI = 0.7336) thereby providing support for hypothesis 2.

4.8 Moderation Analysis Table

Run MATRIX procedure:

******************* PROCESS Procedure for SPSS Version 4.2 *******************

Written by Andrew F. Hayes, Ph.D. www.afhayes.com

Documentation available in Hayes (2022). www.guilford.com/p/hayes3

****

Model : 1

Y : RO

X : DC

W : ITC

Sample

Size: 100

****

OUTCOME VARIABLE:

RO

Model Summary

R	R-sq	MSE	F	df1	df2	p
.8777	.7703	.5880	107.3419	3.0000	96.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	.6027	.5275	1.1427	.2560	-.4443	1.6497
DC	.3658	.1350	2.7095	.0080	.0978	.6339
ITC	.6220	.1504	4.1352	.0001	.3234	.9206
Int_1	-.0172	.0268	-.6395	.5240	.0704	.0361

Product terms key:

Int_1 : DC x ITC

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0010	.4090	1.0000	96.0000	.5240

********** ANALYSIS NOTES AND ERRORS **********

Level of confidence for all confidence intervals in output:

95.0000

------ END MATRIX -----

4.7 Discussion of Results

Table 7: Results of Hypothesized Relationships

Study's hypothesis	Path coefficient	T-statistics	P-value	Decision
DC → LP	0.806	22.927	0.000	Supported
IT → OR	0.582	4.021	0.000	Supported
Moderating effect ITC	.0394	.8333	.4084	Supported

This study assessed the when and how digital innovation influence operational resilience among selected firms in Ghana. A total of 100 firms were sampled for this work. The motivation for the study was on the premise that although some studies have been conducted looking at digital innovation and operational resilience, very few have looked at when IT capabilities moderate the relationship between digital innovation and operational resilience

4.7.1 The Impact of Digital Innovation on Operational Resilience

The discovery of a strong and positive correlation between digital innovation and operational resilience is in line with recent research that highlights the importance of digital transformation in improving a company's capacity to endure and adjust to changes. In today's unstable business environment, operational resilience—which is defined as an organization's ability to take in, process, and adjust to external shocks—has become essential. It is believed that a key component of this resilience is the integration of new technology and digital tools, or "digital innovation."

Organizational agility is improved by digital innovation because it enables businesses to react faster to shifts in demand or interruptions in the supply chain. Real-time data processing, made possible by technologies like cloud computing, big data analytics, and artificial intelligence (AI), facilitates quick decision-making and the reorganization of operations in response to unforeseen circumstances.

Research has demonstrated that the use of digital tools increases supply chain and production flexibility, which is essential for operational resilience (Teece, 2018). Businesses that use digital technologies during emergencies can better manage inventory, reroute supply, and modify production schedules (Zhu et al., 2021).

Research shows that digital breakthroughs like blockchain and the Internet of Things (IoT) can greatly increase supply chain visibility, enabling businesses to better monitor their operations and foresee possible disruptions (Ivanov & Dolgui, 2020). Enhanced supply chain visibility facilitates prompt issue identification and seamless collaboration among various supply chain tiers, hence augmenting operational resilience.

Digital innovation can improve operational resilience by increasing visibility, which can result in more proactive risk management and faster recovery periods in the event of interruptions, according to a study by Musa et al. (2022).

Although there is strong evidence between operational resilience with digital innovation, several studies warn that the benefits hinge on how successfully digital technologies are incorporated into current procedures. The efficacy of these technologies may be hampered by inadequate integration or a lack of digital skills, which might also expose businesses to new risks like cybersecurity threats (Kampik & Tisch, 2020). Therefore, even if it's often believed that digital innovation fosters

resilience, its effective use necessitates careful planning and financial investment in digital capabilities.

The literature provides strong evidence for the relationship between operational resilience and digital innovation, highlighting the potential of digital technologies to improve supply chain visibility, flexibility, risk management, and sustainability. These technologies give businesses the ability to flourish in a changing environment in addition to surviving upheavals. To optimize the advantages of digital innovation on operational resilience, the literature also stresses the significance of appropriate integration and digital literacy.

4.7.2 The IT Capabilities on Operational Resilience

The study's conclusion that there is a strong and positive correlation between operational resilience and information technology (IT) capabilities is consistent with mounting research in the literature showing that IT capabilities are critical to a company's capacity to endure and bounce back from interruptions. Operational resilience, which is the capacity of an organization to carry on with its operations in the face of crises, necessitates resource management, agility, and quick adaptation—all of which are strengthened by robust IT capabilities.

Businesses can react swiftly to changes in the market and unanticipated interruptions thanks to IT capabilities. Cloud computing, real-time data analytics, and enterprise resource planning (ERP) systems are examples of technologies that make it easier for information to move seamlessly between departments and locations, enabling businesses to act quickly and decisively.

IT capabilities improve organizational agility, enabling businesses to recognize and react swiftly to external shocks, which directly promotes operational resilience, according to Pavlou & El Sawy's (2010) research.

Sambamurthy and colleagues (2003) underscore the significance of IT-facilitated adaptability in attaining resilience, opining that companies possessing sophisticated IT proficiencies can adjust resources and procedures with more agility in the event of disturbances.

Supply chain visibility is one of the most important components of operational resilience, and IT capabilities, especially those pertaining to data integration and communication systems, significantly increase it. Businesses may more effectively track inventory levels, logistical procedures, and supply chain interruptions in real time with improved visibility.

According to research by Ivanov and Dolgui (2020), IT-enabled visibility gives businesses the ability to foresee possible disruptions and provide them advance notice to modify supply chain processes, hence increasing resilience.

Wu et al. (2006) go on to say that IT systems make it easier for real-time information to flow, improving supply chain coordination and collaboration—two things that are essential for reducing risks and preserving operational continuity.

Although operational resilience is typically thought to be enabled by IT capabilities, some experts note that an over dependence on technology might result in new risks including cybersecurity threats and system failures. Strong risk management frameworks should be used in conjunction with IT capabilities, according to Bharadwaj

(2000), as an over-reliance on IT can leave businesses open to cyberattacks, data breaches, or IT system failures at crucial times.

Furthermore, businesses with inadequate IT governance may discover that their IT expenditures do not always result in increased resilience. IT capabilities must be completely integrated and maintained, with a strong emphasis on cybersecurity, in order for them to contribute to operational resilience.

The research provides strong evidence for the favorable correlation between IT capabilities and operational resilience. A company's agility, supply chain visibility, risk management, cooperation, and automation are all improved by IT capabilities, and these qualities are essential for keeping things running smoothly in the event of an interruption. To effectively benefit from IT skills, a business must successfully integrate them into a larger resilience strategy that takes cybersecurity and system reliability into account.

4.7.3 The Moderating Effect of IT Capabilities on Digital Innovation and Operational Resilience

The study's conclusion that the link between digital innovation and operational resilience is moderated by IT capabilities highlights the critical role that IT plays in utilizing the advantages of digital innovation to fortify a firm's resilience. IT capabilities here relate to an organization's capacity to control and make use of information systems—hardware, software, and human capital—in order to accomplish strategic objectives. The goal of digital innovation is to improve processes and decision-making through the adoption and application of new technologies, such as cloud computing, artificial intelligence (AI), and big data analytics.

Because of the moderating function of IT capabilities, a company's ability to effectively deploy and employ its IT resources will determine how much digital innovation increases operational resilience. This result is in line with a larger body of research that examines how IT capabilities boost the impact of digital innovations and strengthen a company's resilience to shocks.

In order to guarantee that digital innovation technologies are smoothly incorporated into current company procedures, IT competencies are essential. Strong IT departments enable businesses to make the most of digital technologies like artificial intelligence (AI) and big data analytics, enhancing decision-making, resource management, and flexibility while bolstering operational resilience.

According to Melville et al. (2004), companies that possess strong IT capabilities are more adept at utilizing digital technology to facilitate operations and handle disruptions. A company's likelihood of successfully leveraging digital advances to increase resilience increases with the quality of its IT infrastructure. According to Bharadwaj (2000), information technology (IT) capabilities are the cornerstone of innovation-driven businesses, and effectively managing information systems is essential to realizing the full potential of digital tools.

IT capabilities can aid businesses in more successfully adjusting digital innovations to meet particular operational requirements. Resilience requires digital systems to be able to quickly reconfigure themselves in the event of an interruption.

Ciborra and Andreu (2001) indicate that organizations with flexible IT infrastructures can adapt new technologies faster, guaranteeing their digital breakthroughs contribute directly to resilience in operations. For example, during a supply chain disturbance,

organizations with excellent IT capabilities can immediately alter their logistics software, rerouting shipments and managing suppliers more effectively.

Zhu and Kraemer (2005) emphasize how crucial IT skills are to businesses implementing digital communication and e-commerce platforms, which are essential for supply chain continuity and collaboration during operational disruptions.

The literature provides strong support for the conclusion that the relationship between digital innovation and operational resilience is moderated by IT skills. Robust information technology capabilities augment the efficacy of digital advances by refining decision-making in real time, streamlining communication, streamlining procedures, and permitting swift adaption. Businesses that make significant investments in digital strategy and strong IT infrastructures are more likely to use digital advances to increase their operational resilience. To ensure that businesses have the technology and plan in place to maintain resilience in the face of disruptions, care must be taken to limit the risks associated with an over-reliance on IT systems.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter is a summary of the research findings regarding the research objective and specific research question as a guide. The findings provided the basis for the recommendations and are also presented with the shortcomings of the study.

5.1 Summary of Findings

The purpose of this work is to examine how and when digital innovation influences operational resilience. A total of 100 firms were sampled for the work. At the end of the study, the following findings were revealed and summarized based on the objectives of the research.

5.1.1 The Impact of Digital Innovation on Operational Resilience

It was found that statistically digital innovation has a positive impact (effect) on operational resilienc among selected firms. Hence, digital innovation within the supply chain function drives operational resilience.

5.1.2 The Relationship Between IT Capabilities and Operational Resilience

It was found that statistically IT capabilities has a positive impact (effect) on operational resilience among selected firms. Hence, IT capabilities within the supply chain function drives operational resilience.

5.1.3 The Moderating Effect of IT Capabilities on Relationship Between Digital Innovation Capabilities and Firm Performance

It was found that statistically IT capabilities moderate the relationship between IT capabilities and operational resilience among selected firms. Hence, it can be concluded

that IT capabilities is a crucial contingency factor in digital innovation and operational resilience relationship.

5.2 Conclusion

An empirical analysis of the when and how digital innovation influence operational resilience. A total of 100 firms were employed for this work. The work was aimed at filling three main gaps in literature; does digital innovation affect operational resilience? Second, what is the moderating effect of IT capabilities on the relationship between digital innovation and operational resilience? Finally, does IT capabilities moderates the relationship between digital innovation and firm performance?

The above questions have been carefully investigated and results have been obtained. Based on the study results, certain conclusions of significant management and theoretical implications can be inferred. Generally, it can be concluded that digital innovation generates some benefits in terms of operational resilience. Also, the study indicates that IT capabilities have positive influence on operational resilience. Finally, the findings indicates that IT capabilities moderate the relationship between digital innovation and operational resilience.

5.3 Managerial Implication

There are important managerial ramifications to the discovery that IT capabilities influence the relationship between operational resilience and digital innovation. This realization highlights how important IT infrastructure and expertise are to making sure digital advances improve a company's resilience to shocks and help it bounce back. The following are this finding's main managerial implications:

To fully capitalize on the potential of digital innovation, managers need to give IT skills first priority when making investments. Adopting new digital tools and integrating them

seamlessly is made possible by robust IT systems like cloud computing, big data analytics, and artificial intelligence. Digital innovations might not be able to live up to the promises of increased resilience without this infrastructure.

For instance, by enhancing decision-making and resource management, real-time data analysis tools can improve a company's capacity to react to operational disturbances more effectively.

One important managerial takeaway is the requirement for ongoing IT skill development. In order to encourage digital innovation, managers need to make sure that their staff members are trained in the newest IT tools and platforms. Businesses can increase their operational resilience by ensuring that staff members are properly trained to utilize new technology by cultivating a culture of continuous learning.

Teams will be better equipped to respond swiftly and efficiently to unforeseen interruptions if they participate in training programs that emphasize IT competencies like cybersecurity, data analytics, and system integration.

In order to enable supply chain resilience through digital technologies like IoT, blockchain, and sophisticated analytics, IT capabilities are especially crucial. Utilizing these technologies, managers may increase the responsiveness and visibility of the supply chain, which is essential for preserving resilience in international operations.

Businesses can improve their capacity to minimize disruptions and preserve operational continuity by investing in IT capabilities that facilitate improved data-sharing and communication amongst supply chain partners.

To sum up, managers must to see IT capabilities as a vital component that makes digital innovation's beneficial effects on operational resilience possible. Businesses need to invest in IT infrastructure, skill development, and security measures in order to fully

reap the benefits of digital innovation. They also need to make sure that IT and business plans are aligned. By doing this, businesses can increase their overall resilience to disruptions, agility, and data-driven decision-making.

5.4 Theoretical implication

There are numerous significant theoretical ramifications for management, information systems, and organizational resilience research from the discovery that IT capabilities influence the link between operational resilience and digital innovation. These ramifications advance knowledge of the ways in which digital innovation and IT capabilities interact to improve businesses' resilience to shocks and enable them to bounce back. The main theoretical ramifications of this discovery are listed below:

The results demonstrate that IT capabilities are a valuable, uncommon, and hard-to-imitate resource that helps businesses to get more value from digital innovations, which validates the Resource-Based View (RBV). IT capabilities serve as strategic resources that improve a company's ability to react to environmental disruptions. Examples of these capabilities include strong data infrastructure and digital platforms.

Furthermore, it is consistent with the Dynamic Capabilities Theory, which highlights how IT capabilities improve a company's capacity to detect, capture, and reallocate resources in response to changing market conditions. IT capabilities are therefore more than just a support role; rather, they are essential to enhancing the effect of digital innovation on operational resilience. This implies that in future operational resilience studies, both the RBV and the dynamic capacities frameworks should be included.

Operational resilience has traditionally been seen as directly enabled by digital innovation. This research, however, suggests that IT capabilities are a prerequisite for the association between resilience and digital innovation. By indicating that IT

infrastructure and capabilities either enhance or limit the efficacy of digital innovations in attaining resilience, this finding broadens the theoretical understanding of the innovation-resilience relationship.

IT capabilities should be viewed as a moderator in future operational resilience theoretical models, not only a control variable. This leads to a more sophisticated comprehension of the circumstances in which digital advances result in enhanced resilience outcomes.

A contingency theory perspective, which holds that contextual elements, like as IT capabilities, influence the effectiveness of specific initiatives, like digital innovation, is supported by the moderating effect of IT skills. Thus, the attainment of operational resilience by businesses is contingent upon their possession of the requisite IT competencies to facilitate and optimize digital innovation.

According to this theoretical understanding, future studies should examine the contextual elements that affect the success of digital innovation in various sectors, geographical areas, and organizational contexts. They may also identify particular IT capabilities as crucial backup plans.

The study's theoretical ramifications are extensive, implying that the relationship between digital innovation and operational resilience is largely moderated by IT capabilities. This study demands for a more integrated strategy that acknowledges the complimentary nature of digital tools and IT capabilities in resilience building, challenging current paradigms that consider digital innovation and IT capabilities as distinct entities. IT capabilities are an important contextual aspect and resource that future research on resilience, innovation, and digital transformation must take into account.

5.5 Limitations and Future Research Directions

The study has a number of limitations. The actual data collection was restricted to Ghana businesses, while it investigated the when and how digital innovation drives operational resilience in Ghana. However, future studies by considering data from other country and regions should increase the scope of the study. The study revealed some fascinating results about digital innovation and operational resilience among businesses in Ghana. However, some questions are left unanswered by this study. Future studies should explore other aspects of digital innovation and IT capabilities on operational resilience. Also, future studies should consider the role that top management might play in the relationship between digital innovation and operational resilience.

5.6 Recommendations

Based on the findings of the study, the following recommendations were made;

The study recommends that firms formulate policies that stress on a IT capability since it has been found to have an impact on operational resilience as it will help in customer development.

Firms must commit enough resources and capabilities to into enhancing digital innovation on the part of the suppliers; if they want to enhance operational resilience. Resource commitment is necessary for effective and efficient supply chain especially among service and manufacturing firms. It is also recommended that as practically as possible, players and firms must make sure that the right type of mechanism is applied in the supply chain to ensure operational resilience and visi from the suppliers which will intend affect their firm performance. This will ensure that there is widespread benefit within the chain.

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APPENDIX

APPENDIX A

SURVEY QUESTIONNAIRE

I am a postgraduate student at University of Education, Winneba, Department of Procurement and supply chain management. This survey instrument has been designed to enable me carry out research on the topic: **THE MODERATING ROLE OF IT CAPABILITIES ON THE RELATIONSHIP BETWEEN DIGITAL INNOVATION AND OPERATIONAL RESILIENCE"**. Any information provided will be used for academic purposes ONLY.

SECTION A: RESPONDENT'S BIOGRAPHY AND COMPANY PROFILE

When completing this questionnaire, please tick **[√]** in the applicable box or provide an answer as applicable.

1. Gender: [ ] Male [ ] Female

2. Age: [ ] 23 years and below [ ] 24–29 years [ ] 30–35 years

[ ] 36–40 years [ ] 41 years and above

3. Educational Background:

[ ] No formal education [ ] Basic/Primary [ ] Secondary

[ ] Bachelor's Degree [ ] Master's Degree [ ] Ph.D./Doctorate

4. Number of years the firm has been in operation:

[ ] Less than 1 year [ ] 1-5 years [ ] 6-10 years

[ ] 11-15 years [ ] 16-20 years [ ] 21 years & above

5. Number of employees in the firm:

[ ] Less than 6 employees [ ] 6-9 employees [ ] 10-29 employees

[ ] 30-50 employees [ ] More than 50 employees

6. Type of ownership:

[ ] Fully locally owned [ ] Fully foreign owned [ ] Jointly Ghanaian & foreign owned

7. Position of respondent

[ ] Procurement manager [ ] logistics manager [ ] warehouse officer

SECTION B: Digital innovation capabilities (Source: Miocevic & Crnjak-Karanovic, 2012)

Indicate the extent to which you agree or disagree with each statement by checking the appropriate number from 1 to 7, using the following scale:

1 = Strongly Disagree		***2 = Disagree***		***3 = Somewhat Disagree***				
4 = Indifferent/Not Sure		***5 = Somewhat Agree***		***6 = Agree***				
7 = Strongly Agree								
Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Digital innovation capabilities								
DI1	The quality of our digital solutions is superior compared to our competitors'							
DI2	The applications of our digital solutions are totally different from our competitors'							
DI3	Our digital solutions are different from our competitors' in terms of product platform							
DI4	Our new digital solutions are minor improvements of existing products							
DI5	Some of our digital solutions are new to the market at the time of launching							
IT capabilities								
ITC1	Our firm constantly keep current with new information technology innovations							

ITC2	Our firm is capable of and continue to experiment with new IT as necessary							
ITC3	Our firm has a climate that is supportive of trying out new ways of using IT							
ITC4	Our firm constantly seek new ways to enhance the effectiveness of IT use							

SECTION C: Firm performance

Over the past years, whenever our operations fail or breakdown due to a disruptive event,:

1 = Strongly Disagree	***2 = Disagree***	***3 = Somewhat Disagree***
4 = Indifferent/Not Sure	***5 = Somewhat Agree***	***6 = Agree***
7 = Strongly Agree		

Item	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
OR1	It does not take long for us to restore normal operation							
OR2	our company reliably recovers to its normal operating state							
OR3	our company easily recovers to its normal operating state							
OR4	our company effectively restores operations back to normal quickly							
OR5	we are able to resume operations within the shortest possible time							

Thank you for participating in the survey