TECHNOLOGICAL INNOVATION, ENTREPRENEURIAL ORIENTATION, AND PERFORMANCE OF MICRO, SMALL, AND MEDIUM ENTERPRISES IN GHANA

BY

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Thesis submitted in fulfilment of the requirements for the award of the degree of Master of Management by Research

The Graduate School of Business Administration

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ABSTRACT

Technological innovation and entrepreneurial orientation are noted to be key ingredients for business success. Given that advanced economies enjoy the benefits of technological innovation and entrepreneurial orientation, emerging economies are rolling out programmes and projects to facilitate technological innovation and entrepreneurial orientation. However, empirical studies that bring forth the benefits of technological innovation and entrepreneurial orientation is scanty. With partial least square structural equation modelling, we explore the relationship between technological innovation, entrepreneurial orientation, and performance of MSMEs in Ghana. Specifically, the research examined the effect of technological innovation on entrepreneurial orientation in MSMEs in Ghana, assessed the effect of technological innovation on the performance of MSMEs in Ghana and analysed the combined effect of technological innovation and entrepreneurial orientation on the performance of MSMEs. Primary data was collected from using closed-ended structured questionnaire between the period of 31 March 2022 to 1 June 2022 and analysed with the Structural Equation Modelling based on Partial Least Squares. The analysis and discussion of the study utilized the Schumpeterian theory of innovation and the resource-based theory. The findings of this study confirm the positive and substantial influence of technological innovation and entrepreneurial orientation on performance, aligning with the foundational principles of resource-based theory, which highlights the pivotal role of resources in gaining competitive advantage. It is advised that managers of MSMEs instill organizational practices steeped in technological innovation and entrepreneurial orientation and anchored in knowledge. Additionally, these managers should foster an environment where innovative ideas and solutions from their employees are not only welcomed but encouraged. The study also underscores the significance of the policy recommendations derived from these results.

Keywords: Entrepreneurial orientation; Firm performance; Ghana; MSMEs; Structural equation modelling; Technological innovation

JEL Classifications:

O12 – Microeconomic Analyses of Economic Development

O14 – Industrialization; Manufacturing and Service Industries; Choice of Technology

O31 – Innovation and Invention: Processes and Incentives

O33 – Technological Change: Choices and Consequences; Diffusion Processes

L26 – Entrepreneurship

M21 – Business Economics

L25 – Firm Performance: Size, Diversification, and Scope

DECLARATION

I, **Rose Akosua Abebrese**, hereby declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted to fulfil the requirements for the award of Master of Management by Research at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

ROSE AKOSUA ABEBRESE

Signed at: **Wits Business School, Johannesburg, South Africa.**

On the ....

DEDICATION

To my children – Nana Osei, Owura Addae, Maame Pokuaa, and Nana Nyarko

ACKNOWLEDGEMENTS

I would like to express my deep appreciation and gratitude to all those who have contributed to the successful completion of my Master of Management by Research at the Wits Business School, University of the Witwatersrand, Johannesburg. This journey has been a transformative experience, and I am thankful for the guidance, support, and encouragement I have received from a host of wonderful individuals.

First and foremost, my sincere thanks go to my supervisor, Professor Thomas Anning Dorson. Your mentorship, dedication, and unwavering support were invaluable throughout this research journey. Your insights and expertise have significantly enriched my work, and I am truly grateful for the privilege of being under your guidance.

I would also like to extend my appreciation to the esteemed members of the defense panel: Professor Anokye Mohammed Adam (University of Cape Coast), Dr. Emmanuel Quaye (Wits Business School), Dr. Jacques Totowa (Wits Business School), Dr. Erasmus Appiah (Wits Business School), and Dr. Peterson Owusu Junior (University of Cape Coast). Your thoughtful feedback and challenging questions played a pivotal role in shaping my research and enhancing its quality. To the examiners of this thesis, I say a big thank you. Your commitment to upholding academic standards is commendable and pivotal to the success of this endeavor. I am genuinely grateful for the opportunity to benefit from your extensive knowledge and experience.

My heartfelt thanks also go to Mmabatho Leeuw and the administrators at WBS, whose support ensured that the administrative aspects of my research progressed smoothly. To the dedicated staff at the faculty office, including Owen Naicker, Jennifer Mgolodela, and Veli Mongwe, your assistance was greatly appreciated, and it made the logistical aspects of my academic journey seamless. I would like to express my deepest gratitude to my family, friends, and all those whose unwavering support, patience, and encouragement sustained me throughout this academic endeavor. I am truly thankful for their support and guidance on this academic journey.

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ACRONYMS & ABBREVIATIONS

ABBREVIATION	MEANING
AG	Aggressiveness
AU	Autonomy
EO	Entrepreneurial Orientation
GLS	Generalized Least Square
GEA	Ghana Enterprises Agency
GSS	Ghana Statistical Service
MMDAs	Metropolitan, Municipal, and District Assemblies
MSMEs	Micro, Small, and Medium Size Enterprises
NBSSI	National Board for Small Scale Industries
OECD	Organisation for Economic Cooperation and Development
PC	Process Innovation
PD	Product Innovation
PR	Proactiveness
R&D	Research and Development
RS	Risk-taking behaviour
PLS	Partial Least Square
SMEs	Small and Medium Size Enterprises
SEM	Structural Equation Model

CHAPTER ONE

INTRODUCTION

1.0 Background and context

The important role played by micro, small, and medium enterprises (MSMEs) in job or employment creation, capacity building, productivity, income generation, and economic growth in developing countries like Ghana has been widely recognized by notable bodies such as the European Union, African Union, United Nations, World Bank, and World Trade Organization. In Ghana specifically, MSMEs account for a significant portion of registered businesses, employment, and gross domestic product (GDP) or national output. Data on Ghana indicate that MSMEs account for about 92 percent of registered businesses, 80 percent of employment (Ghana Statistical Service, 2018), and 70 percent of gross domestic product or national economic output (Ministry of Trade and Industry, 2019; Avevor, 2016; Abor & Quartey, 2010). Also, the Ghana Living Standards Survey Round 7 (GLSS 7) reported that MSMEs were responsible for reducing the national poverty rate from 23.4 percent in 2012/2013 to 21.4 percent in 2016/2017 (Ghana Statistical Service, 2018). In addition to these contributions, MSMEs are relevant for diversification, innovation, entrepreneurship, and regional development, warranting the recognition and support for the growth and sustenance of MSMEs a crucial imperative to foster inclusive and sustainable economic development in Ghana.

The concept of technological innovation has become widely recognized as a very significant tool in globalization and competitiveness (Moughari & Daim, 2023). This refers to the process of introducing, adopting, or developing new or improved technologies, processes, or systems within an organization. It involves the application of scientific knowledge, technological advancements, and creative problem-solving to enhance products, services, operations, or business models. Technological innovation can encompass a range of activities, such as implementing new machinery, adopting digital tools and platforms, improving production processes, or developing innovative products (Haddoud et al., 2023). According to Subrahmanya et al. (2010), technological capacity or capability is very crucial for MSMEs. The dearth of research on the question of whether technological innovation drives entrepreneurial orientation and firm performance justifies the imperative to undertake further empirical.

The performance of firms relates to how technological infrastructure is channelled to the various aspects of the firm to capture competitive advantage. Technological innovation serves as an imperative tool to enhance the growth and development of economies (Becheikh et al., 2006). According to Subrahmanya et al. (2010), technological capacity or capability is very crucial for micro, small and medium size enterprises (MSMEs). More importantly, the dearth of research on the question of whether technological innovation drives entrepreneurial orientation, justifies the imperative to undertake further empirical research.

There are arguments that the concepts of entrepreneurship and innovation are separate constructs. Whereas some studies claim that an entrepreneur is not essentially an innovator (Brannback et al., 2008), others such as Drucker (2006) argue that entrepreneurship and innovation move together. According to Mueller (2007), the more innovative an entrepreneurial process is, the farther and the better its impact on growth. This strand of research on technological innovation-based entrepreneurship, commonly coined as technopreneuship or entreprenology, has become very attractive due to the potential to impact MSMEs in developing economies. If technological innovation is a key driver for sustainable competitive advantage, then there is a need to advance investigations into the channels through which it brings about value creation for entrepreneurial orientation and business entities (Dadfar et al., 2013).

Technological innovation plays a pivotal role in shaping the performance of MSMEs (Martínez-Peláez et al., 2023; Wang & Ahmed, 2007) and this occurs through various channels. The Organisation Economic Cooperation and Development (OECD) finds the adoption of new technologies as one of the primary channels. According to them, MSMEs that embrace technological advancements can significantly improve their performance by leveraging advanced tools, systems, or processes (OECD, 2020; Wang & Ahmed, 2007). By integrating new technologies into their operations, these enterprises can enhance their operational efficiency, streamline processes, and optimize resource utilization. This, in turn, contributes to improved productivity, reduced costs, and increased competitiveness. Moreover, technological innovation enables MSMEs to develop and offer enhanced or novel products and services (Damanpour & Schneider, 2006). Through continuous improvements and innovations, these enterprises can satisfy evolving customer needs, boost customer satisfaction, expand their customer base, and ultimately drive higher sales and profits (Chesbrough & Rosenbloom, 2002; Davenport, 1993; Porter & Millar, 1985). Furthermore, the implementation of technological innovation can optimize internal processes, such as production, inventory management, supply chain, or customer relationship management. By streamlining and automating these processes, MSMEs can achieve cost savings, minimize errors, reduce lead times, and enhance overall operational performance (Radicic & Petković, 2023; OECD, 2020; Damanpour & Schneider, 2006; Teece, 1986).

The overarching subject of this discourse has been the quest to establish the association between technological innovation activities and entrepreneurial orientation and how they combine to boost the performance of MSMEs in Ghana. A study by Wolf (2006) emphasized the significance of innovation in the development of an economy and concluded that an increase in the productivity of SMEs is connected to their dexterities and capabilities to innovate and the adoption of new technologies and application of innovative processes to local conditions. Entrepreneurial orientation, characterized by an entrepreneurial mindset and behaviours, also serves as a significant channel through which the performance of MSMEs is influenced (Iqbal et al., 2023; Goyal & Mishra, 2023). A key channel within entrepreneurial orientation involves the identification and pursuit of entrepreneurial opportunities (Cunningham et al., 2023). MSMEs that exhibit a strong entrepreneurial orientation are adept at recognizing untapped markets, emerging trends, or unmet customer needs. By identifying these opportunities, these enterprises can develop and offer products or services that cater specifically to these demands, gaining a competitive edge and driving performance (Cunningham et al., 2023; Kusa et al., 2021).

Moreover, entrepreneurial orientation encourages risk-taking and innovation, which are vital drivers of firm performance (Covin & Lumpkin, 2011). Entrepreneurs willing to take relevant risks and introduce innovative ideas or practices are more likely to differentiate their offerings, seize competitive advantages, and generate positive business outcomes (Stagni et al., 2021; Covin & & Wales, 2018). Furthermore, entrepreneurial orientation promotes a market-oriented approach, emphasizing the understanding of customer needs, preferences, and market dynamics. MSMEs that embrace this orientation prioritize customer satisfaction, tailor their offerings to meet customer demands, and exhibit a high level of customer responsiveness. By doing so, these enterprises can enhance customer loyalty, gain market share, and achieve sustainable performance (Zhang & Xing, 2023; Edwards et al., 2014; Lumpkin & Dess, 1996).

The role of entrepreneurial orientation in opportunity recognition, risk-taking, innovativeness, collaboration, market orientation, and customer focus links it to technological innovation (Stagni et al., 2021; Covin & Wales, 2018). Entrepreneurs with these orientations are more likely to engage in technological innovation, embrace advancements, and leverage them to develop innovative solutions that drive business success and competitive advantage (Zhang & Xing, 2023; Edwards et al., 2014). Entrepreneurial orientation emphasizes the identification and pursuit of entrepreneurial opportunities. Technological innovation provides a fertile ground for identifying and capitalizing on opportunities arising from advancements in technology, changing market needs, or emerging trends (Radicic & Petković, 2023). Entrepreneurs with an orientation toward opportunity recognition are more likely to actively seek out technological advancements and leverage them to develop innovative products, services, or business models (Covin & Miller, 2014). Entrepreneurs with an entrepreneurial orientation possess a mindset of innovativeness and resourcefulness. They are inclined to think creatively, challenge the status quo, and find novel solutions to problems. This mindset aligns with the process of technological innovation, as it requires the ability to generate new ideas, connect existing technologies in unique ways, or develop entirely new technological solutions (Upadhyay et al., 2023; Covin & Wales, 2018; Covin & Miller, 2014).

The arguments supporting the role of technological innovation and entrepreneurial orientation in influencing the performance of MSMEs can be derived from both theoretical perspectives and reasonable intuition. The resource-based theory suggests that a firm's resources and capabilities, including technological assets and entrepreneurial orientation, can lead to competitive advantage and improved performance (Peppard & Rylander, 2001; Gali et al., 2023; Kindermann et al., 2023). Technological innovation represents a valuable resource that can provide MSMEs with the ability to develop new products, improve processes, or access new markets. Similarly, entrepreneurial orientation, characterized by risk-taking, proactiveness, and innovativeness, enhances the firm's ability to identify and exploit opportunities, adapt to changes, and drive performance (Covin & Miller, 2014). Therefore, it is logical to expect that technological innovation and entrepreneurial orientation can positively improve the performance of MSMEs (Gali et al., 2023; Kindermann et al., 2023).

Also, the theory of innovation by Schumpeter supports the claim that technological innovation and entrepreneurial orientation can influence the performance of MSMEs. The theory highlights the role of innovation, entrepreneurship, and the dynamic nature of competition in driving economic growth, industry transformation, and firm success (Ince et al., 2023; Kraus et al., 2023). By embracing technological innovation and fostering an entrepreneurial orientation, MSMEs can position themselves to adapt to changing market conditions, seize opportunities, and achieve sustained performance in the face of evolving competitive landscapes (Ince et al., 2023; Kraus et al., 2023).

According to the Ghana Enterprises Agency (GEA), formerly the National Board for Small Scale Industries (NBSSI), the MSMEs sector remains underdeveloped, and it is largely constrained by factors such as inadequate access to appropriate technology, limited access to international markets, weak institutional capacity, lack of management skills and training, and most importantly access to finance (GEA, 2021). The lack of innovative technology accounts for the limited performance of MSMEs in Ghana. For instance, Oduro (2020) researched the barriers to the adoption of open innovation practices by SMEs in Ghana. The study suggested that the lack of access to open innovation for MSMEs in Ghana has resulted in a scarcity of diverse resources and stifled competencies. These in turn limit their survival and growth potential. As argued by Al-Mubaraki and Aruna (2013), failure to adopt technological innovations has made it challenging for SMEs to survive tight competition and crisis. On the other hand, Oduro and Nyarku (2018) claim that incremental innovation practices have largely improved the performance of SMEs in Ghana as reflected in increased customer satisfaction, sales growth, competitive advantage, and international market access.

Therefore, more research must be conducted on MSMEs in developing countries so that their inferences and recommendations can be tailored to suit the peculiarities of these economies. Some of the features of developing countries that have adversely affected technological innovation by MSMEs include, but are not limited to, educational levels, lack of collateral, and a lack of capacities on the part of owners. One challenge with enterprise development in most African countries, for instance Ghana, is the lack of education among its people. The educational attainment in most African countries has a grim outlook. Quartey (2003) finds that the level of education is among the factors that influence the growth of SMEs in Ghana. The author recommends the provision of adequate training centres to equip entrepreneurs to ensure the sustained growth of SMEs.

Again, there is a lack of collateral on the part of MSMEs which limits their ability to access credit facilities to embark on technologically innovative development (Tetteh & Essegbey, 2014). Nonetheless, the educational level may mitigate this situation. Salifu et al., (2018) reveal that a higher educational background of the operators is associated with significantly better repayment performance. They further note that, in comparison with those with only primary-level education, tertiary education level SME owners perform best in repayment performance followed by those with secondary education in Ghana. The continued record of successful repayment generally improves access to loans. Another challenge with innovation in MSMEs in most African countries such as Ghana is the lack of capacity building. This serves as a hindrance for entrepreneurs in MSMEs to adopt and embrace innovative technologies to better their productivity (Hausman, 2005). These challenges have featured in the slow rate of adoption and sustainable application of technological innovations by entrepreneurs and managers of MSMEs in Ghana.

The government has recognized the importance of supporting MSMEs through technology and entrepreneurship promotion initiatives. For instance, the National Entrepreneurship and Innovation Plan (NEIP) launched in 2017 aims to provide training, mentorship, and funding opportunities to enhance entrepreneurial skills and support innovative ventures. Additionally, the government has implemented programs like the Digital Transformation Agenda and the National MSME Development Policy to promote the adoption of digital technologies and create an enabling environment for the growth and innovation of MSMEs. In light of the recent developments in technology adoption, the entrepreneurial landscape, and initiatives of governments, this study aims to contribute to the existing body of knowledge by examining the effect of technological innovation and entrepreneurial orientation on the performance of MSMEs in Ghana. This research will provide fresh insights into the dynamics of technological innovation and entrepreneurial orientation in the Ghanaian MSME sector. The findings will offer practical implications for policymakers, business support organizations, and MSME owners and managers, enabling them to develop targeted interventions and strategies that foster innovation, competitiveness, and sustainable growth.

1.1 Problem statement

The important role that MSMEs play when it comes to the creation of jobs and employment, and in terms of capacity building, productivity, and income generation as well as contribution to the growth of the economy cannot be belittled in developing countries such as Ghana (Susanto et al., 2023). Page and Söderbom (2015) indicate that notable bodies such as the EuropUnion, Africa Union, United Nations, World Bank, World Trade Organization, and the like have given attention to MSMEs and their potential contributions in recent times.

It is not surprising that many governments have made attempts to support MSMEs with diverse initiatives and policies. Nevertheless, the adoption of innovative technology by MSMEs in Ghana has been limited, bringing about its attendant problems (MacGregor & Vrazalic, 2005). Initiatives by governments have been directed at enhancing the capacity of MSMEs to take advantage of the latest innovative technologies (Oduro, 2020). Despite the recognition and support from governments through diverse initiatives and policies, MSMEs in Ghana face challenges that hinder their survival and growth. Limited access to credit or finance, inadequate access to equipment and technology, and insufficient entrepreneurial and managerial skills are among the constraints faced by MSMEs in Ghana. These challenges impede their ability to adopt innovative technologies and hinder their overall performance.

However, a greater number of these enterprises in the MSMEs landscape find it difficult to survive the subsequent years after their inception (Bhorat et al., 2018). While MSMEs are recognized for their significant contributions to job creation, capacity building, and income generation, many of these enterprises face difficulties in sustaining their performance over time. This is due to some obvious factors, which includes the slow or non-adoption of technology-based innovation (Chichoni, 2011). There is a consensus in the literature that, for MSMEs to survive and have sustained growth, they must employ varying intensities of technology and technological innovations according to their abilities (Hadjimanolis, 1999; Iddris & Ibrahim, 2015).

According to the Ministry of Trade and Industry (2019), Ghana shares the challenges and constraints of MSMEs development as many developing countries. The challenges include limited access to credit or finance, limited access to equipment and technology, and inadequate entrepreneurial and managerial skills. These challenges hinder their ability to compete effectively, innovate, and adapt to changing market conditions, ultimately affecting their profitability and long-term sustainability. The government appreciates the fact that innovation is very limited in Ghanaian businesses and finds it imperative to promote entrepreneurship and innovation as enabling conditions for its long-term development agenda (Government of Ghana, 2017). The government has established a National Entrepreneurship and Innovation Programme (NEIP) as an initiative to push the entrepreneurship and innovation agenda by offering development services to start-ups and access to finance.

Despite the growing opportunities in technology, the industry has a long way to go, and innovation among start-ups and entrepreneurs in Ghana seems to be occurring incrementally more so than radically. Robson et al., (2009) confirmed the incidence of incremental innovation as far greater than that of novel innovation in Ghana. Some empirical studies on SMEs in developing countries suggest a positive correlation between the non-adoption of innovation and their poor performance (Abugre, 2014). But the specific dimensions of innovation were not explored in those studies. This is also seen in Essegbey and Frempong (2011), which seek to establish the relationship between technological innovation and the performance of SMEs in Ghana through mobile telephony operations. Unfortunately, this study failed to give direct attention to the various dimensions of technological innovation (product innovation and process innovation) and how each of them influences the performance of SMEs and the management challenges that come with these innovations.

A review of extant literature shows that technological innovation and firm performance have a positive correlation, especially for larger firms. However, there is a dearth of such studies on technological innovation, entrepreneurship, and the development of SMEs in developing countries such as Ghana (Essegbey & Frempong, 2011). Studies on the relationship between technological innovation and entrepreneurship and how they contribute to the development of MSMEs in developing countries have mostly concentrated on just a single measure of performance. The measure has usually been financial performance which is measured by sales or return on assets. There is scanty literature on how technological innovation affects product quality, which invariably may lead to profitability and hence firm performance. A deeper dive into the extant literature has also revealed that there are limited studies on the subject especially in Africa as a whole. This has left several gaps in the existing body of knowledge.

Most of the studies concentrate on the manufacturing sector while little or no mention is made of the services sector. Again, most of the studies are not concentrated on the very small businesses known as micro enterprises in Ghana. Studies on technological innovation and firm performance are skewed towards emerging economies such as China, Japan, and Korea. The literature is scanty on the African continent, especially for Ghana. Most of the extant literature is concentrated on the big industries in advanced or industrialised economies (Ngisau, 2016). It is notably clear that developing countries differ considerably in their economies although some countries have achieved some form of economic development that can be said to be nearer to industrialised countries, the likes of China, South Korea, and Russia. Consequently, Hobday (2005) argues that models, as well as policies from these studies in the innovation space, have been skewed in favour of big firms in the industrialised or newly industrialised economies. Micro and small firms in developing economies in Africa, such as Ghana, have thus experienced limited representation in the incumbent literature.

Another gap in the extant literature is the dearth of the services sector as a focus to assess the relationship that exists between technological innovation, entrepreneurial orientation, and performance of MSMEs in developing countries. Against the backdrop of the gaps and weaknesses identified above, the purpose of this research is to investigate the relationship between technological innovation and entrepreneurial orientation in MSMEs in Ghana as well as how they affect the performance of MSMEs in Ghana individually and synergically or synergistically. This study seeks to fill this knowledge gap by apportioning its questionnaire to the manufacturing as well as the services sector while concentrating on the micro and small entrepreneurs. By concentrating on previously underexplored areas, including the services sector, micro-enterprises, and dimensions of innovation encompassing product quality and process innovations, this study seeks to provide a more holistic view of the MSME landscape in Ghana, shedding light on the unique challenges faced by various sectors and enterprise sizes.

Additionally, the research contributes valuable insights into how technological innovation and entrepreneurial orientation can improve not only financial performance but also product quality and overall firm performance. By addressing these gaps, the study enhances the understanding of the MSME ecosystem in Ghana and offers practical recommendations for policymakers and practitioners to bolster the growth and competitiveness of these enterprises. The study advances the empirical knowledge of entrepreneurial innovation in MSMEs. It is conceived that MSMEs would be guided as to how to institute novel innovative capabilities that may enable them to increase productivity, based on the finding and recommendations of this study. By incorporating these prescriptions, MSMEs will boost their access to markets, respond faster to customer needs and thereby gain a competitive edge.

1.2 Purpose of the study

This study explores the relationship between technological innovation, entrepreneurial orientation, and the performance of MSMEs in Ghana. In other words, the study unpacks the relationship between technological innovation and entrepreneurial orientation and their combined effect on firm performance. The study has the following specific objectives:

1. To examine the bidirectional relationship between technological innovation and entrepreneurial orientation in MSMEs in Ghana.
2. To assess the effect of technological innovation on the performance of MSMEs in Ghana.
3. To investigate the effect of entrepreneurial orientation on the performance of MSMEs in Ghana.
4. To examine the combined effect of technological innovation and entrepreneurial orientation on the performance of MSMEs.

1.3 Research questions

To better understand the relationship between technological innovation, entrepreneurial orientation, and the development of MSMEs, the study has these research questions to answer.

1. Is there a bidirectional relationship between technological innovation and entrepreneurial orientation in MSMEs in Ghana?
2. What is the effect of technological innovation on the performance of MSMEs?
3. What is the effect of entrepreneurial orientation on the performance of MSMEs?
4. What is the combined effect of technological innovation and entrepreneurial orientation on firm performance?

1.4 Hypotheses of the study

The null hypotheses to be tested for the above research questions are the following:

1. There is no significant bidirectional relationship between technological innovation and entrepreneurial orientation in MSMEs in Ghana.
2. Technological innovation does not have a significant effect on the performance of MSMEs in Ghana.
3. Entrepreneurial orientation does not have a significant effect on the performance of MSMEs in Ghana.
4. There is no significant combined effect of technological innovation and entrepreneurial orientation on the performance of MSMEs in Ghana.

1.5 Delimitations of the Study

This research is centred on exploring the bidirectional relationship between technological innovation and entrepreneurial orientation within the context of MSMEs operating in Ghana, with a specific focus on the vibrant city of Accra. The study encompasses a defined scope that includes geographic, temporal, and sectorial aspects.

Geographically, the primary area of investigation is Accra, Ghana's capital city, which serves as a representative microcosm of the broader MSME landscape in the country. By concentrating on Accra, the research aims to provide insights that can resonate with MSMEs across Ghana, recognizing the diverse economic activities within this region.

In terms of the time frame, the study delves into data spanning from March 2022 to June 2022, encapsulating the technological innovation and entrepreneurial orientation initiatives undertaken by MSMEs during this specific period. While this timeframe is bounded, it offers a snapshot of the dynamic interactions between these variables.

Moreover, the research considers MSMEs from various sectors, both within the manufacturing and services domains. This sectorial diversity ensures that the findings encompass a wide spectrum of economic activities, acknowledging the distinct challenges and opportunities that may exist between sectors.

The findings generated from this research, while valuable, may bear a degree of context specificity. They are primarily applicable to Accra and may not be directly transferable to other regions in Ghana or countries with differing economic, cultural, or institutional contexts. There were resource limitations, including time, budget, and access to certain MSMEs, may have influenced the scope and comprehensiveness of data collection.

In conclusion, despite these delimitations, this research aspires to furnish meaningful insights into the interplay between technological innovation, entrepreneurial orientation, and the performance of MSMEs within the delineated scope and time frame.

1.6 Organization of the Study

The dissertation contains five chapters. Chapter One has covered the introduction of the study. It has covered the background to the study, the statement of the research problem, the purpose of the study, and the contributions to be made by the study. Chapter Two presents the literature review. We capture the definitions of the key concepts, the theories underpinning the study, and a review of the empirical studies on the main themes of the study. Chapter Three covers the methodological approach employed in this study. The chapter covers the research design, population, sample size, sampling techniques, estimation processes, and ethical considerations. Chapter Four presents the empirical results and discussions. The last chapter presents the conclusions, general policy recommendations, and areas for further research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

This chapter presents the theoretical and empirical reviews on technological innovation and entrepreneurial orientation and how they combine to contribute to the performance of MSMEs in Ghana. The purpose of this review is to establish the gaps in the extant body of research. This will form the foundation of the research as well as the methodological approach employed in the study.

2.1 Conceptual definitions

In this section, we provide the definitions of relevant concepts and their dimensions or measures.

2.1.1 Definition of innovation

Although there have been a few definitions for innovation in the literature, there has not been a consensus on the exact definition of the term (Amara & Landry, 2005). Frame and White (2002) assert that innovation is anything that is done for the first time that tends to reduce costs and risks as well as anything that leads to the improvement of a product, a service, or an instrument that gives customers greater satisfaction. Innovation is made possible due to technological changes, one's ability to respond to increased risk, or embracing new regulations, while Drucker (1985) described innovation to be the process of providing new and the improvement of capabilities or increased productivity.

Therrien et al. (2011) defined innovation as a complex process related to changes in production functions and processes through which firms seek to acquire and build upon their distinctive technological competence understood as the set of resources a firm possesses and how these are transformed by the firm’s capabilities. Kuratko and Hodgetts (2004) also defined innovation from a different perspective and assert that innovation is when new wealth is created or the alteration and improvement that is applied to already existing resources for the creation of new wealth.

The Organisation for Economic Cooperation and Development (OECD, 2005) defined innovation as any activity that can significantly lead to the improvement of products or services and leads to the improvement in methods in terms of the processes of manufacturing and the marketing aspect of the outputs and the organization of the business in general. According to Thornhill (2006), innovation is defined as the creation of ideas and the development of an invention as well as the introduction of a novel process in terms of the product itself and how the product is made, such as the process and the services of the product on the market.

2.1.2 Classifications of innovation

Avermaete et al., (2003) and OECD (2005) divided the types of innovation into four dimensions, which is product, process, organizational, and marketing innovation. Technological innovation is an elongated concept of innovation which has well-defined concept as the understanding of innovation has a broad meaning to many people, and especially numerous understandings in the academic and business world. Technological innovation is the process where an organization embarks on a journey where the importance of technology as a source of innovation has been identified as a critical success factor for increased market competitiveness (OECD, 2005).

According to OECD (2005), technological innovation reflects business consideration of enhancing business value by working on technological elements of a product or service. There is not one unique technology at the heart of the system in a vast majority of products and services. The success of a product or service is due to the combination, integration, and interaction of different technologies.

Carayannis et al. (2015) explained technological innovation as "a new technology that creates new products, hence new opportunities for the industry". Technological innovation is defined as when there is an improvement in a product or process whose technological characteristics are largely different from what existed before. Technological product innovations are novel products, that is, product innovations or processes in application known as process innovations which are made known to the market. The product or process is classified to be an innovation when some benefits for the enterprise concerned are achieved.

OECD (2005) categorised technological innovation into two broad types: product innovation and process innovation. Product technological innovation is the production and commercialization of novel goods and services to the market or goods with enhanced performance features, while process technological innovation has to do with the implementation or adoption of a new or improved production process. Schumpeter (1939) explain technological innovation from the perspective of bringing together the factors of production which will result in the alteration of inputs to outputs. Schumpeter viewed the technological innovation process as a sequence that is very pivotal to an understanding of the growth of the economy.

Mytelka (2000) views technological innovation as the process by which firms become used to the production process and thus implement the designs of the goods and services which is novel to the market. Technological innovation is a sequential activity that includes the implementation of technology and methods that are new to the business; it also includes the adoption of techniques in production that are new as well as new management tactics or strategies. The sequential activity also has to do with the improvement of the production quality and the development of new products, and new services as well as the exploration of new markets and the realisation of market value.

According to Feifei and Li (2007), technological innovation comprises several activities which include procedures such as the conceptualisation of new ideas, product designing, prototyping, the production of higher volumes of goods, the marketing and commercialisation among others. It is also the process of creation of knowledge, conversion, and application. The importance of technological innovation is the introduction of techniques that are novel in the production of goods and services and a new application to commercialization.

Product innovation

Schumpeter (1930) defines product innovation as the introduction of new goods that consumers are not yet familiar with. According to Schumpeter (1942), product innovation greatly influences businesses today and it is analyzed in conjunction with an extensive array of managerial phenomena. These include the degree of maturity of firms and the ability to innovate continuously, entrepreneurial capacities, organizational culture, and human resource, as well as leadership, collaborations in networks, and the spillovers associated with research and development (Dougherty & Hardy, 1996).

Susman et al. (2006) indicate that product innovation involves the introduction of new functions, enhanced performance, or the addition of new features to existing products. Product innovation may be viewed as a good or service that is perceived to be new. It comprises diverse organizational strategies and incorporates unique inputs, resulting in the creation of novel outputs (Martinez-Ros & Labeaga, 2009).

Product innovation can be understood as the establishment of novel marketing approaches and the improvement of existing products (Radicic & Petković, 2023; Chang et al., 2012). Technological advancements and evolving customer needs are key drivers of product innovation, which, in turn, leads to shorter product life cycles and increased competition (Gunday et al., 2011).

Process innovation

This involves the incorporation of novel ways of production and methods of delivery to existing ways of production and delivery. The new ways of production include a significant alteration in the techniques of production and the usage of the equipment as well as the accompanying software. The implementation of process innovation led to decreased unit cost of production and reduced delivery times. This helps to increase the quality and to deliver new and significantly enhanced products (OECD, 2005).

Marketing innovation

This type of innovation occurs when organizations try to implement new marketing methods that involve significant changes in product design or packaging, product placement, product promotion, or pricing. Marketing innovations are purposely embarked upon to better address customer needs and to open new markets (including the implementation of an important change in the design of a furniture line to give it a new look and widen its appeal). It is the implementation of a new marketing method that involves pertinent alterations in product design or packaging, product placement, product promotion, or pricing (OECD, 2005).

Marketing innovation helps organizations to appreciate the state of the competition in the industry as well as the costs and benefits of their strategies, and the acceptance of their innovation (Yam et al., 2011). Marketing innovations are purposely meant to address customer needs; they also lead to the establishment of new markets, and they also help to position the products of organizations in a better way when it comes to their marketability and with the sole purpose of increasing the sales volume for the business (Gunday et al., 2011).

Organizational innovation

According to the OECD (2005), organizational innovation is exhibited when firms embrace new organizational methods or techniques in their business practices, it is also a situation whereby novel practices are instituted at the workplace and a new working relationship with the external stakeholders is implemented. Organizational innovation, if properly implemented, may have the ability to enhance the performance of organizations by cutting waste in the areas of administration and cost which relates to transactions. It may also improve workplace satisfaction thereby increasing labour productivity. Organizational innovation helps firms to gain access to non-tradable asset. When the structures of the organization and the procedures are altered, it thus leads to the facilitation of enhancement of the products as well as the processes of production (Chang et al., 2012). The organizational innovation types are assessed by the indicators that have been underscored by Yam et al. (2011) and Gunday et al. (2011).

2.1.3 Entrepreneurship and entrepreneurial orientation

The concept of entrepreneurship has many definitions. The basic understanding has been that entrepreneurship involves identifying and implementing opportunities in the surroundings (Radicic & Petković, 2023; Glinka & Gudkova, 2011). They describe entrepreneurship as a process of looking for market opportunities and organising the resources essential to implement such prospects to gain long-term results. This can be distinguished as independent risk-taking capacity to accomplish gains in the market (Radicic & Petković, 2023). According to Miller (1983), an entrepreneurial firm is one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with ‘proactive’ innovations, beating competitors to the punch. Entrepreneurial orientation is defined by Miller (2011) as involving the strategies firms employ to enter competitive markets. An earlier definition by Lumpkin and Dess (1996) included processes, practices, and decision-making activities that lead to new entry in the definition of EO.

Entrepreneurship can be defined as new entry into competitive markets such as business founding, new product introductions, and globalization (Miller, 2011). That is, the process of that new entry has been defined as EO. According to Zhang and Xing (2023), EO is a method of implementing a strategy that makes use of the resources owned by organizations. EO has become a firm-level strategic orientation that captures an organization's strategy-making practices, managerial philosophies, and firm behaviour that are entrepreneurial in nature. According to Miller (1983), an entrepreneurial firm is one that engages in product-market innovation, undertakes somewhat risky ventures, and is the first to come up with ‘proactive’ innovations, beating competitors to the punch. He characterized and tested entrepreneurship with three dimensions: innovativeness, pro-activeness, and risk-taking.

2.1.4 Dimensions of entrepreneurial orientation

EO is typically defined as a strategic mindset, behavior, or set of activities that characterize an organization's approach to entrepreneurship. It comprises several dimensions, which are traits or characteristics that collectively form the entrepreneurial orientation of a firm. The most recognized dimensions of EO are explained below.

Competitive aggressiveness

Aggressiveness in entrepreneurial orientation refers to the willingness and ability of an entrepreneur or organization to be competitive, assertive, and proactive in pursuing opportunities and achieving goals (Lumpkin & Dess, 1996). It involves a strong drive to outperform competitors and gain a competitive advantage in the market. Aggressiveness includes taking bold actions, making strategic moves, and being persistent in pursuing business opportunities (Lumpkin & Dess, 2001; Andrevski & Ferrier, 2019).

Autonomy

Autonomy refers to the level of independence and decision-making authority an entrepreneur or organization possesses (Lumpkin & Dess, 1996; Edwards et al., 2014). In an entrepreneurial context, autonomy means having the freedom and flexibility to make strategic decisions and take initiatives without excessive constraints or external interference. It allows entrepreneurs to act swiftly and nimbly in response to market changes and seize opportunities (Lumpkin et al., 2009; Bledow et al., 2021).

Innovativeness

Innovativeness is a key dimension of entrepreneurial orientation and reflects a firm's willingness and ability to introduce novel ideas and solutions. Lumpkin and Dess (1996) defines innovativeness as the tendency of a firm to engage in innovative activities that lead to the development of new products, services, or processes. Innovativeness implies a proactive approach to innovation and a readiness to embrace new methods and technologies to maintain a competitive edge in the market (Amodu & Aka, 2017; Edwards et al., 2014). It involves being open to change, seeking opportunities for innovation, and actively pursuing creative solutions.

Innovativeness refers to the inclination and capability of entrepreneurs or organizations to introduce new ideas, products, services, or processes, and the constant pursuit of ways to improve and differentiate from competitors. In the context of entrepreneurship, innovativeness involves the willingness to take risks, adapt to changing market conditions, and develop creative solutions to address existing problems or meet unmet needs. Entrepreneurs with a high degree of innovativeness are often at the forefront of technological advancements and are keen on exploring novel approaches to solving business challenges. They are not content with the status quo and actively seek opportunities for innovation in their products, services, or operations. Innovativeness is closely tied to the ability to identify market gaps and create unique value propositions that set a business apart from its competitors (Covin & Wales, 2018; Edwards et al., 2014; Lumpkin & Dess, 1996).

Proactiveness

Proactiveness in entrepreneurial orientation refers to the willingness to anticipate and initiate changes and actions to capitalize on emerging opportunities or address potential challenges (Lumpkin & Dess, 2001; Patel et al., 2014). It involves taking a forward-thinking approach, being future-oriented, and engaging in market scanning and environmental sensing to stay ahead of competitors. Proactive entrepreneurs are quick to recognize trends and act pre-emptively to leverage them (Edwards et al., 2014; Astrini et al., 2020).

Risk-taking

Risk-taking is a crucial dimension of entrepreneurial orientation and pertains to the willingness of entrepreneurs to undertake calculated risks to achieve business objectives (Zhang & Xing, 2023; Edwards et al., 2014; Lumpkin & Dess, 1996). Entrepreneurs understand that innovation and growth often involve uncertainty and potential setbacks. They are willing to take calculated risks and embrace uncertainty to pursue high-reward opportunities and achieve breakthroughs (Stagni et al., 2021; Covin & Wales, 2018).

2.1.5 Definition of firm performance

Firm performance is a multidimensional construct defined as the standard measurement of organizational achievements (Yeung et al., 2003). Lee et al. (2001) assert that firm performance should be measured by product quality and should consist of the operating and financial performance of companies.

According to Wolf and Pett (2006), firm performance can be described as a multidimensional concept and can be viewed from departmental (production, finance, or marketing) or growth and profit perspectives. They explained further that performance measurement and performance management practices have become commonplace in all businesses. Exploring the association between innovation and firm performance offers practical insights for the proper management of firms. With this knowledge, managers of SMEs would be capable of optimizing their decision-making processes as it relates to various performance outputs.

Some studies have described firm performance from the perspective of how organizational objectives are well achieved (Wood, 2006). The performance of firms can be analysed in terms of the overall achievement of their objectives (Gerba & Viswanadham, 2016). Other studies contend that the assessment of firm performance can be seen from the ability to produce an appreciable outcome (Wood, 2006; Chittithaworn et al., 2011). Gerba and Viswanadham (2016) give a different perspective on the performance of firms and indicate that the performance of firms can be viewed from financial and non-financial measures. Some of these measures are return on investment, sales value, sales volume, profitability, employment size, total assets, capital employed, market share, turnover, delivery time, customer satisfaction, productivity, employee turnover, and others.

Some scholars also viewed firm performance from the operational dimension. The operational performance is assessed through the production of the firm’s output and the efficiency and effectiveness of the operations of the company. Performance in terms of operations is normally measured with a composite of different variables. This must reflect the performance of the operations of a company internally when it comes to product or process quality, efficiency, and productivity (Feng, et al., 2006).

2.1.6 Dimensions of firm performance

The dimensions of firm performance can vary depending on the context and the specific focus of a study. The choice of dimensions depends on the specific research or assessment goals. Researchers and organizations may focus on a subset of these dimensions based on their objectives and the industry in which they operate. Some common dimensions of firm performance used in this study have been discussed below.

Financial or profitability performance

Profitability performance is a key indicator of a firm's financial success. It measures the ability of a business to generate profits and create value for its shareholders. Profitability is influenced by various factors, including revenue growth, cost management, efficient operations, and effective pricing strategies. High profitability performance indicates that the firm is generating a healthy return on its investments and is financially sustainable.

Financial performance has been defined by Lin and Jang (2008) as the achievement of financial objectives such as company sales growth, profitability, net profit margin, financial results, and cash flow. Some of the measures are the return on investment, sales value, sales volume, profitability, employment size, total assets, capital employed, market share, turnover, delivery time, customer satisfaction, productivity, employee turnover, and others (Selvam, et al., 2016; Santos & Brito, 2012).

Customer performance

Customer satisfaction is a crucial aspect of firm performance as it reflects how well a firm meets the needs and expectations of its customers. Satisfied customers are more likely to be loyal, repeat customers and can become advocates for the brand, leading to positive word-of-mouth and increased sales (Selvam, et al., 2016; Selvam, 2016; Santos & Brito, 2012). Customer performance is often measured through surveys and feedback to gauge the overall perception of the firm's products, services, and customer service.

Quality performance or product quality performance

Product performance refers to the level of excellence and reliability of a firm's products or services. It is a critical aspect of firm performance as high-quality products can lead to customer satisfaction, loyalty, and positive word-of-mouth, while poor-quality products can lead to customer complaints, returns, and a damaged reputation (Selvam et al., 2016). Investing in product quality can result in a competitive advantage, increased market share, and improved profitability for the firm. Quality performance evaluates the quality of a firm's products or services. It includes measures like defect rates, product recalls, and adherence to quality standards (Selvam et al., 2016; Selvam, 2016; Santos & Brito, 2012; Richard et al., 2009).

Environmental performance

Environmental performance refers to a firm's efforts to minimize its environmental impact and adopt sustainable practices. It involves reducing waste, conserving resources, and implementing environmentally friendly initiatives (Gull et al., 2022). Firms with strong environmental performance are seen as responsible corporate citizens and may attract environmentally conscious consumers and investors (Abban & Hasan, 2021). Additionally, complying with environmental regulations and adopting sustainable practices can lead to cost savings and operational efficiencies. Environmental performance consists of internal and external efforts combined with rules and regulations concerning environmental issues (Awaysheh et al., 2020; Dijkstra et al., 2020; Lüdeke-Freund & Dembek, 2017).

Social performance

Social performance relates to a firm's contributions to society and the well-being of its stakeholders, including employees, communities, and society at large (Crișan-Mitra, Stanca, & Dabija, 2020). Socially responsible firms often demonstrate ethical behavior, respect for human rights, and a commitment to social causes. They may engage in corporate social responsibility initiatives, philanthropy, and community development projects. Socially responsible firms can build strong relationships with their stakeholders, enhance their reputation, and create a positive brand image (Gond, Mena, & Mosonyi, 2023).

2.2 Theoretical foundations

This section presents the theories underpinning innovation and how they relate to the entrepreneurial orientation and performance of MSMEs.

2.2.1 Schumpeterian theory of innovation

The theory proposed by Schumpeter (1934) is typical of the rudimentary role played by entrepreneurs and firms that have just been created in undertaking innovative activities. The theory surmises that there is always a constant state where there is disequilibrium resulting from the acquisition of new knowledge and innovation expressed through the manufacturing of new products and the introduction of new technologies. This theory assumes that information asymmetry among entrepreneurs is the main reason why some entrepreneurs have and exhibit the acquisition of new knowledge and transform it to new technology. According to Lazonick (2005), Schumpeter viewed firms that are innovative to be the manifestation of their individual specific skills which enables them to embark on a novel pursuit that has the potential to pose as a threat to other businesses, which may lead to economic growth, and which invariably causes disequilibrium.

According to Schumpeter (1942), innovation is primarily the determination of the role that is played by big reputable organisations that present some obstacles to new entrants because of the domination of the market by larger firms. Schumpeter chronicles this proposition as the condition of the market structure whereby firms that fall within a perfect contest or competitive environment have an equal competitive advantage, and because of that, the incentive to invest in innovation is not attractive and that research and development is not supported in a desirable proficient manner (Gilbert, 2006).

This proposition of Schumpeter also got challenged as Arrow (1962) claimed that larger organizations have the capacity and the abilities to engage in technological innovation because they can channel profits and other financial resources to innovation. Arrow (1962) asserts that the motivations of a firm enjoying from monopoly to initiate innovation are somehow limited compared to organizations in a competitive environment. This is because firms that are monopolist tend to change their own mechanisms or products, whereas a firm in a competitive space will change those of rivals, which will lead to the acquisition of market stakes as well as profits.

The Schumpeterian theory of innovation emphasizes the role of entrepreneurship in driving technological innovation and economic growth. This theory suggests that technological innovation can stimulate entrepreneurial orientation in MSMEs (Kraus et al., 2023). When MSMEs adopt new technologies and innovative practices, they are more likely to seek new opportunities, take risks, and proactively respond to market changes. Technological innovation can foster an entrepreneurial mindset among MSME managers, leading to a more proactive and innovative approach to their business operations.

Technological innovation is a key driver of economic growth and productivity. It can significantly impact the performance of MSMEs in Ghana. By adopting new technologies, MSMEs can improve their production processes, product quality, and operational efficiency, leading to cost savings and higher productivity. This, in turn, can positively influence their overall performance, profitability, and competitiveness in the market (Darmawan et al., 2023).

The theory emphasizes that innovation and entrepreneurship can interrelate and mutually reinforce. The combined effect of technological innovation and entrepreneurial orientation can lead to a synergetic impact on the performance of MSMEs. Technological innovation provides the tools and capabilities for MSMEs to implement new business ideas and seize opportunities (Ince, Imamoglu, & Karakose, 2023).

2.2.2 Resource-based theory

The resource-based view has become one of the most influential and cited theories in the history of management and entrepreneurship studies. It explains the internal sources of a firm's sustained competitive advantage (Kraaijenbrink, Spender, & Groen, 2010). Penrose (1959) submits a reasonable account of the evolution rate of a firm by making it clear or removing any doubt relating to the causal relationships among firm resources, production capability, and performance. The interest is based on the efficient and innovative use of resources. The claim is that a huge amount of productive resources which is controlled by firms could vary significantly by firm and in that sense, firms are fundamentally heterogeneous even if they are in the same industry (Barney & Clark, 2007).

This theory argues that a sustained competitive advantage occurs when organizations can have resources that are inimitable, which are not substitutable, tacit in nature, and synergistic (Peppard & Rylander, 2001; Barney, 1991). Managers need to identify the pertinent resources and what drives performance in organizations. The theory again claims that a company's competitive advantage emanates from its ability to bring together and exploit the appropriate combination of resources. Such resources may be tangible or intangible and represent the inputs into a firm's production process, such as equipment, or capital as well as the expertise of the distinctive personnel, capital, patents, and endowed management. A company's set of available resources grow as competencies and effectiveness intensify (Barney & Clark, 2007).

The resource-based theory focuses on how the unique resources and capabilities of a firm contribute to their competitive advantage and performance. With the first objective, technological innovation can be considered as a valuable resource for MSMEs (Gali et al., 2023). By leveraging innovative technologies, MSMEs can gain a competitive edge, attract customers, and enhance their market position. This can lead to a positive effect on their entrepreneurial orientation, as they become more proactive and resourceful in seeking new business opportunities and adapting to market dynamics (Kindermann et al., 2023).

Technological innovation can positively affect the performance of MSMEs in Ghana by providing them with valuable and unique resources. By adopting and leveraging advanced technologies, MSMEs can enhance their productivity, efficiency, and product quality, which can lead to increased customer satisfaction, market share, and profitability. Technological innovation can act as a critical resource for MSMEs, enabling them to gain a competitive edge in the market and improve their overall performance.

According to the resource-based theory, technological innovation can be seen as a valuable resource that contributes to the performance of MSMEs. Innovations in technology can enhance product differentiation, customer satisfaction, and market positioning, leading to improved financial performance. Moreover, access to advanced technologies can attract skilled employees and enhance human capital, further contributing to overall performance.

When MSMEs possess both technological innovation capabilities and a strong entrepreneurial orientation, they can effectively identify and exploit new market opportunities and use technology to create unique value propositions for customers. This combination of resources and entrepreneurial behaviour can lead to superior performance, as it allows MSMEs to adapt to changing market conditions, outperform competitors, and sustain their competitive advantage over time.

2.3 Review of empirical studies and conceptual framework

We present a review of studies on the determinants of technological innovation, the relationship between technological innovation and entrepreneurship, the effects of technological innovation on SMEs, and the challenges associated with innovation.

2.3.1 Determinants of technological innovation

There have been several studies that have provided evidence that innovation stimulates the productivity and growth of firms and equips organizations with the ingredients for competitive advantage (Motwani et al., 2006). This section looks at the main determinants of technological innovation within organizations.

A study by Le Bas, Mothe, and Nguyen-Thi (2011) on technological innovation persistence used a multinomial probit model to estimate the probability of each of the groups having any of the dimensions of innovation. They categorised the data into three groups. The sample used for the study contained 615 firms which had more than 10 employees. The services sector had 405 (representing 65.9%) and the manufacturing sector had 210 (representing 34.1%). The study constructed a longitudinal data set of firms based on this data by using interviews. The findings reveal the distinct determinants of technological innovation, and the influence of R&D intensity, R&D cooperation, and competition intensity. The study further documented that organizational innovation parameters such as external contacts and knowledge management define innovation persistence.

Another study conducted by Kim et al. (1993) on two small firms in Korea determined the technological innovation of these firms. They used 24 innovative and 25 non-innovative small firms by using environmental, strategic, structural, and top management characteristics as the main variables. The study discovered that the prevalent determinants of technological innovation differ according to the types of organization and, in the case of small firms, managerial attitudes toward innovation are the most critical factor.

Another study conducted by Ganau and Di Maria (2014) provided credence to the study by Kim et al. (1993) and Le Bas et al., (2011) that the determinants are mainly managerial and organizational attitudes. The study concluded that the main determinants of technological innovation were firm-specific characteristics which may include managerial and organizational characteristics. The study used 4000 Italian firms with data from 2004 to 2006. The study employed parametric probabilistic models to establish the joint effects of distinct potential determinants of successful technological innovation. The findings showed that technological innovation in manufacturing SMEs is mainly facilitated by firm-specific characteristics. Again, it was discovered that experience and knowledge accumulated over time (age) as well as the availability of human and capital resources (size) matter for innovative firms.

Ngisau (2016) studied the determinants of technological innovation in Malaysia by employing partial least squares and structural equation modelling tools. The study explored the factors that determine the adoption of technological innovation in the manufacturing sector in Malaysian SMEs. The results discovered that the determinant of technological innovation is associated with firm size.

In Ghana, a study by Udimal et al (2019) analysed the determinants of product innovation in the SME sector in Ghana using tobit model to analyse data from 550 owners. It was established that product innovation is influenced by sources of innovation expenditure. Specifically, the determinants of product innovation were found to be foreign capital, government tax credits, subsidies, and patents.

Most of the empirical studies identify similar variables, that is organizational attitude, managerial attitude, the external environment as well as environmental homogeneity, and firm-specific characteristics as some of the determinants of technological innovations. These studies are mostly centred on large firms and again the attention seems to be in the developed countries.

2.3.2 Technological innovation and entrepreneurship

Entrepreneurship and innovation as well as technology have been the main pillars that drive the development of advanced economies. Entrepreneurial and innovation practices are mostly the pertinent elements that facilitate economic growth in the long run. This section looks at the empirical studies on the linkage between technological innovation and entrepreneurship.

Zhao (2005) conducted a study in Australia on six case studies of entrepreneurial and innovative organizations to explore the synergies between entrepreneurship and innovation. The study found that entrepreneurship and innovation are positively related. Again, entrepreneurship and innovation interplay to help an organisation to flourish. That is, entrepreneurship and innovation are complementary, so they combine to ensure organisational success and sustainability in a dynamic and changing business environment.

Margaret (2008) assessed the effect of entrepreneurial orientation and human capital on the implementation of product innovation. Data from a sample of 218 carpentry workshops drawn from Kenya were analysed with the help of a logit model. The study discovered that entrepreneurial orientation brings about the implementation of drastic product innovation activities.

Price et al. (2013) used data from 430 SMEs to analyse the linkage between innovation and entrepreneurship with data from Australia and USA using hierarchical regression analysis. The study assessed the relationship between innovation and knowledge in family business as against knowledge in non-family businesses. The finding was that innovation is an important factor in both family and non-family groupings. It was also discovered that, knowledge in family firms was a significant factor in innovation.

A study by Setyanti et al. (2013) investigated the role innovation plays in the mediating effect of entrepreneurial orientation, management capabilities and the sharing of knowledge toward business performance of 125 owners of Batik SMEs in East Java in

Indonesia. The partial least square analysis yielded the result that innovation affects the performance of businesses positively. Innovation assumes a complete mediation in the relationship between management capabilities and the sharing of knowledge toward business performance. Innovation has become a partial mediation in relation to entrepreneurship orientation toward the performance of businesses.

Chatterjee, Gupta, and Upadhyay (2020) investigated how women entrepreneurs have been empowered through ICT. Evidence-based primary data established the covariance structure between the dimensions of access, ICT adoption intention, and entrepreneurial orientation. The study found that different types of access like mental, material, skill, and usage contribute significantly to the adoption of ICT among rural women. The study further stresses that adopting ICT enhances entrepreneurial orientation which leads to micro-entrepreneurship on the part of women.

Galindo and Mendez-Picazo (2013) studied the role entrepreneurship innovation plays in economic growth, using Schumpeter's approach. Using the generalized least square (GLS)-cross-section weights and panel least squares methods for the period 2001-2009, the study found that, innovation is key when it comes to drivers of economic growth and the entrepreneur is the channel through which new technologies are introduced to stimulate high output and profit levels of firms.

Ndubisi (2014) investigated the relationship between entrepreneurship and service innovation, with a focus on entrepreneurial orientation, innovation, and entrepreneurship. The study found that entrepreneurial orientation, innovation, and entrepreneurship are three closely related variables. That is, once EO promotes innovation in organizations innovation promotes entrepreneurship. This relationship between EO, innovation, and entrepreneurship plays an important role in organizational performance, which creates a competitive advantage for the organization. This is consistent with the theory of innovation by Schumpeter. The theory suggests that, as MSMEs adopt new technologies and engage in innovation, they are more likely to demonstrate higher levels of proactiveness, risk-taking, and creativity, which are key components of entrepreneurial orientation. Regarding the effect of EO on technological innovation, the resource-based theory underpins such that MSMEs with greater resource endowments (financial, human, and technological resources) are more likely to exhibit a higher level of entrepreneurial orientation. The availability of resources provides the necessary foundation for MSMEs to take risks and pursue entrepreneurial opportunities, fostering a proactive and innovative organizational culture. These arguments serve as the basis for our hypothesis below:

H1: There is a bidirectional positive relationship between technological innovation and entrepreneurial orientation.

2.3.3 Technological innovation and performance of SMEs

This sub-section looks at the empirical studies in relation to the effects of technological innovation on the performance of SMEs**.** Ukpabio, Oyebisi, and Siyanbola (2018) conducted a study in South-Western Nigeria using 305 SMEs. The study revealed that there is a significant direct association between the various dimensions of innovation and firm performance. They employed correlation analysis and hierarchical regression for the estimation. Whereas the result from the correlation indicates a positive relationship, the regression pointed to a significant influence of process innovation and organizational innovation on performance. It was also discovered that; innovation is responsible for nearly 56% of differences in the output of the SMEs sampled. It was concluded that all aspects of innovation (especially process and organizational innovation) are essential factors in enhancing the productivity of Nigerian SMEs.

Another study by Mwangi (2014) on the Kenyan economy gives credence to the study conducted by Ukpabio et al., (2018) which suggests that SMEs strive positively when organizations adopt technological innovation. The study again used the manufacturing industries to assess the impact of technological innovation on SMEs. The study used stratified random sampling and purposive sampling techniques for the data collection. The data was collected using structured questionnaires and it was analysed using descriptive statistics. The study discovered that there is a strong relationship between innovation and the growth of businesses and recommended that the Kenyan government establish close links with SMEs in the garment manufacturing industries to encourage innovative strategies that would enable the sector to expand.

Kafetzopoulos and Psomas (2015) assessed how the performance of organizations is influenced by innovation capability in Greece. The study discovered that there is no direct effect of innovation capability on financial performance although innovation capability contributes to product quality and operational performance directly, whereas it contributes to financial performance indirectly through the moderating role of operational performance. The study indicated that the operational performance of firms must be considered to illustrate the positive influence it has on the quality of a product. Thus, manufacturing firms can augment their productivity and gain a competitive edge by implementing innovative frameworks. The result confirmed that important considerations should be accorded to innovation.

Rajapathirana and Hui (2018) conducted studies on the insurance industry in Sri Lanka to discover the effects of innovation type and innovation capability on performance. The findings of the survey distributed to 379 top managers of insurance firms documented a significant connection between innovation capabilities, innovation activities, and firm performance. It was further discovered that company with higher innovation capabilities does have has positive effect on their firm's performance. It was also reported that the absence of skills and expertise is one of the key obstacles to innovation in SMEs operating in the insurance space. The authors recommended the need for SMEs in the insurance sector to turn from a conventionally risk-averse stance to a position that boosts experimentation that comes with minimized financial risk.

A study conducted on Turkish automotive supplier industry by Atalay, Anafarta, and Sarvan (2013) sought to investigate the relationship between innovation and firm performance. The results showed that technological innovation (product and process innovation) has significant and positive impact on the performance of firms. However, there was no significant relationship between non-technological innovation (organizational and marketing innovation) and firm performance.

Another study conducted on SMEs in Nigeria manufacturing firms by Akinwale, Adepoju, and Olomu (2017) affirmed generally the notion that technological innovation has a positive effect on SMEs. The study collected data from 1,000 SMEs with a structured questionnaire from randomly selected manufacturing firms extracted from the directory of the Association of Nigerian Manufacturers. The study adopted the least squares method of multiple regressions and a binary regression for the estimation.

Research and development undertaken by organizations as well as technological innovations has considerable effect on the performance of firms.

Van Auken et al. (2008) used a sample of 1,901 SMEs from the manufacturing sector in Spain to assess the relationship among innovation and firm performance. Their study confirmed the direct connection among three types of innovation and performance of organizations. Also, a study by Garrido and Camarero (2010) examined the effect that innovation and learning orientation have on performance of organizations. The finding was that there is a significant influence of learning orientation on both innovativeness and firm performance. Also, Terziovski (2010) does a study on SMEs in Australia to assess how innovation practice affects the performance of firms. It was reported that innovation strategy is a vital determinant of SMEs performance.

A study by Younas and Rehman (2021) on the relationship between technological innovation and firm performance observed a significant positive effect of product and process innovation on firm performance. By elaborating their study further, the predicted research intensity has a positive impact on innovation output no matter which proxy is used for the firm-level innovation. Again, non-technological innovations with respect to marketing and organizational innovation have no impact on firm performance for all the alternative econometrical specifications and are mostly in line with the existing literature.

Another study by Dalgıç and Fazlıoğlu (2021) reported that innovation crucially adds to the likelihood of firm growth. The study was conducted in Turkey. The study provides evidence of innovation efforts to have more pronounced effects on growth performance of firms at the upper end of the distribution of growth. The results also confirm that that compared with services, manufacturing firms are influenced more by R&D whereas innovation outputs are more beneficial for services firms.

Chen, Wang, and Huang (2020) assessed the relationship between organizational innovation and technological innovation capabilities and analyses their effect on firm performance. The study used a sample of 265 manufacturing firms from the Pearl River Delta in China and examined whether innovation capabilities mediated the effects of organizational innovation on firm performance. The study also examined how organizational innovation moderated the relationship between innovation capabilities and firm performance. The study employed SEM reported that innovation capabilities partially mediated the relationship between organisational innovation and firm performance. Similarly, organizational innovation partially moderated the relationship between innovation capabilities and firm performance.

Liao, Liu, and Liu (2021) examined the relationship between environmental innovation and firm performance. The study used 33 empirical studies and evaluated the moderating effects of the economic development level of a country, cultural background, industry diversity, and data types. The findings of the study revealed that environmental innovation can positively promote both firms' financial performance and environmental performance. Again, environmental innovation has a stronger effect on firm performance in developed countries and Eastern culture, and the effect of environmental innovation on environmental performance is stronger within the context of developing countries.

Most empirical reports on how technological innovation affects SMEs show a certain unidirectional pattern that technological innovation has a positive effect on SMEs in general. However, the gap identified by this study is that almost all the studies concentrate on the manufacturing sector while little or no mention is made of the services sector. Most of the studies do not concentrate on the very small business, that is the micro sector, and few studies are found in developing countries such as Ghana. The study focused on process and product innovation specifically because these two dimensions are commonly studied for SMEs and are highly relevant in the context of MSMEs. Additionally, process and product innovations are often considered as the primary drivers of firm performance and competitive advantage, making them critical areas of investigation. Concentrating on process and product innovation allows for a more focused and manageable investigation.

Consistent with the theory of innovation, MSMEs that embrace and implement technological advancements in their processes and products are likely to experience improved operational efficiency, enhanced product quality, and increased customer satisfaction. These are expected to have a positive effect on the overall performance of MSMEs in Ghana.

H2: Technological innovation has a positive effect on firm performance.

2.3.4 Entrepreneurial orientation and firm performance

The literature based on earlier studies establishes five dimensions used to describe entrepreneurial orientation. These are autonomy, pro-activeness, innovativeness, risk-taking, and competitive aggressiveness (see, for example, Lumpkin & Dess, 1996; Hughes & Morgan, 2007; Polites et al., 2012). The context of these dimensions has engendered ongoing debate regarding the relationship between EO and firm performance in the literature. However, the results are discordant or conflicting at best (Aftab et al., 2022). Authors such as Ngo (2023), Nguyen (2023), Wales et al. (2019), Wales (2016), Semrau et al. (2016), and Lee et al. (2011) have argued that the effects of entrepreneurial orientation on performance are affected by the context of the study. Others also argue based on the measure of financial performance (see Ngo, 2023; Soomro & Shaher et al., 2020; Gupta & Wales, 2017; Kantur, 2016).

One school of thought suggests that entrepreneurs with a strong presence of the five dimensions perform better than those without (Wales et al., 2013; Filser et al., 2014; Saeed et al., 2014). Another group of scholars contend that the dimensions of EO impact negatively on firm performance (Mahmood & Hanafi, 2013; Anderson, 2010; Arunchalan et al., 2013), while other studies have provided inconclusive evidence regarding the relationship (see, Arshad et al., 2014). The strands of arguments evolve around whether to use the individual dimensions of EO or a composite measure.

Whereas most of the studies that used the individual dimensions reported mixed findings for the different dimensions (see, Ambad & Wahab, 2013; Rezaei & Ortt, 2018; Amarteifio & Agbeblewu, 2020), those that focused on the composite measure found unidirectional effect of EO on firm performance (see, Galbreath et al., 2020). Another dimension of the literature has involved the moderating role of some variables: competitive strategy (Galbreath et al., 2020); acquisitive learning and generative learning (Gupta, Niranjan, & Markin, 2020); organizational learning (Hina et al., 2020); competitive advantage (Kiyabo & Isaga, 2020); resource capability and environmental dynamics (Choi, Lee, & Kang, 2020); learning orientation and innovativeness (Soares & Perin, 2020); and others. Most of these studies have documented a positive relationship between EO and firm performance, both directly and under the moderating roles of the variables employed.

Alshahrani and Salam (2023) investigated the relationship between entrepreneurial orientation and firm performance through the mediating role of absorptive capacity in SMEs in Saudi Arabia. The results suggest that EO enhances firm performance through absorptive capacity. The findings support owners and managers of SMEs in increasing the performance of their firms by implementing the dimensions of absorptive capacity with existing entrepreneurial characteristics to boost performance. Similarly, a study by Aloulou (2023) investigated the relationship between the dimensions of EO and firm performance under the mediation roles of innovation capability and firm resilience capability. The results revealed that there are significant relationships between EO and innovation capability. The study found no direct relationships between EO and resilience capability or between EO and firm performance.

Ince et al. (2023) investigated the mediating effect of innovation performance on the relationships between entrepreneurial orientation and firm performance and between social capital and firm performance. They report the following: entrepreneurial orientation and social capital affect innovation performance, innovation performance affects firm performance, as well as innovation performance serves as a mediator in the relationship between social capital and firm performance, and between entrepreneurial orientation and firm performance. 0247904627

Susanto et al. (2023) examined the effect of EO on firm performance under the moderating role of social media usage and the mediating role of marketing capabilities and social media usage. The findings show that an EO has a significant and positive effect on performance, albeit conditional on the role of social media and marketing capabilities. This reveals that marketing capabilities significantly mediate the relationship between EO and firm performance. Also, social media usage moderates the EO-performance relationship and partially mediates the nexus.

Nguyen (2023) explored the impact of the dimensions of EO on the performance of women-owned SMEs in Vietnam. The results show that innovation, competitive aggressiveness, proactiveness, and autonomy positively affect business performance, while risk-taking negatively affects business performance. The results suggest that female business owners should know how to improve each dimension of the entrepreneurial in line with its context. A similar study by Loan et al. (2023) identified and evaluated the relationship between the dimensions of EO (innovation, risk-taking, and proactiveness) and the performance of women-owned SMEs in Vietnam. The results highlight the positive effect of proactiveness and innovation and the negative effect of risk-taking on the performance of women-owned SMEs.

Crick and Crick (2023) investigated the association between EO and firm performance under different degrees of coopetition. The results suggest positive and significant relationships existing between EO and firm performance. On the other hand, the interaction between EO and coopetition negatively influenced firm performance. EO has been linked to improved firm performance, under-resourced owner-managers of certain smaller-sized enterprises may struggle to implement these activities. The authors recommend the need for SMEs to cooperate with competitors to enhance resources and capabilities and lead to mutually beneficial outcomes.

Šlogar et al. (2023) examined the existence of nonlinearity between EO and subjective financial performance among SMEs in South-eastern European countries. The results confirmed existence of the positive direct relationship EO has on financial performance, including the positive effects on sales growth and profit-to-sales ratio. On the other hand, results have not confirmed existence of nonlinearity effects that EO has on financial performance, sales growth, nor on the profit-to-sales ratio. In other words, the observed relationship does not exhibit inversed U-shape characteristics among southeast European SMEs.

Darmawan et al. (2023) conducted general influence of technological capability, social capital, entrepreneurial orientation on firm performance through absorptive capacity in the food and beverage packaging industry in Indonesia. This study found that technological capability, social capital, and absorptive capacity have a positive and significant effect on firm performance. Meanwhile, entrepreneurial orientation has a positive but not significant effect on firm performance. This study found that technological capability, social capital, and absorptive capacity have a positive and significant effect on firm performance. Meanwhile, entrepreneurial orientation has a positive but not significant effect on firm performance. Alali (2023) explored the mediating effect of EO, looking at the relationship between relational capital and performance of manufacturing SMEs in Iran. The results turned out positive. Also, the findings indicate a positive relationship between relational capital and EO, as well as EO to performance.

Huang et al. (2023) examined how configurations of the EO dimensions (innovativeness, risk-taking, and proactiveness) might lead to high and low firm performance, and how the configurations differ under different firm contexts. Our findings show that three (four) configurations can result in high (low)-firm performance, demonstrating that the EO dimensions can contribute to as well as hinder firm performance. Al-Momani and Haddad (2023) investigated the moderation role of

Entrepreneurial Orientation (EO) on the influence of innovation on the performance pharmaceutical SMEs in Jordan. The results indicate that innovation has a significant positive impact on pharmaceutical SMEs, and EO moderates the influence of innovation on performance.

Aftab et al. (2022) investigated the effect of EO on the performance of SMEs in Pakistan and the moderating role of environmental dynamism. The results indicate that EO positively influences entrepreneurial competencies and firm performance, and entrepreneurial competencies also mediate the relationship between EO and performance. The findings further establish the role of environmental dynamism in strengthening the positive relationship between entrepreneurial competencies and performance. The authors argue that entrepreneurial competency is the missing link between EO and firm performance.

Raisal et al. (2021) studied the effect of EO on firm performance with the mediating role of absorptive capacity. The study collected 226 valid responses from senior managers of SMEs. The study employs structural equation modelling technique to test the hypotheses. The findings show a strong positive causal relation between EO and firm performance. Moreover, absorptive capacity substantiated to be a mediator between EO and firm performance.

A study in Ghana by Li et al. (2021) examined the impact of EO on the performance of firms in the food processing sector, with innovation types and intellectual property serving as mediators. The study used partial least squares structural equation techniques to model data from 702 managers/owners in the industry. The results highlight that EO, innovation types, and intellectual property influenced firm performance positively.

Faizol et al. (2010) analysed the effect of EO on the performance of SMEs in the Hambantota district of Sri Lanka. They used manufacturing companies in accordance with the definition of SMEs by the National Development Bank of Sri Lanka. The study applied multiple regressions and reported a strong linkage between EO and firm performance.

In line with results from earlier research on EO, it is expected that all the measures of EO as recommended by Lumpkin and Dess (1996), will positively and significantly influence firm performance. However, using all five dimensions of entrepreneurial orientation alongside the dimensions of technological innovation can lead to issues of multicollinearity in the analysis. Aside from multicollinearity, excluding innovativeness from the dimensions of entrepreneurial orientation addresses potential construct overlaps and redundancy issues. In this context, technological innovation and innovativeness share a similar conceptual foundation. Both involve the tendency to introduce and adopt new ideas and unique products or services, ideas, processes, or technologies to drive improvement and change within an organization. When both are included as separate dimensions in the same analysis, it can lead to redundancy, making it difficult to discern their unique effects. By excluding innovativeness and focusing solely on other dimensions of entrepreneurial orientation, the study can maintain clarity and specificity in the interpretation of the results. Each remaining dimension can be more effectively examined for its independent contribution to the outcomes related to technological innovation.

The mixed results observed in the relationship between entrepreneurial orientation and firm performance can be attributed to various factors and methodological considerations. It is essential to consider these arguments and context-specific factors when interpreting the mixed results. The relationship between entrepreneurial orientation and firm performance is complex and can vary across different organizational settings and industries. The relationship between entrepreneurial orientation and firm performance can vary depending on the industry and market conditions. Some industries may be more receptive to innovation and risk-taking, while others may prioritize stability and efficiency.

Some researchers found a negative or inconclusive relationship between entrepreneurial orientation and firm performance and provided arguments relating to risk exposure, resource constraints, and time lag. Entrepreneurial orientation involves taking risks, which, if not managed effectively, can lead to adverse outcomes. Overly aggressive risk-taking or pursuing too many opportunities simultaneously may result in excessive resource depletion or failure to meet financial targets. Also, smaller firms, such as MSMEs, might face resource constraints that limit their ability to fully leverage their entrepreneurial orientation. Limited financial and human resources may hinder the implementation of innovative ideas, negatively affecting firm performance. Finally, the positive impact of entrepreneurial orientation on firm performance may not be immediately evident and may require time to materialize. Studies with short-term observation periods might not capture the full effect of entrepreneurial behaviour on performance.

Those who established a positive relationship between entrepreneurial orientation and firm performance also put forward arguments relating to competitive advantage, adaptability, and customer orientation. Entrepreneurial orientation enables firms to identify and seize new market opportunities, which can lead to a competitive advantage. Such firms may introduce novel products, offer unique services, or respond quickly to changing customer demands, which can result in increased market share and profitability. Also, firms with high entrepreneurial orientation tend to be more flexible and adaptable to changing market conditions. They may be better equipped to navigate uncertainties and disruptions, allowing them to sustain growth and perform well in dynamic environments. Finally, entrepreneurial firms often exhibit a strong customer focus, actively seeking feedback and understanding customer needs. This customer-centric approach can lead to higher customer satisfaction and loyalty, positively impacting firm performance. Hence, in line with the resource-based theory, this study assumes a direct and positive effect of EO on firm performance as formulated in the hypothesis below:

H3: Entrepreneurial orientation has a positive effect on firm performance.

2.3.5 Technological innovation, entrepreneurial orientation, and firm performance

Combining H2 and H3, the study explores the combined effect of technological innovation and entrepreneurial orientation on firm performance. Innovativeness is a dimension of EO, and both individually affect firm performance. It has also been hypothesized that there is a bidirectional causal relationship between technological innovation and EO. The combination of technological innovation and a high level of entrepreneurial orientation has a synergistic effect on the performance of MSMEs in Ghana. MSMEs that possess both technological innovation capabilities and a strong entrepreneurial orientation are expected to outperform those with either alone. The combination of these two factors allows MSMEs to identify and seize new market opportunities, create unique value propositions, and effectively leverage their resources for improved performance.

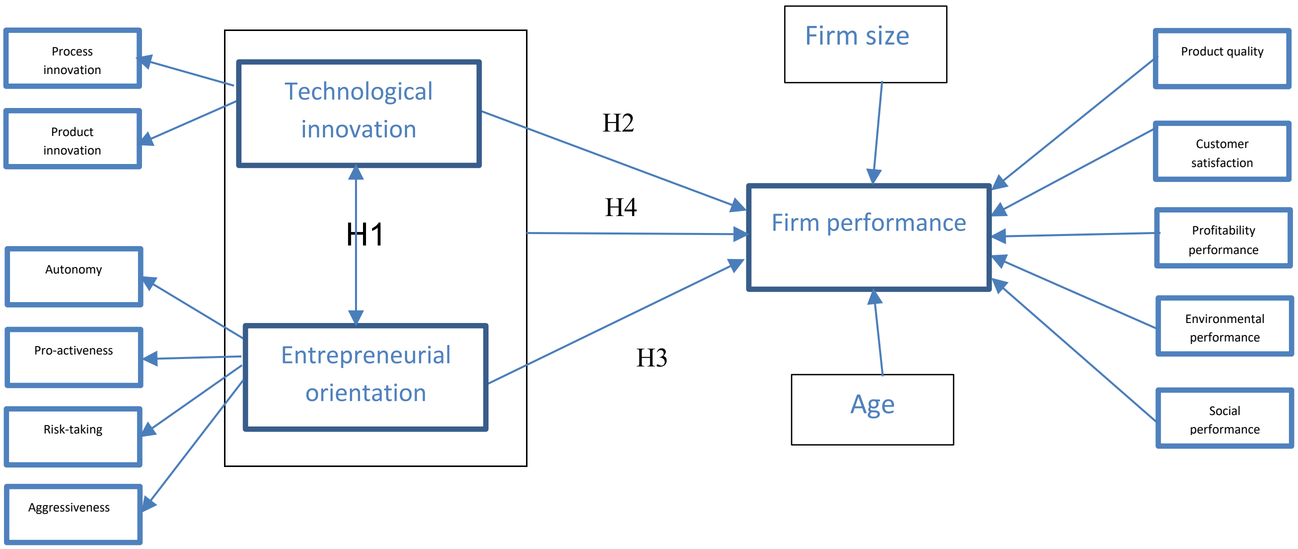
The definitions of both technological innovation and EO involve the use of new products, services, technological innovations, markets, or business model innovations that did not exist before (Covin & Wales, 2019). Based on the resource-based theory, this study argues that technological innovation and EO are firm resources that generate a competitive edge for firms and ultimately boost the performance of firms (Kiyabo & Isaga, 2020). The theory by Schumpeter (1911) also postulated that innovation is very crucial in inducing economic progress, such that economic development happens because of innovation, entrepreneurship, and market power. It is, therefore, hypothesized that there is a positive effect of technological innovation and EO on firm performance.

H4: Technological innovation and entrepreneurial orientation combine to have a positive effect on firm performance.

2.4 Conceptual model

The conceptual framework in Figure 1 has been developed around the possible interconnections existing among technological innovation, entrepreneurial orientation, and performance of MSMEs in Ghana. Our model speaks to the possibility of a feedback or bidirectional relationship between technological innovation and entrepreneurial orientation. As argued in some studies, technological innovation is a key function of entrepreneurial innovation and serves as a channel for entrepreneurs to make resources available and generate wealth-creating ventures (see Nnadi, 2014). Another feature of the model captures the use of firm characteristics such as firm size (measured by the number of employees) and firm age (number of years in operation) and their effects on the relationships hypothesized in this model. Based on the review of both theoretical and empirical literature, the following conceptual framework has been designed.

Figure 1: Conceptual framework



CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter presents the methodological approach to the study. It describes the data collection approach, the population, sampling techniques, and the data used. Further, the PLS-SEM technique employed for the estimation will be presented.

3.1 Research paradigm

This study was grounded on a positivist epistemology. This paradigm was based on the following key features: the belief that empirical observations are a basis of objective research, the world conforms to permanent cause-effect laws, the research is value-free with considerations that the truth and reality about the study subject are independent of the cognitive thinking of the researcher and uses the relationship of variables and experiments to study and test the hypotheses about human behaviour (Aliyu et al., 2014; Kim, 2003).

3.2 Research design

The study employed the quantitative method to examine the interactions associated with technological innovation, entrepreneurial orientation, and performance of MSMEs. By using a structured questionnaire, variables explaining the description of trends, facts, and perceptions of a population from a sample were measured for the numerical data to be statistically analysed (see Creswell, 2003). In line with the quantitative research proposition by Creswell and Creswell (2017), there was the need to be unbiased and control against alternative explanations and the ability to generalize and replicate the study results. The study followed the explanatory research design since the research sought to investigate causal relationships between the variables under consideration (see, Saunders et al., 2019).

3.3 Study population

The study concentrates on MSMEs in the Greater Accra region of Ghana. Because Accra is the capital city and the economic hub of Ghana, it serves as a good laboratory for researching MSMEs. This provides access to a diverse range of MSMEs across different industries and sectors. The concentration of MSMEs in Accra facilitates data collection and engagement with relevant stakeholders, including MSME owners, managers, and government agencies.

The study based its population on the definition of SMEs provided by the Ghana Statistical Service (GSS) and the National Board of Small-Scale Industries (NBSSI) currently called the Ghana Enterprises Agency (GEA). According to GSS, firms that employ fewer than 10 staff are classified as small-scale, and those engaging 10 or more as medium-scale or large-size firms. The GEA, on the other hand, defined MSMEs based on staff strength and fixed assets of the business. According to them, SMEs are entities that have 29 or fewer staff and investments of not more than GH¢10 million. Combining the two definitions provided us with a measure of the firms we needed to capture under the study in terms of number of employees as micro/small (0–9 employees) and medium (10–29 employees).

The survey focused on owners and top management of MSMEs as defined in this section. The target population is consistent with the Ministry of Trade and Industry (2019) which estimated that there are about 800,000 MSMEs or entities in the region and the various metropolitan, municipal, and district assemblies (MMDAs) in Accra. They included general manufacturing (textiles, leather, apparel, footwear, and others), financial services (susu enterprises, microfinance, micro-insurance, and others), health services, water production firms, construction services, wholesale outlets, oil and gas filling stations, hospitality (restaurants, canteens, hotels, and others), wood processing, and others.

3.4 Sample and sampling technique

The study follows the procedure prescribed in Table 7.1 on page 302 by Saunders et al. (2019), albeit not in the strict sense. With an estimated population of 800,000 MSMEs in Greater Accra, the sample size was estimated to be about 400 for the 5 percent margin of error or 95 percent confidence level considered. This is also in line with a report by the Economic Commission for Africa (2021) which documents that almost 40 percent of Ghana's GDP is produced from Greater Accra. The 400 respondents were taken from the different sub-sectors of the industry. Stratified random sampling was employed as the sampling technique to distribute the questionnaire to the owners or managers of the MSMEs. This sampling technique ensured that proportionate representatives were selected from the micro, small, and medium sub-sectors.

3.5 Survey instrument

Based on the objectives of the study, socio-demographic data was collected from the selected organizations. This included the age of the firm, size, and ownership structure. The study adopted the 5-point Likert scale for data collection. The questions aimed to solicit data to help explore the relationship between the variables of interest (technological innovation, entrepreneurial orientation, and firm performance). The questionnaire is divided into five sections, each focusing on different aspects of the study. In Section A, the instrument captures measures of the two dimensions of technological innovation – process innovation (PC) and product innovation (PD). This section assesses the level of agreement with various technological innovations in the firm.

The instrument captures the measures of entrepreneurial orientation in Section B. This section explores the dimensions of entrepreneurial orientation within the firm. It includes statements related to Autonomy (AU), Proactiveness (PR), Risk-taking (RS), and Aggressiveness (AG). Participants are asked to rate their level of agreement on a scale from 0 to 5 for each statement regarding the entrepreneurial orientation in their firm.

The next Section is on firm performance. This section focuses on assessing the firm's performance. It includes statements related to product quality (PQ), profitability performance (PF), customer satisfaction (CS), environmental performance (EP), and social performance (SP). Participants are asked to rate their level of agreement on a scale from 0 to 5 for each statement regarding the performance of their firm.

The last two sections cover the demographic information of the firm as well as the owner/entrepreneur. This section collects demographic data about the firm including the gender of the employee/respondent, the age of the firm in years, and the number of employees in the firm. Demographic information collected about the owner/entrepreneur include the position of the respondent in the firm, educational qualification, and years of experience. The demographic information sections provide additional context about the firms and owners/entrepreneurs participating in the study. The questionnaire covers different dimensions of the study, including technological innovation, entrepreneurial orientation, and firm performance. It utilizes a rating scale to gather respondents' perceptions and opinions on these dimensions. In all the sections, participants are asked to rate their agreement on a scale from 0 to 5 for each statement regarding the concept being measured. The instrument for data collection can be found in Appendix A.

3.5.1 Measures of firm performance

This was measured by the amount of goods and services that was patronized daily. This measure constituted the financial performance (profitability) of the firm, customer satisfaction, product quality, and operational performance.

3.5.2 Measures of technological innovation

The two dimensions of technological innovation (product and process) were constructed using questionnaires. The questions selected under the product innovation dimension specifically addressed five areas which are: the presentation of a considerably enhanced product or new product, new or enhanced machines and equipment, additional renovated or improved equipment, products that were fresh to the firm, and the introduction of fresh products to the market.

The process innovation dimension addressed the introduction of new or considerably upgraded methods of developing, supporting activities for manufacturing processes, purchasing/leasing of machines/equipment, modification of existing techniques and the engagement in research meant for creating creations.

The justification for choosing these variables as measures of technological innovation was that they have been extensively employed in the extant literature. Process innovation and product innovation have been generally accepted as measures of technological innovation as explicitly stated in the Oslo Manual (OECD, 2005). They have become a reference point for defining and assessing innovative activities.

3.5.3 Measures of entrepreneurship

The usual dimensions of entrepreneurial orientation (autonomy, proactiveness, risk-taking, and aggressiveness) were used. Each dimension had questions based on the literature. The development of items for measuring entrepreneurship involved careful consideration of established relevant theories or theoretical frameworks that define and conceptualize entrepreneurship in existing empirical studies.

3.6 Structural equation modelling

3.6.1 Model estimation

To investigate the degree of relationship between technological innovation, entrepreneurial capacity, and performance of MSMEs in Ghana, the study employed a multi-criteria approach or technique. The approach adopted the Partial Least Square-Structural Equation Model (PLS-SEM) which included exploratory and confirmatory factor analysis that could extract the factors of the variables and examine the relationships between them.

3.6.2 Evaluating the structural model

This focused on issues relating to the structural model such as collinearity, effect size, importance and significance of the structural model, the predictive significance of the path model, and the joint weight of the exogenous variables or measures. To escape any spurious results, we first checked for collinearity. According to Hair et al. (2019), a variance inflation factor value of at least 5 and a tolerance of at most 0.2 is an indication of a collinearity problem. To determine the path coefficient, the study further conducted a test of significance for the structural model relationships. Evidence of stronger correlation ranged from close to +1 to -1, while path coefficient closer to zero (0) were taken as indications of weaker relationships. Findings on the path coefficient were based on t-values and the p-value significance levels.

3.7 Ethical concerns and clearance

The research was steered by the processes involved in the data collection and analysis of scientific studies governed by the University of the Witwatersrand. Firstly, all respondents used in the study were 18 years and above. Secondly, permissions were taken from all respondents before their engagement. Lastly, all information regarding the identity, location, ages, and other personal details are ensured to remain strictly confidential. Measures were implemented to ensure that the outcome of the study provided fairness and reliability and to ensure the avoidance of deception, exaggeration, bias, and the use of inappropriate language in line with the Ethical Clearance attached in Appendix B obtained from the Human Research Ethics Committee.

Common method bias was addressed through careful design of the questionnaire, separation of measures, separation of time, as well as anonymity and confidentiality. Different response formats and reverse-coded items were included to minimize response tendencies or acquiescence bias. Also, we separated the measures of independent, dependent, and control variables into different sections to allow for a more objective assessment of the variables.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Introduction

The chapter presents the results and discussion needed to unravel the three research hypotheses. The PLS-SEM nonparametric tool is employed to examine the relationships among the constructs and indicators without making any distributional assumptions on the data. Particularly, the study investigates the relationship among technological innovation, entrepreneurial orientation, and the performance of MSMEs in Ghana. Accordingly, the study is streamlined based on the relationship between technological innovation and entrepreneurial orientation and their individual and combined effects on firm performance.

4.1 Empirical results

4.1.1 Relationship between technological innovation and entrepreneurial orientation

The initial focus of this study considers the effect of technological innovation on entrepreneurial orientation. It explores how the adoption, integration, and/or advancement of technology influences the mindset, behavior, and activities associated with entrepreneurial orientation.

The analysis begins with a model evaluation to determine its fitness through construct reliability (as measured by Cronbach's alpha and Rho_A), indicator reliability, convergent validity, and discriminant validity as argued by Nitzl (2016). Construction dependability was assessed using composite reliability. The study also presents an average variance extracted (AVE) with a cut-off of 0.5, suggesting the model's convergent validity.

Table 1a and 1b present the summary of measurement scales for models 1 and 2, respectively. These demonstrate that some constructions have composite reliability (CR) values above 0.7 in most instances, demonstrating the structures' resilience (Straub, 1989). The item loadings for each model proved that the indicator's minimal cut-off of 0.5 was accurate, which is consistent with Hair et al. (2014). Also, for convergent validity, all indicators with values larger than 0.5 are loaded. According to Fornell and Larcker (1981), the AVE for each model should be at least 0.601, showing that the products often have higher volatility than the variance implied by the concept. All latent variables have an AVE of at least 0.5, hence the outcomes show the models' convergent validity.

Table 13a: Summary of Measurement Scale for Model 1

Model 1: Effect of entrepreneurial orientation on technological innovation					
Latent Variable	Loadings	CA	Rho_A	CR	AVE
AG		0.770	0.986	0.888	0.800
AG1	0.831				
AG2	0.954				
AU		0.835	0.836	0.901	0.752
AU1	0.837				
AU2	0.887				
AU3	0.877				
PC		0.865	0.899	0.902	0.652
PC1	0.604				
PC2	0.833				
PC3	0.857				
PC4	0.854				
PC5	0.857				
PD		0.832	0.845	0.882	0.601
PD1	0.662				
PD2	0.707				
PD3	0.836				
PD4	0.785				
PD5	0.866				
PR		0.962	0.962	0.975	0.929
PR1	0.965				
PR2	0.962				
PR3	0.965				
RS		0.862	0.950	0.913	0.779
RS1	0.928				
RS2	0.953				
RS3	0.752				

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS) Source: Source: Abebrese (2023)

Table 14b: Summary of Measurement Scale for Model 2

Model 2: Effect of technological innovation on entrepreneurial orientation					
Latent Variable	Loadings	CA	Rho_A	CR	AVE
AG		0.770	0.806	0.895	0.810
AG1	0.873				
AG2	0.927				
AU		0.835	0.841	0.900	0.751
AU1	0.847				
AU2	0.883				
AU3	0.869				
PC		0.865	0.895	0.902	0.652
PC1	0.614				
PC2	0.833				
PC3	0.855				
PC4	0.853				
PC5	0.855				
PD		0.832	0.848	0.882	0.601
PD1	0.659				
PD2	0.705				
PD3	0.839				
PD4	0.783				
PD5	0.870				
PR		0.962	0.962	0.975	0.929
PR1	0.965				
PR2	0.962				
PR3	0.964				
RS		0.862	0.923	0.915	0.782
RS1	0.915				
RS2	0.957				
RS3	0.772				

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS) Source: Source: Abebrese (2023)

Table 2 shows the discriminant validity using the Fornell-Larcker Criterion. This is also presented for models 1 and 2 which are addressing the bidirectional relationship between entrepreneurial orientation and technological innovation. For discriminant validity to be adequate, “the square roots of each construct’s AVE should be higher than the correlations of that construct with all other constructs” (Fornell-Larcker, 1981, p. 8). The values in bold face are larger than other correlation values among the latent variables when examined both vertically and horizontally, as seen in Table 2. Thus, the criteria for discriminant validity have been met in both models.

Table 15: Discriminant Validity: Fornell-Larcker Criterion

	AG	AU	FA	FS	PC	PD	PR	RS
Model 1: Effect of entrepreneurial orientation on technological innovation								
AG	**0.894**							
AU	-0.142	**0.867**						
FA	0.320	-0.179	**1.000**					
FS	0.176	-0.001	0.009	**1.000**				
PC	0.049	0.538	-0.143	0.092	**0.807**			
PD	-0.138	0.777	-0.161	0.021	0.711	**0.775**		
PR	-0.225	0.854	-0.224	0.005	0.590	0.736	**0.964**	
RS	0.711	0.020	0.268	0.110	0.267	0.009	0.008	**0.882**
Model 2: Effect of technological innovation on entrepreneurial orientation								
AG	**0.900**							
AU	-0.136	**0.867**						
FA	0.324	-0.176	**1.000**					
FS	0.165	-0.001	0.009	**1.000**				
PC	0.050	0.538	-0.141	0.092	**0.807**			
PD	-0.135	0.781	-0.161	0.020	0.708	**0.775**		
PR	-0.226	0.851	-0.224	0.005	0.589	0.736	**0.964**	
RS	0.725	0.018	0.268	0.112	0.264	0.004	0.004	**0.885**

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS) Source: Abebrese (2023)

In Table 3, the predictive relevance of the constructs which acted as dependent variables in the SEM is presented. This is demonstrated by the Q^2. The rule of thumb is Q^2 value > 0 for the exogenous variables (Henseler et al., 2009) are recommended. As a result, the closer the Q^2 is to the adjusted R square, the better. Henseler et al. (2009) provided Q^2 values criteria; $0.02 \leq Q^2 < 0.15$ (weak effect), $0.15 \leq Q^2 < 0.35$ (moderate effect) and $Q^2 > 0.35$ (strong effect). It can be seen from Table 3 that the constructs (dependent variables) in each model are strongly explained by their corresponding independent variables. Specifically, PC (0.410) and PD (0.610) from model 1 are strongly explained. Same can also be said of model 2 for AG, AU, PR, and RS.

Table 16: Constructs and Indicators Predictive Relevance

	Q^2	RMSE	MAE
Model 1			
PC	0.410	0.772	0.598
PD	0.610	0.628	0.485
Model 2			
AG	0.701	AG	0.160
AU	0.504	AU	0.603
PR	0.514	PR	0.552
RS	0.709	RS	0.205

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS) Source: Source: Abebrese (2023)

After achieving construct reliability, indicator reliability, convergent validity and discriminant validity, the study sets out to assess the diagnostics of the coefficients for models 1 and 2. This is presented in Table 4 for adjusted R square, effect size (f square) and variance inflation factor (VIF). Table 4 has multiple dependent and independent variables for each of the two models. The dependent variables are shown in brackets for clarity.

Table 17: Diagnostic Tests of Coefficients

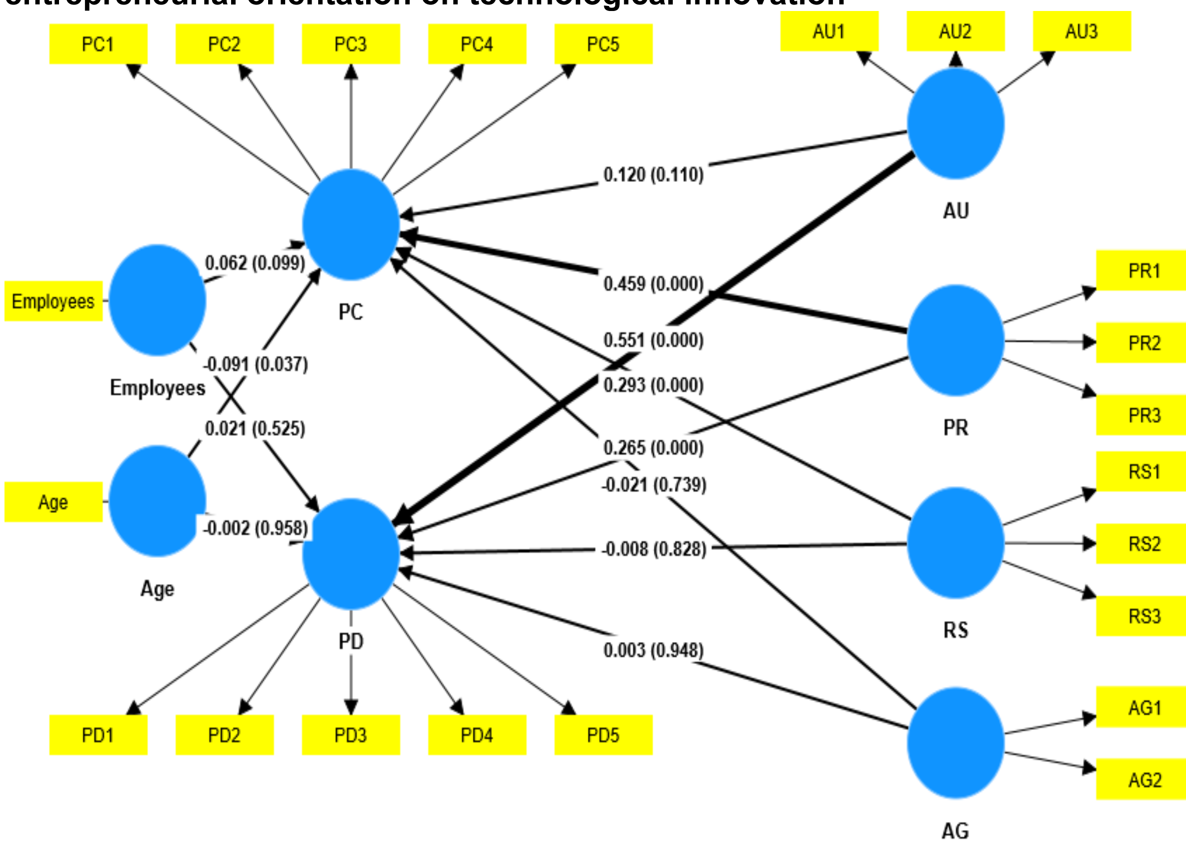
Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process

Variables	Adjusted R^2	f^2	VIF	Adjusted R^2	f^2	VIF
	Model 1 (PC)			**Model 1 (PD)**		
AG	0.423	0.000	2.390	0.618	0.000	2.390
AU	0.423	0.007	3.763	0.618	0.214	3.763
FA	0.423	0.013	1.160	0.618	0.000	1.160
FS	0.423	0.006	1.038	0.618	0.001	1.038
PR	0.423	0.091	4.058	0.618	0.046	4.058
RS	0.423	0.069	2.187	0.618	0.000	2.187
	Model 2 (AG)			**Model 2 (AU)**		
FA	0.171	0.119	1.029	0.609	0.007	1.029
FS	0.171	0.024	1.013	0.609	0.001	1.013
PC	0.171	0.049	2.032	0.609	0.001	2.032
PD	0.171	0.051	2.028	0.609	0.806	2.028
	Model 2 (PR)			**Model 2 (RS)**		
FA	0.558	0.024	1.029	0.215	0.000	1.029
FS	0.558	0.001	1.013	0.215	0.105	1.013
PC	0.558	0.020	2.032	0.215	0.006	2.032
PD	0.558	0.441	2.028	0.215	0.176	2.028

innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS) Source: Abebrese (2023)

The models provided by the effect of all other variables on their respective dependent variables from Table 4 signify that PC, PD, AG, AU, PR, and RS are explained at 42%, 62%, 17%, 61%, 56% and 22% respectively. The effect size measure presented in Table 4 shows that except for PD in model 2 (PR) which has a strong effect (f^2 = 0.441), all the independent variables have a small effect on their corresponding dependent variables as per Cohen's f^2. From Table 4, the maximum VIF of 4.058 which is lower than 5 (Hair et al., 2014) demonstrates that the independent variables are free of multicollinearity.

Figure 2: Path coefficients and bootstrapping results on the effect of entrepreneurial orientation on technological innovation

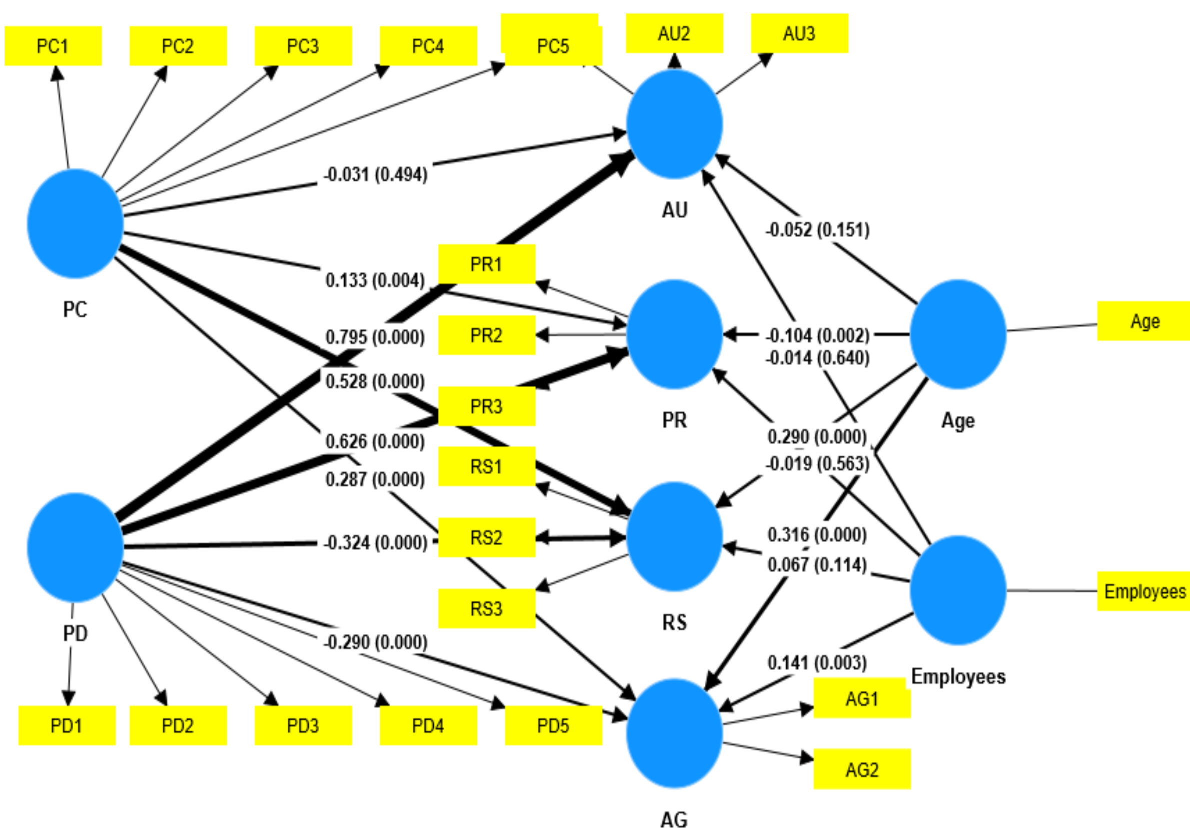


Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS)
Source: Abebrese (2023)

The effect of entrepreneurial orientation on technological innovation was tested using two main proxies for technological innovation, PD and PC. The study employed four explanatory variables namely AU, PR, RS, and AG, and two control variables measured by Age and number of employees. The constructs AU *($\beta = 0.551$, $p < 0.05$)*, and PR *($\beta = 0.265$, $p < 0.05$)* showed a significant positive effect on PD. In contrast, RS *($\beta = -0.008$, $p > 0.05$)*, and AG *($\beta = 0.003$, $p > 0.05$)*, proved to have an insignificant influence on PD.

Interestingly, the results on PC showed some contradicting findings as PR *($\beta = 0.459$, $p < 0.05$),* and RS *($\beta = 0.293$, $p < 0.05$),* significantly affected PC positively. However, the effects of AU *($\beta = 0.120$, $p > 0.05$)*, and AG *($\beta = -0.021$, $p > 0.05$)*, on PC were found to be insignificant. The results suggested a positive but nonsignificant influence of number of employees on PD *($\beta = 0.021$, $p > 0.05$),* and PC *($\beta = 0.062$, $p > 0.05$).* Age was found to have an insignificant negative effect on PD *($\beta = -0.002$, $p < 0.05$),* but negatively affected PC *($\beta = -0.091$, $p < 0.05$)*.

Figure 3: Path coefficients and bootstrapping results on the effect of technological innovation on entrepreneurial orientation



Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS)
Source: Abebrese (2023)

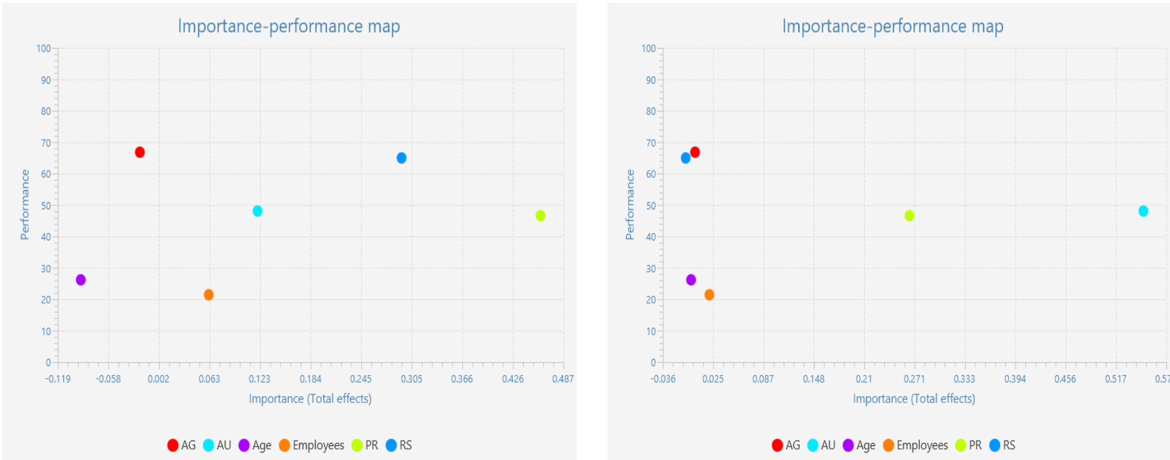
The results presented examined the effect of technological innovation (PD and PC) on entrepreneurial orientation (AU, PR, RS, and AG), controlled by Age and number of employees. The effect of PD on AU *($\beta = 0.795, p < 0.05$),* and PD on PR *($\beta = 0.626, p < 0.05$),* were found to be positive and significant at the 5% level. In contrast, PD was found to have a significant negative effect on RS *($\beta = -0.324, p < 0.05$),* and AG *($\beta = -0.290, p < 0.05$).* The results revealed that PC had a significant positive impact on PR *($\beta = 0.113, p < 0.05$),* and on RS *($\beta = 0.528, p < 0.05$).* At the same time, PC had a statistically significant positive impact on AG *($\beta = 0.287, p < 0.05$)*. However, the results suggested a negative but nonsignificant effect of PC on AU *($\beta = -0.031, p > 0.05$)*.

The control variables (age and number of employees) produced no significant effects on AU *($\beta = -0.052, p > 0.05$)* and *($\beta = -0.014, p > 0.05$)* respectively. On the contrary, Age proved to have a significant positive relationship with RS *($\beta = 0.290, p < 0.05$),* and AG *($\beta = 0.316, p < 0.05$)*. Similarly, number of employees had a positive and significant influence on AG *($\beta = 0.141, p < 0.05$),* but produced no effect on RS *($\beta = 0.067, p > 0.05$)*. Age *($\beta = -0.104, p < 0.05$),* significantly affected PR negatively. However, the results generated indicate that the negative relationship that exists between the number of employees and PR was statistically non-significant since the evidence found was insufficient *($\beta = -0.019, p > 0.05$)*.

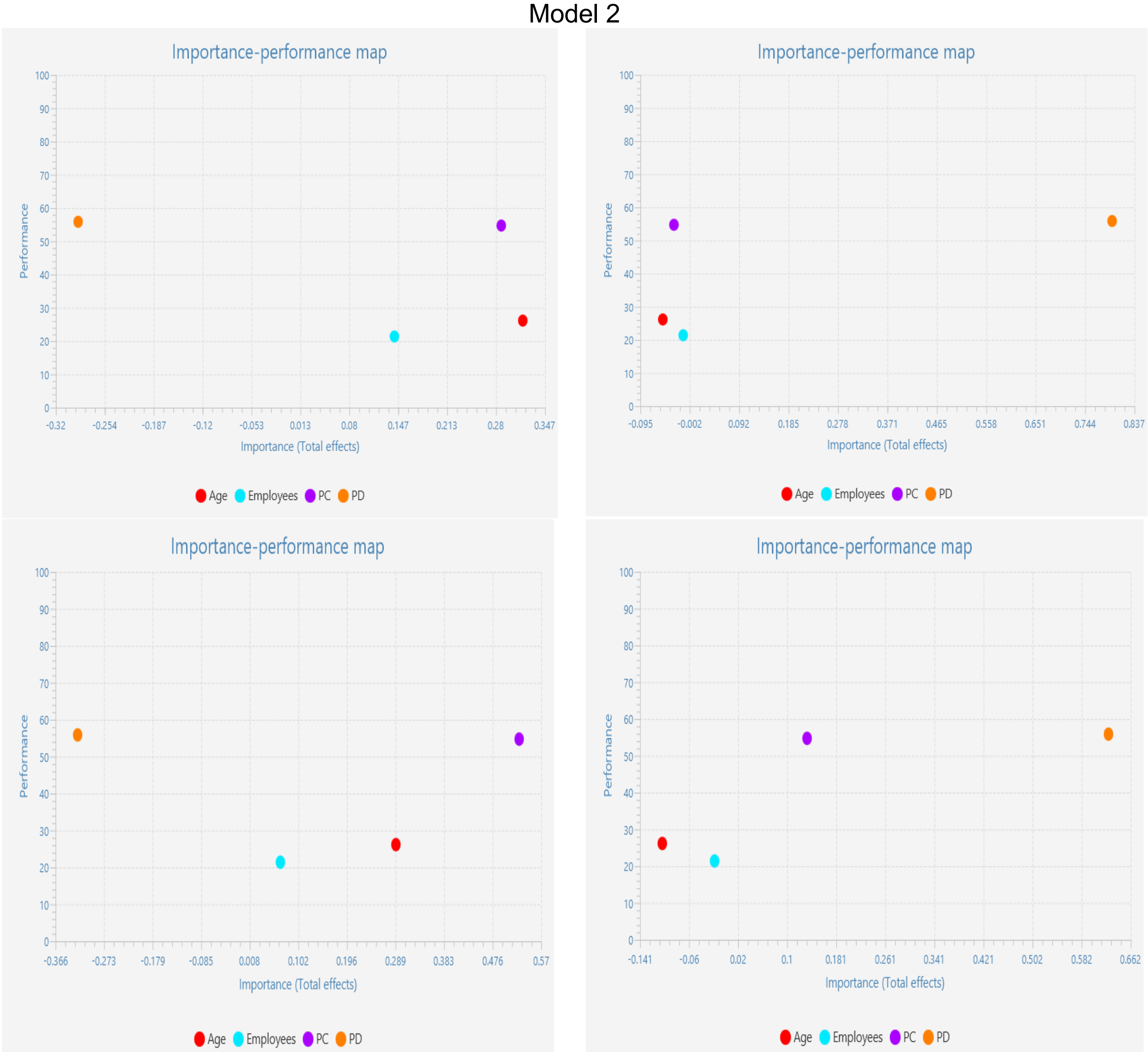
This section provides the direct nexus between technological innovation and entrepreneurial orientation. This is supported by the importance-performance and total effects tests. It can be seen from Figure 3 in Model 1 that aggressiveness (as a measure of entrepreneurial orientation) has the most impact on technological innovation. For Model 2, product innovation has the most impact on entrepreneurial orientation.

Figure 4: Importance performance map on the nexus between technological innovation and entrepreneurial orientation

Model 1



Model 2



Source: Abebrese (2023)

4.1.2 Technological innovation, entrepreneurial orientation, and firm performance

In this section, the combined effect of technological innovation and entrepreneurial orientation on the performance of MSMEs in Ghana is investigated.

Construct Reliability, Indicator Reliability, and Convergent Validity

The PLS-Structural Equation Modelling findings begin with a model evaluation to determine its fitness by analysing the construct's reliability (as measured by Cronbach's alpha and Rho_A), the indicator's reliability, convergent validity, and discriminant validity (Nitzl, 2016) as shown in Table 5. Construction dependability was assessed using composite reliability (CR). The study also presents an average variance extracted (AVE) with a cut-off of 0.5, suggesting the model's convergent validity.

From Table 5, all constructions have composite reliability (CR) values above 0.7 in most instances, demonstrating the structures' resilience (Straub, 1989). Item loadings for each model in Table 4 show that the minimal cut-off of 0.5 was accurate (Hair et al., 2014). For convergent validity, all indicators with values larger than 0.5 are loaded (Hair et al., 2014). According to Fornell and Larcker (1981), the AVE for each model should be at least 0.601, showing that the products often have higher volatility than the variance implied by the concept. All latent variables have an AVE of at least 0.5, hence the outcomes show the models' convergent validity.

Table 18: Summary of Measurement Scale

LV	Loadings	CA	Rho_A	CR	AVE
AG		0.770	0.770	0.897	0.813
AG1	0.898				
AG2	0.905				
AU		0.851	0.442	0.849	0.743
AU2	0.998				
AU3	0.700				
PC		0.880	0.915	0.916	0.732
PC1	0.866				
PC2	0.862				
PC3	0.863				
PC4	0.830				
PD		0.766	0.771	0.895	0.810
PD1	0.910				
PD2	0.890				
PR		0.962	1.020	0.974	0.927
PR1	0.970				
PR2	0.948				
PR3	0.970				
RS		0.862	0.883	0.916	0.786
RS1	0.896				
RS2	0.952				
RS3	0.805				
Performance		0.898	0.898	0.918	0.585
FP1	0.774				
FP2	0.744				
FP3	0.743				
FP4	0.735				
FP5	0.704				
FP6	0.763				
FP7	0.816				
FP8	0.832				

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm performance (FP), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS)
Source: Abebrese (2023)

Moreover, Table 6 shows the discriminant validity using the Fornell-Larcker Criterion. This is also presented for the effects of entrepreneurial orientation and technological innovation on performance. For discriminant validity to be adequate, “the square roots of each construct's AVE should be higher than the correlations of that construct with all other constructs" (Fornell-Larcker, 1981, p. 8).

Table 19: Discriminant Validity: Fornell-Larcker Criterion

	AG	AU	Age	Employees	PC	PD	PR	Perf	RS
AG	**0.902**								
AU	-0.089	**0.862**							
FA	0.325	-0.162	**1.000**						
FS	0.156	0.042	0.009	**1.000**					
PC	0.046	0.413	-0.146	0.096	**0.855**				
PD	0.078	0.489	-0.100	0.094	0.790	**0.900**			
PR	-0.229	0.785	-0.223	0.003	0.569	0.580	**0.963**		
FP	0.561	-0.036	0.279	0.247	0.302	0.312	-0.103	**0.765**	
RS	0.733	-0.039	0.266	0.112	0.251	0.243	-0.003	0.633	**0.886**

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS)

The values in bold face are larger than other correlation values among the latent variables when examined both vertically and horizontally, as seen in Table 6. This suggests that the criteria for discriminant validity have been met.

In Table 8, the predictive relevance of the constructs which acted as dependent variables in the SEM is presented. This is demonstrated by the Q^2. The rule of thumb is Q^2 value > 0 for the exogenous variables (Henseler et al., 2009) are recommended. As a result, the closer the Q^2 to the adjusted R square, the better. Henseler et al. (2009) provided Q^2 values criteria; $0.02 \leq Q^2 < 0.15$ (weak effect), $0.15 \leq Q^2 < 0.35$ (moderate effect) and $Q^2 > 0.35$ (strong effect).

Table 7: Constructs and Indicators Predictive Relevance

Latent Variable	Q2	RMSE	MAE
Performance	0.525	0.694	0.535

Source: Abebrese (2023)

It can be seen from Table 8 that performance is strongly explained by entrepreneurial orientation and technological innovation. Specifically, performance is strongly explained by entrepreneurial orientation and technological innovation. After achieving construct reliability, indicator reliability, convergent validity and discriminant validity, the study sets out to assess the diagnostics of the coefficients. This is presented in Table 8 for adjusted R square, effect size (f square) and variance inflation factor (VIF). Table 8 has multiple dependent and independent variables.

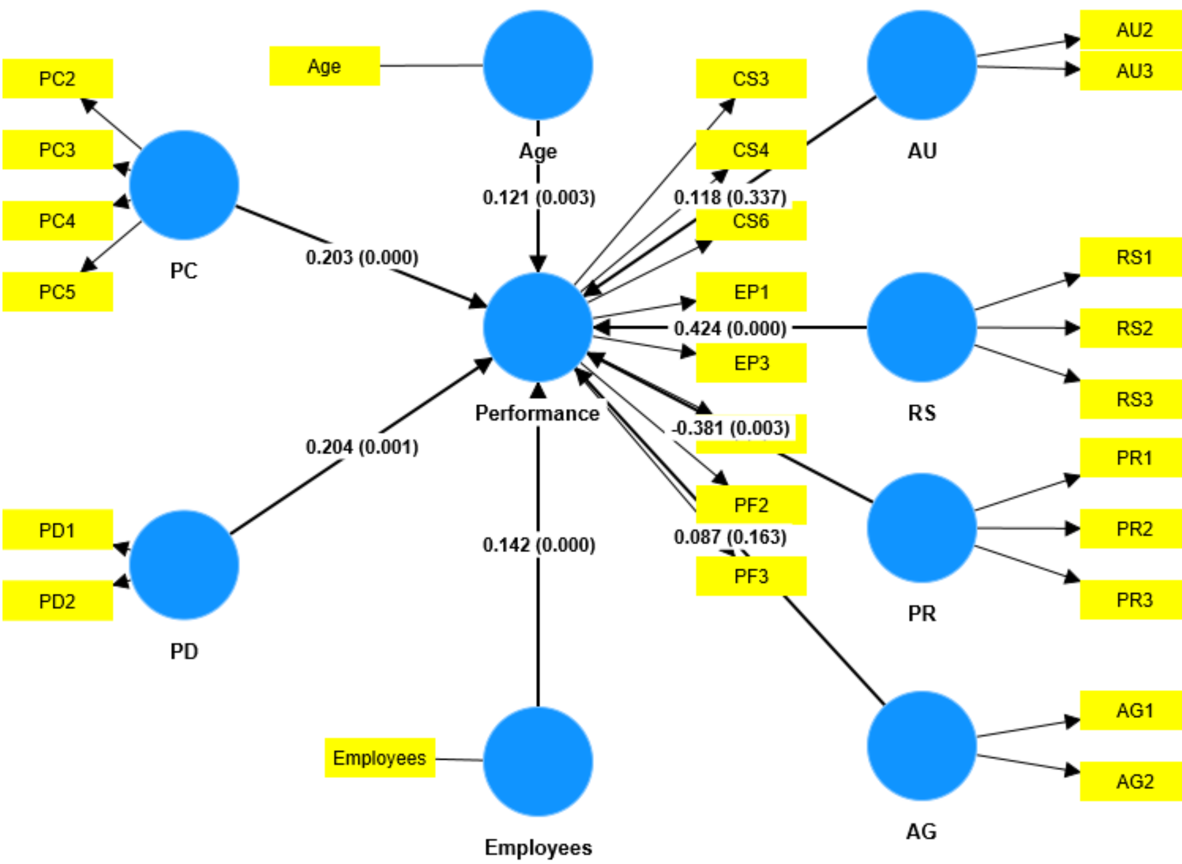
Table 20: Diagnostic Tests of Coefficients

Variables	Adjusted R^2	f^2	VIF
AG	0.536	0.006	2.750
AU	0.536	0.010	2.938
FA	0.536	0.028	1.174
FS	0.536	0.043	1.038
PC	0.536	0.030	2.967
PD	0.536	0.031	2.991
PR	0.536	0.082	3.878
RS	0.536	0.151	2.622
AU	0.536	0.006	2.750

Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Proactiveness (PR), and Risk-seeking (RS)
Source: Abebrese (2023)

On the effect of entrepreneurial orientation and technological innovation on firm performance, Table 8 denotes that performance is explained at about 54%. The effect size measure presented in Table 8 shows that entrepreneurial orientation and technological innovation has a small effect on performance as per Cohen's f^2. From Table 4, the maximum VIF of 3.878 which is lower than 5 (Hair et al., 2014) shows that entrepreneurial orientation and technological innovation are free of multicollinearity.

Figure 5: Path coefficients and bootstrapping results on the effects of entrepreneurial orientation and technological innovation on performance



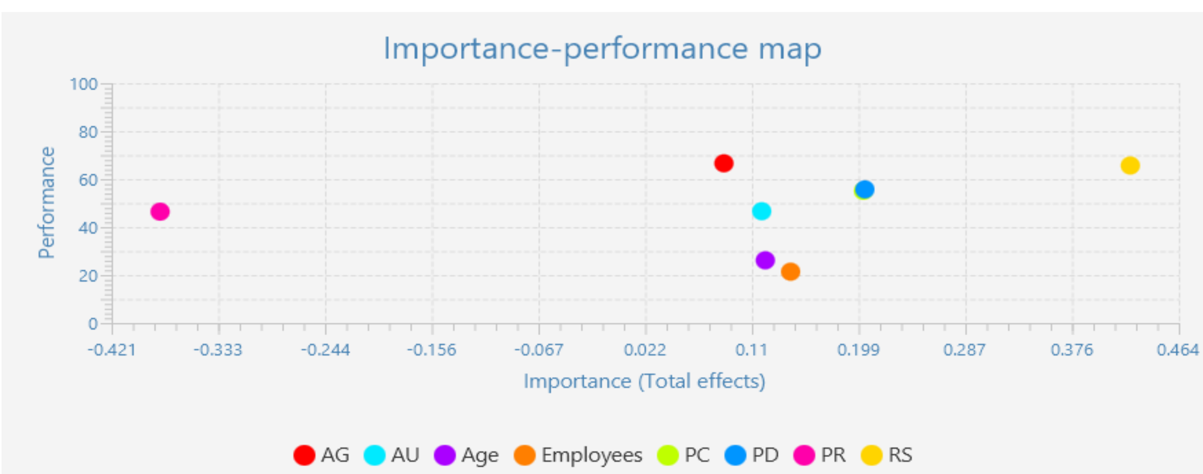
Notes: The variables are Aggressiveness (AG), Autonomy (AU), Firm age (FA), Firm size (FS), Process innovation (PC), Product innovation (PD), Firm performance (PF), Proactiveness (PR), and Risk-seeking (RS)

Source: Abebrese (2023)

The effects of entrepreneurial orientation and technological innovation on performance were analyzed and presented above. Age and number of employees were employed as control variables for the model. The findings of the study revealed a positive and significant relationship exists between RS and performance *($\beta = 0.424$, $p < 0.05$)*, while PR had a significant negative influence on performance *($\beta = -0.381$, $p < 0.05$)*. However, AU *($\beta = 0.118$, $p > 0.05$)*, and AG *($\beta = 0.087$, $p > 0.05$)*, exhibited a positive nonsignificant effect on performance. Interestingly, technological innovation dimensions PD *($\beta = 0.204$, $p < 0.05$)*, and PC *($\beta = 0.203$, $p < 0.05$)*, proved to have a significant positive influence on performance. Also, Age *($\beta = 0.121$, $p < 0.05$)*, and number of employees *($\beta = 0.142$, $p < 0.05$)*, produced similar findings on performance.

This section provides the direct impact of technological innovation and entrepreneurial orientation on performance. This is supported by the importance-performance and total effects tests. It can be seen from Figure 5 that AG (measuring entrepreneurial orientation) has the most impact on performance.

Figure 6: Importance performance map on the effect of entrepreneurial orientation and technological innovation on performance



Source: Abebrese (2023)

4.1.3 Effect of technological innovation and entrepreneurial orientation on firm performance

The analysis begins with the construct's reliability (as measured by Cronbach's alpha and Rho_A), the indicator's reliability, convergent validity, and discriminant validity (Nitzl, 2016) as shown in Table 9. Construction dependability was assessed using composite reliability (CR). The study also presents an average variance extracted (AVE) with a cut-off of 0.5, suggesting the model's convergent validity.

Table 21: Summary of Measurement Scale

LV	Loadings	CA	Rho_A	CR	AVE
TI & EO		0.843	0.854	0.874	0.566
PC2	0.630				
PC4	0.690				
PC5	0.690				
PD1	0.664				
PD2	0.662				
RS1	0.734				
RS2	0.762				
RS3	0.614				
Performance		0.929	0.930	0.938	0.587
CS1	0.661				
CS2	0.723				
CS3	0.772				
CS4	0.704				
CS5	0.656				
CS6	0.703				
EP1	0.737				
EP2	0.623				
EP3	0.680				
EP6	0.613				
PF1	0.733				
PF2	0.755				
PF3	0.761				
SP1	0.688				
SP2	0.665				

Notes: The variables are Customer satisfaction (CS), Environmental performance (EP), Process innovation (PC), Product innovation (PD), Product quality (PQ), and Social performance (SP) Source: Abebrese (2023)

From Table 9, all constructions have composite reliability (CR) values above 0.7 in most instances, demonstrating the structures' resilience (Straub, 1989). The item loadings in Table 9 proved that the indicator's minimal cut-off of 0.5 was accurate (Hair et al., 2014). For convergent validity, all indicators with values larger than 0.5 are loaded (Hair et al., 2014). According to Fornell and Larcker (1981), the AVE for each model should be at least 0.566, showing that the products often have higher volatility than the variance implied by the concept. All latent variables have an AVE of at least 0.5, hence the outcomes show the models' convergent validity.

Moreover, Table 10 shows the discriminant validity using the Fornell-Larcker Criterion. This is also presented for the combined effects of entrepreneurial orientation and technological innovation on performance. For discriminant validity to be adequate, "the square roots of each construct's AVE should be higher than the correlations of that construct with all other constructs" (Fornell-Larcker, 1981, p. 8).

The values in bold face are larger than other correlation values among the latent variables when examined both vertically and horizontally, as seen in Table 10. This suggests that the criteria for discriminant validity have been met. In Table 11, the predictive relevance of the constructs which acted as dependent variables in the SEM is presented. This is demonstrated by the Q^2. The rule of thumb is Q^2 value > 0 for the exogenous variables (Henseler et al., 2009) are recommended. As a result, the closer the Q^2 to the adjusted R square, the better. Henseler et al. (2009) provided Q^2 values criteria;

$0.02 \le Q^2 < 0.15$ (weak effect), $0.15 \le Q^2 < 0.35$ (moderate effect) and $Q^2 > 0.35$ (strong effect).

Table 22: Discriminant Validity

	Age	Employees	Performance	TI & EO
FA	**1.000**			
FS	0.009	**1.000**		
FP	0.250	0.242	**0.699**	
TI & EO	0.081	0.142	0.698	**0.682**

Notes: The variables are Entrepreneurial orientation (EO), Firm age (FA), Firm size (FS), Firm performance (FP), and Technological innovation (TI) Source: Abebrese (2023)

Table 23: Constructs and Indicators Predictive Relevance

Latent Variable	Q2	RMSE	MAE
Performance	0.534	0.688	0.510

Source: Abebrese (2023)

It can be seen from Table 11 that performance is strongly explained by the combined effects of entrepreneurial orientation and technological innovation. After achieving construct reliability, indicator reliability, convergent validity and discriminant validity, the study sets out to assess the diagnostics of the coefficients. This is presented in Table 12 for adjusted R square, effect size (f square) and variance inflation factor (VIF). Table 12 has the combined effects of entrepreneurial orientation and technological innovation on performance.

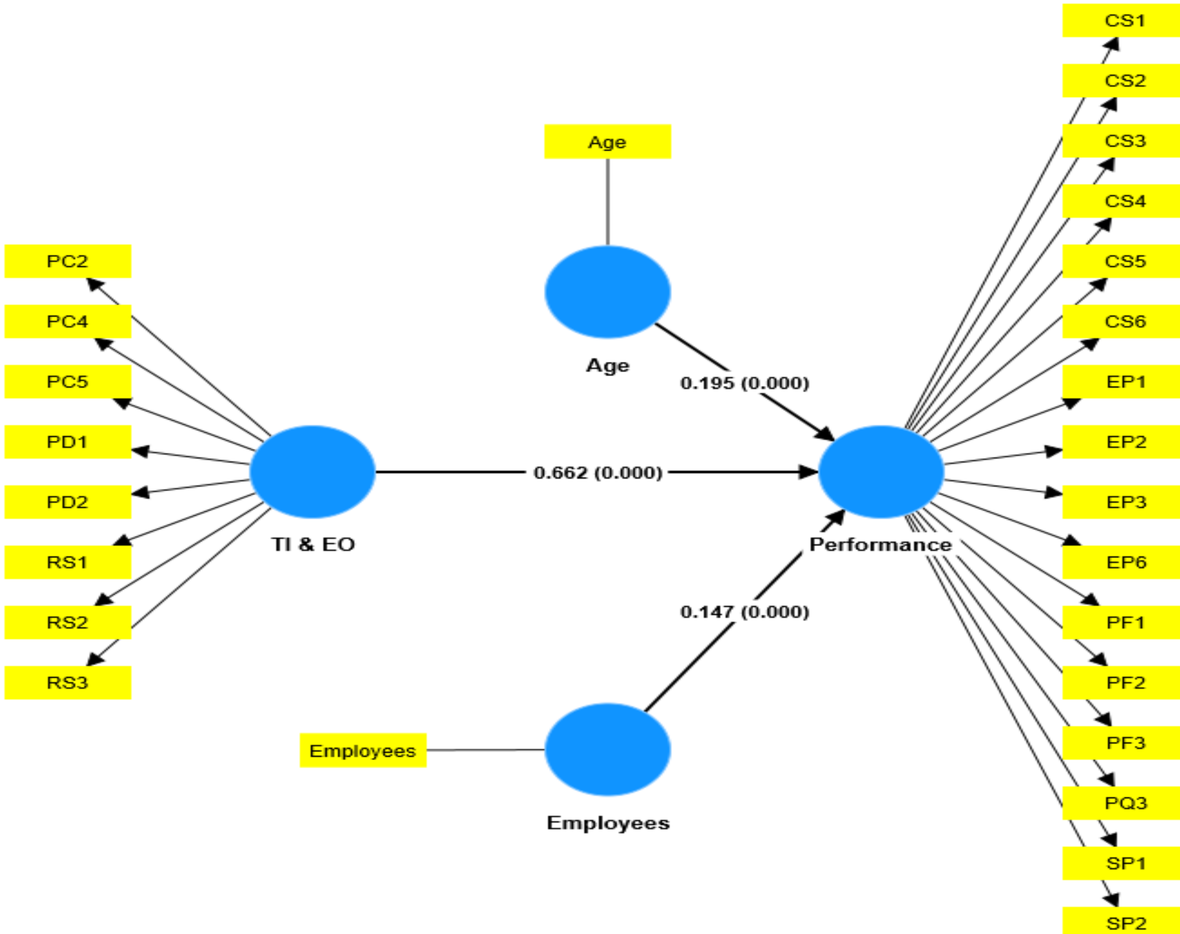
Table 24: Diagnostic Tests of Coefficients

Variables	Adjusted R^2	f^2	VIF
FA	0.543	0.083	1.007
FS	0.543	0.046	1.021
TI & EO	0.543	0.940	1.027

Notes: The variables are Entrepreneurial orientation (EO), Firm age (FA), Firm size (FS), Firm performance (FP), and Technological innovation (TI) Source: Abebrese (2023)

The model presented by the combined effect of entrepreneurial orientation and technological innovation on firm performance from Table 12 denotes that performance is explained at about 54%. The effect size measure presented in Table 8 shows that the combined effect of entrepreneurial orientation and technological innovation has a strong effect on performance as per Cohen's f^2. From Table 12, the maximum VIF of 1.027 which is lower than 5 (Hair et al., 2014) shows that the model representing the combined effect of entrepreneurial orientation and technological innovation on performance are free of multicollinearity.

Figure 7: Path coefficients and bootstrapping results on the combined effects of entrepreneurial orientation and technological innovation on performance

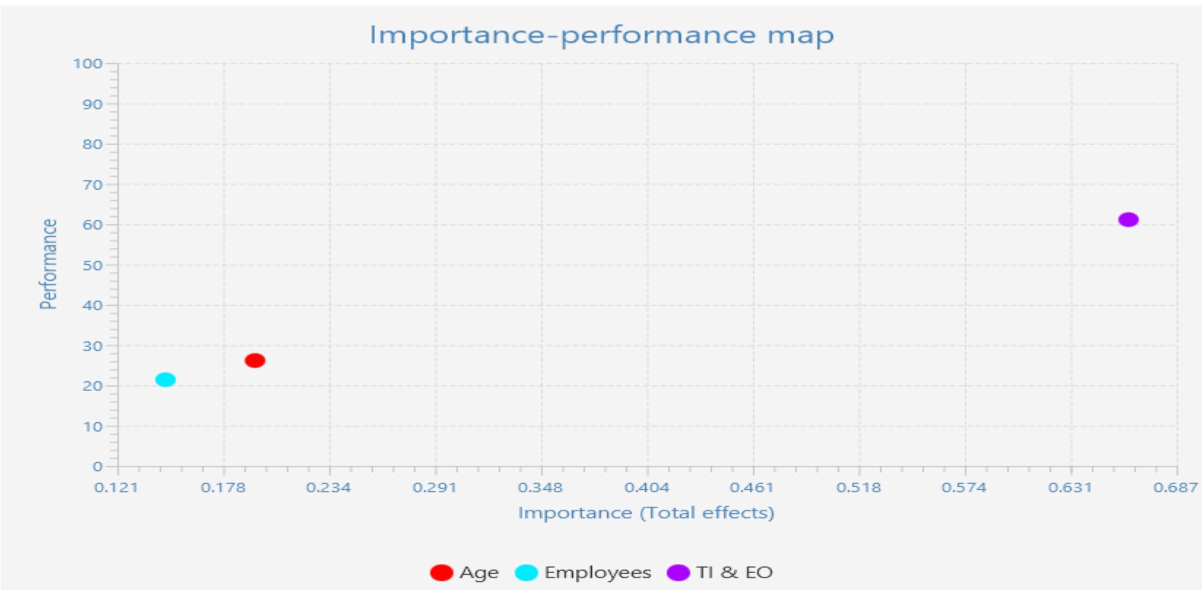


Notes: The variables are Customer satisfaction (CS), Environmental performance (EP), Process innovation (PC), Product innovation (PD), Product quality (PQ), Profitability performance (PF), Risk-seeking (RS), and Social performance (SP) Source: Abebrese (2023)

The combined effects of entrepreneurial orientation and technological innovation on performance while controlling for Age and number of employees were presented above. The findings of the study revealed a positive and significant effect of TI and EO on performance *($\beta = 0.662$, $p < 0.05$)*. Also, firm age *($\beta = 0.195$, $p < 0.05$)*, and firm size *($\beta = 0.147$, $p < 0.05$)* positively influence performance.

This section provides the direct impact of technological innovation and entrepreneurial orientation on performance. This is supported by the importance-performance and total effects tests. It can be seen from Figure 7 that the combined effect of technology innovation and entrepreneurial orientation has the most impact on performance.

Figure 8: Importance performance map on the combined effect of entrepreneurial orientation and technological innovation on performance



Source: Abebrese (2023)

4.2 Discussion of results

4.2.1 Relationship between technological innovation and entrepreneurial orientation

The first objective of the study sought to determine the effect of technological innovation (PD and PC) on entrepreneurial orientation (AU, PR, RS, and AG), controlled by age and firm size (measured by number of employees). The findings suggest that, *at 5% significance levels,* PD has a significant positive effect on AU and PR. PD was, however, found to have an insignificant negative influence on RS and AG. PC had a significant positive impact on PR, RS and AG but an insignificant negative relation with AU. The control variables exhibited no significant influence on AU and PR. Age, however, exhibited a direct relation with RS and AG whilst the number of employees also exhibited a significant effect on AG but no effect on RS. Age significantly and negatively affected PR. The number of employees and PR were also found to have an insignificant negative relationship.

According to the theory by Schumpeter, innovation is primarily the determination of the role that is played by big reputable organizations that present some obstacles to new entrants because of the domination of the market by larger firms. Schumpeter further adds that innovative firms are the manifestation of their individual specific skills which enables them to embark on a novel pursuit that has the potential to pose as a threat to other businesses, which may lead to economic growth, and which invariably causes disequilibrium. Similarly, Chatterjee et al. (2020) found that adopting ICT enhances entrepreneurial orientation which leads to micro-entrepreneurship on the part of women. According to Setyanti et al. (2013), innovation has become a partial mediation in relation to entrepreneurship orientation toward the performance of businesses. Galindo and Mendez-Picazo (2013) found similar results and claimed that innovation is key when it comes to drivers of economic growth and the entrepreneur is the channel through which new technologies are introduced to stimulate high output and profit levels of firms. Ndubisi (2014) found that innovation within organizations tends to promote entrepreneurship.

The effect of entrepreneurial orientation on technological innovation was the next to be investigated. Technological innovation was measured using (PD and PC) whilst entrepreneurial orientation was also measured using (AU, PR, RS, and AG) with age and number of employees as control variables. The findings suggest that, *at 5% significance levels,* AU and PR exhibit a significant positive effect on PD whilst, RS and AG exhibit a negative and positive insignificant effect on PD, respectively. However, PR and RS showed a significant positive influence on PC whilst AU and AG exhibited a positive and negative insignificant effect on PC respectively. The control variables of Age and number of employees also exhibited various effects on PC and PD. The number of employees had a positive nonsignificant effect on PD and PC whilst firm age had an insignificant negative effect on PD but a positive significant relation with PC.

The findings also concur with the Schumpeterian theory of innovation which states that there is disequilibrium resulting from the acquisition of new knowledge and innovation expressed through the manufacturing of new products and the introduction of new technologies. According to this theory, information asymmetry among entrepreneurs is the main reason why some entrepreneurs have and exhibit the acquisition of new knowledge and transform it into new technology. The study further confirms the findings of Margaret (2008) who found that entrepreneurial orientation brings about the implementation of drastic product innovation activities. Ndubisi (2014) also realized that EO promotes innovation in organizations that promote entrepreneurship. This relationship between EO, innovation, and entrepreneurship plays an important role in organizational performance, which creates a competitive advantage for the organization.

4.2.2 Effect of technological innovation on firm performance

The second objective investigated the influence technological innovation had on the performance of MSMEs in Ghana. The results suggest that both measures of technological innovation – product innovation and process innovation – exhibited significant positive effects on performance. The control variables – firm age and firm size – had a significant positive influence on performance. The findings harmonize with the resource-based theory which emphasizes that a sustained competitive advantage occurs when organizations can have inimitable resources, that are not substitutable, tacit in nature, and synergistic (Peppard & Rylander, 2001; Barney, 1991). These resources may be tangible or intangible and represent the inputs into a firm's production process, such as equipment, or capital as well as the expertise of the distinctive personnel, capital, patents, and endowed management. This consequently tends to be a competitive advantage and the business can rely on for improved production and service ultimately leading to increased performance.

The findings concur with Ukpabio et al. (2018) who found that there is a significant direct association between the various dimensions of innovation and firm performance. They further added that SMEs strive positively when organizations adopt technological innovation. Chen, Wang, and Huang (2020) conducted a similar study in China and found that innovation capabilities partially mediate the relationship between organisational innovation and firm performance and that organizational innovation partially moderate the relationship between innovation capabilities and firm performance. Atalay et al. (2013) similarly revealed that technological innovation has a significant and positive impact on the performance of firms. This finding is further affirmed by Akinwale et al. (2017) who found similar results.

4.2.3 Effect of entrepreneurial orientation on firm performance

The findings suggest that the dimensions of entrepreneurial orientation exhibited varying significance and directions. RS exhibited a positive significant relationship whilst PR exhibited a negative relation. Both AU and AG exhibited a positive but insignificant relation with performance. From the resource-based theory, intangible resources such as entrepreneurial orientation can be a competitive resource which improves organisational performance in the long run. Kiyabo and Isaga (2020) confirm this by reporting that technological innovation and EO are firm resources that generate competitive edge to firms and ultimately boost the performance of firms. The finding is in harmony with the claim of Galbreath et al., (2020) who revealed that different dimensions specifically those that focused on the composite measure found a unidirectional effect of EO on firm performance. Raisal, Tarofder, and Ilmudeen (2021) also found that there is a strong positive causal relation between EO and firm performance. Li et al. (2021) also found that EO, innovation types, and intellectual property influenced firm performance positively.

4.2.4 Technological innovation, entrepreneurial orientation, and firm performance

The third objective sought to analyse the combined effect of technological innovation and entrepreneurial orientation on performance. The positive and significant combined effect of TI and EO on performance confirms the resource-based theory, which views resources as a source of competitive advantage. TI and EO are vital resources businesses can use to enhance competition and performance. Zhao (2005) found that entrepreneurship and innovation are related positively. The study further reported that entrepreneurship and innovation combine to boost an organization. This implies that entrepreneurship and innovation are complementary, and as such combine to ensure organisational success and sustainability in a dynamic and changing business environment. Similarly, Setyanti et al. (2013) add that innovation has become a partial mediation of entrepreneurial orientation toward the performance of businesses.

Technological innovation and entrepreneurial innovation can combine in various ways to significantly impact firm performance. Their synergy can lead to improved competitiveness, growth, and overall success for a business. By combining technological and entrepreneurial innovation, firms can create a dynamic and innovative environment that is well-equipped to seize opportunities, adapt to changes, and stay competitive. This synergy can lead to enhanced firm performance through increased revenue, market share, efficiency, and the ability to respond effectively to the challenges of a rapidly evolving business landscape. The relationship between entrepreneurship and innovation is essential for organizations to thrive and remain competitive in dynamic and evolving business landscapes. Entrepreneurial innovation is about recognizing opportunities, while innovation more broadly involves the creation and implementation of solutions. Together, they enhance a company's ability to adapt, create value, and sustain success in a rapidly changing world.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

This is the last chapter of the dissertation. It presents the summary of major findings, and conclusions and offers recommendations from the study.

5.1 Summary of major findings

Objective 1: Relationship between technological innovation and entrepreneurial orientation

From the first objective, the study developed the hypothesis that there is a bidirectional positive relationship between the dimensions of technological innovation and those of entrepreneurial orientation. The results suggest that product innovation has a significant positive influence on autonomy and proactiveness. Also, there is a significant negative effect of product innovation on aggressiveness and risk-seeking. On the other hand, process innovation has a positive effect on aggressiveness, proactiveness, and risk-taking.

Regarding the effect of entrepreneurial orientation on technological innovation, the findings suggest that both autonomy and proactiveness exhibit significant positive impacts on product innovation. Also, proactiveness and risk-taking showed a significant positive effect on process innovation.

Objective 2: Effect of technological innovation on firm performance

The second objective examined the effects of technological innovation on the performance of MSMEs in Ghana. It was established that technological innovation has a positive effect on firm performance. The findings suggest that both product innovation and process innovation exhibit significant positive effects on firm performance. Also, both firm age and firm size affect firm performance positively.

Objective 3: Effect of entrepreneurial orientation on firm performance

The third objective considered the effect of the dimensions of entrepreneurial orientation on firm performance. It was found that the dimensions of entrepreneurial orientation exhibited varying significance and directions. Both proactiveness and risk-taking have significant effects on firm performance. However, whereas risk-taking exerts a positive effect, proactiveness influences firm performance negatively.

Objective 4: Combined effect of technological innovation and entrepreneurial orientation on performance

The final objective examined the combined effect of technological innovation and entrepreneurial orientation on performance. The findings showed that technological innovation and entrepreneurial orientation combine to exhibit a positive and significant effect on firm performance. This confirms the resource-based theory which views resources as a source of competitive advantage.

5.2 Conclusions

Objective 1: Relationship between technological innovation and entrepreneurial orientation

The finding that product innovation significantly enhances autonomy and proactiveness underlines the potential to foster a proactive and autonomous organizational environment. However, the interesting finding that product innovation has a significantly negative effect on aggressiveness and risk-seeking suggest that an increased focus on product innovation may lead to a more risk-averse and less aggressive approach.

The positive effect of process innovation on aggressiveness, proactiveness, and risk-taking highlights its potential to promote a culture of risk-taking and proactive behaviour within MSME organization. Also, whereas autonomy and proactiveness have significant positive influences on product innovation, proactiveness and risk-taking have a positive impact on process innovation. This reflects the connection between entrepreneurial orientation and technological innovation.

Objective 2: Effect of technological innovation on firm performance

Both product innovation and process innovation are found to exert significant positive effects on firm performance. This underscores the pivotal role of technological advancements in enhancing overall firm performance. Additionally, the study identifies that firm age and firm size have positive effects on firm performance, suggesting that established firms with a history of operations and larger firms tend to perform better.

Objective 3: Effect of entrepreneurial orientation on firm performance

Proactiveness and risk-taking both significantly impact firm performance. However, the relationship between proactiveness and firm performance is negative, suggesting that an excessive focus on proactiveness may adversely affect firm performance. In contrast, risk-taking positively influences firm performance, indicating that a calculated approach to risk can lead to improved overall performance.

Objective 4: Combined effect of technological innovation and entrepreneurial orientation on performance

The integration of technological innovation and entrepreneurial orientation yields a robust understanding of their combined impact on firm performance. The findings underscore the positive and significant effects of their combined influence on firm performance. This supports the resource-based theory, which considers resources, including technological innovation and entrepreneurial orientation, as vital sources of competitive advantage. The combined effect highlights the synergistic potential of technological innovation and entrepreneurial orientation to drive improved firm performance, which underscores the importance of balancing these factors to achieve a competitive edge.

5.3 Recommendations for MSMEs

Based on the findings and conclusions enumerated above, the following recommendations are discussed for organizations to consider.

Objective 1: Relationship between technological innovation and entrepreneurial orientation

Organizations should strike a balance between product and process innovation. While product innovation can enhance autonomy and proactiveness, it is important to ensure that it does not stifle aggressiveness and risk-taking. Process innovation should be encouraged to promote a culture of risk-taking and proactive behaviour. Organizations should foster entrepreneurial orientation, with a particular focus on proactiveness and risk-taking. Proactiveness can be a double-edged sword, so it is important to strike a balance. Encourage employees to take calculated risks and be proactive in identifying and seizing opportunities.

Objective 2: Effect of technological innovation on firm performance

Given the positive effects of both product and process innovation on firm performance, organizations should prioritize technological innovation. Investing in research and development, staying up-to-date with technological advancements, and encouraging a culture of innovation can enhance overall firm performance. Recognize the positive impact of firm age and size on firm performance. Established firms with a history of operations and larger organizations tend to perform better. While start-ups and smaller firms can be highly innovative, they should focus on growing strategically and building a strong operational foundation as they mature.

Objective 3: Effect of entrepreneurial orientation on firm performance

Organizations should continuously assess the balance between proactiveness and risk-taking. While proactiveness is important for seizing opportunities, it should be managed to avoid negatively impacting firm performance. Regularly evaluate how these dimensions influence decision-making and adapt strategies accordingly.

Objective 4: Combined effect of technological innovation and entrepreneurial orientation on performance

Develop resource allocation strategies that consider the combined effect of technological innovation and entrepreneurial orientation on firm performance. Seek to align these factors with the organization's overall strategy to maximize competitive advantage and performance. Create a work environment that encourages innovation, knowledge sharing, and collaboration. Employees should feel empowered to contribute ideas and participate in both technological and entrepreneurial innovation efforts. Continuously monitor and adapt strategies based on changing market conditions and emerging trends. Flexibility and the ability to adapt to evolving circumstances are crucial for success in dynamic business environments.

5.4 Contributions of the Study

The study will make contributions to the empirics, policy, and practice by testing the effects of technological innovation and entrepreneurial orientation on the performance of MSMEs. The in-depth knowledge and understanding provided by this study will be relevant for researchers, practitioners, and policymakers in many ways.

Research/Empirical

We will contribute to attempts made by previous researchers to fill gaps in the existing body of knowledge and the incumbent literature. This novelty is achieved through the broadened focus or scope of the study and the advancement of the empirical technique. The study tests the combined effect of technological innovation and entrepreneurial orientation on the performance of both manufacturing and services, unlike other studies that focus on only technological innovation and manufacturing firms. Another contribution is the focus on micro-enterprises that have been relegated in most existing studies. The application of a more robust structural equation model will meaningfully add to the enrichment of the literature on developing countries.

Practical/Managerial

In addition to the empirical contribution, the findings of the study will provide prescriptions for business owners, government, and policymakers on the salient drivers of entreprenology and how to promote technological innovations in MSMEs in the Ghanaian economy. For entrepreneurs, it will give them the adequate knowledge necessary for decisions regarding the need for investment in technological innovation and its effects on entrepreneurial orientation and firm performance.

Government/Policy

Lastly, the study will guide government and policymakers on how to re-channel and align technological investment activities of MSMEs with government priorities. While many studies and literature abound on technological investment in developed countries, this study will contribute to providing information specific to the Ghanaian context. The knowledge and understanding produced by this study will inform how resources are disbursed for the provision of goods and services. Consequently, the deeper analysis of product and process innovations will inform policymakers on which area to invest more in terms of technological innovation. The findings may serve as an important reference for policymakers on technological investment in Africa.

5.5 Suggestions for further research

This thesis has employed a quantitative approach to investigate the role of technological innovation and entrepreneurial orientation on the performance of MSMEs in Ghana. Some avenues have been identified for further research to augment a deeper and better understanding of the subject matter. Future studies can employ qualitative research or mixed methods to gain a richer understanding of how MSMEs in Ghana integrate technological innovation and entrepreneurial orientation into their business strategies.

Also, future research could delve deeper into specific industries within the micro, small, and medium enterprises (MSMEs) sector in Ghana. Investigating how technological innovation and entrepreneurial orientation impact different industries could yield valuable insights tailored to the unique challenges and opportunities each sector presents.

In addition, there is a need to explore the mediating and moderating factors that influence the relationship between technological innovation, entrepreneurial orientation, and MSME performance. For instance, the role of government policies, access to financing, or the impact of socioeconomic factors could be further examined.

Lastly, considering the growing global emphasis on environmentally responsible business practices, further research could be undertaken to investigate the role of technological innovation and entrepreneurial orientation in promoting sustainability and green entrepreneurship within MSMEs in Ghana. This could be done together with how digital technologies, e-commerce, and online platforms have been employed to boost sustainability and green entrepreneurship.

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APPENDIX A: QUESTIONNAIRES

Author's Contact:
M: +233 24 886 6338
E:
2323756@students.wits.ac.za

Technological innovation, entrepreneurial orientation, and performance of MSMEs in Ghana

Dear Participant

I am a MMR Student at the University of Witwatersrand in Johannesburg, South Africa. I invite you to take part in a survey as part of my thesis on "Technological innovation, entrepreneurial orientation, and performance of MSMEs in Ghana". The survey is being conducted to solicit the views of owner/managers of MSMEs. The outcome of the study would better inform managers/entrepreneurs, policymakers, and researchers the appropriate strategies to manage investments in technology and innovation.

Please note that your response is private and confidential. Your organisation was carefully selected to be part of this survey due to its position in the MSME industry. This is a self-administered questionnaire. Your identity and that of your organisation will not be disclosed in any data or report. Survey responses will not be linked with any personal or organisational records.

Participation in this survey is highly valued, but voluntary. You are free to withdraw consent at any time. We will protect your anonymity and the confidentiality of your response to the fullest possible extent within the limits of the law and ethics of research.

If you have any questions about this survey or would like further information, please contact me on 0248866338 or 2323756@students.wits.ac.za.

The survey takes between 10 and 15 minutes to complete. Thank you for considering your involvement in this survey.

Yours sincerely

Rose Akosua Abebrese

PRINCIPAL INVESTIGATOR

SECTION A: MEASURES OF TECHNOLOGICAL INNOVATION

On a scale 0 (no agreement) to 5 (high agreement), please rate the level of agreement with the existence of the following technological innovation in your firm. Please tick {√} in response to the questions.

Code	Technological Innovation (TI)						
PC	**Process Innovation**	0	1	2	3	4	5
PC1	The company has the capability to adjust the processes at all levels concerning the production process, inventory, distribution, logistics, etc						
PC2	The company displays clever response to new processes introduced by other companies						
PC3	The company improves existing machinery and equipment.						
PC4	The company uses machinery adaptations and develops original processing solutions						
PC5	The company has the capability to adjust the processes at all levels concerning the production process, inventory, distribution, logistics, etc						
PD	**Product Innovation**						
PD1	The company introduces new and innovative products into the market						
PD2	The company has the capability to bring in new knowledge or technologies to develop new products						
PD3	The company makes efforts to develop new products in terms of hours/persons, team and training involved						
PD4	The company has the capability to use new materials, new product function and new design						
PD5	The company's products are modified and improved						

SECTION B: DIMENSIONS OF ENTREPRENEURIAL ORIENTATION

On a scale 0 (no agreement) to 5 (highest agreement), please rate the level of agreement with the following statements with respect to entrepreneurial orientation in your firm. **Please tick {√} in response to the questions.**

Code	Entrepreneurial Orientation (EO)	0	1	2	3	4	5
AU	**Autonomy**						
AU1	We support individuals and/or teams that work autonomously						
AU2	We believe that the best results occur when individuals and/or teams decide for themselves						
AU3	Individuals and/or teams take decisions without constantly referring to their supervisor(s)						
PR	**Pro-activeness**						
PR1	Imitativeness towards competitors						
PR2	Imitativeness towards introducing new products						
PR3	Overall position						
RS	**Risk-taking**						

RS1	Willingness to take risk						
RS2	Dealing with uncertainty						
RS3	Exploring potential opportunities						
AG	**Aggressiveness**						
AG1	Our firm often leads the competition by initiating actions						
AG2	Our firm typically adopts a very competitive posture						

SECTION C: FIRM PERFORMANCE

On a scale 0 (no agreement) to 5 (high agreement), please rate the level of agreement with the issues raised with respect to the performance of your firm. Please tick {√} in response to the questions.

Code	**Firm Performance (FP)**	0	1	2	3	4	5
PQ	**Product Quality**						
PQ1	Our products have the perceived quality compared with that of competitors						
PQ2	Our products have the perceived reliability						
PQ3	Our products have the perceived durability						
PF	**Profitability Performance**						
PF1	Net profit margin during the last three years						
PF2	Sales growth during the last three years						
PF3	Market growth during the last three years						
CS	**Customer Satisfaction**						
CS1	Our customers follow us on social media						
CS2	Our products have high repurchase rate						
CS3	We receive less number of complaints						
CS4	We have high new customer retention						
CS5	Our customers frequently leave positive feedback						
CS6	Our customers appreciate our service verbally.						
EP	**Environmental Performance**						
EP1	We have projects to improve/recover the environment						
EP2	We use recyclable materials						
EP3	The firm has not experienced any lawsuits due to its practices						
EP4	We use lesser water in our operations						
EP5	We have met all the environmental performance goals we set for the business.						
EP6	We have data to show that our contribution to pollution has reduced drastically						
SP	**Social Performance**						
SP1	We have a number of social and cultural projects						
SP2	Our firm has not experienced any lawsuits						
SP3	We meet regulatory agencies requirement						
SP4	We engage in fair trade						
SP5	We work to reduce vulnerability in our community						
SP6	The business has good relations with the community						

SECTION D: DEMOGRAPHIC INFORMATION OF THE FIRM

1. Please indicate your gender
    0. Male [ ]   1. Female [ ]
2. What is the age of the firm (in years)? …………………

3. How many employees do you have? …………………

SECTION E: DEMOGRAPHIC INFORMATION OF THE OWNER/ENTREPRENEUR .

4. Please indicate your position in the firm:
    Owner [ ]   Manager [ ]   Owner/Manager [ ]   others, state………………

6. Please state your educational qualification:
    None [ ]   Basic [ ]   Secondary [ ]   University degree [ ]   others, state…………….…….

5. Please state your experience (in years) ……………...

THANK YOU FOR PARTICIPATING

APPENDIX B: ETHICAL CLEARANCE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Abebrese

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H21/11/01**
PROJECT TITLE	Techonological innovation, entrepreneurial orientation, and performance of micro, small and medium enterprises in Ghana
INVESTIGATOR(S)	Ms R Abebrese
SCHOOL/DEPARTMENT	Wits Business School/
DATE CONSIDERED	19 November 2021
DECISION OF THE COMMITTEE	Approved Risk Level: Minimal
EXPIRY DATE	09 August 2025

DATE 10 August 2022 **CHAIRPERSON** ____________________ (Professor J Watermeyer)

cc: Supervisor : Professor T Dorson-Anning

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I agree to completion of a regular progress report. For Minimal and Low studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

ROAA ____________________
Signature

11 / 08 / 2022
Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES