DRIVERS OF SUCCESSFUL COMMERCIALISATION OF INDIGENOUS INNOVATION: EVIDENCE FROM THE VOLTA REGION, GHANA

by

Harrison Paul Adjimah

Submitted in fulfilment of the requirements for the degree of

PhD in Management Sciences

(Entrepreneurship)

in the

Faculty of Management Sciences

at the

Central University of Technology, Free State

Supervisor: Professor DY Dzansi

Co-supervsor: Dr VY Atiase

March 2022

Central University of Technology, Free State

Central University of Technology, Free State

DECLARATION

I, Harrison Paul Adjimah with student number ______, declare that this research project submitted to the Central University of Technology, Free State, for the degree of PhD in Management Sciences (Entrepreneurship) is my independent work. It complies with all relevant policies, procedures, rules and regulations of the Central University of Technology, Free State. It has not been previously submitted to any institution, by me or any other person, in fulfilment or partial fulfilment of the requirements for attaining any qualification.

2/03/2022

Signature   Date

ABSTRACT

There is a limited understanding of the commercialization of indigenous innovation by firms in the small-scale industry (SSI) of many Sub-Saharan African countries. Meanwhile, SSIs and micro and small enterprises (MSEs) have become important strategic foci for governments in promoting entrepreneurship and innovation because of their potential for growth in terms of GDP, income, and jobs. In countries such as Ghana, a lack of reliable information from empirical studies has constrained appropriate policy formulation. Few studies that have investigated the factors that affect innovation and firm performance have not thoroughly examined the effects of these drivers on the commercial dimensions of sales, profitability, and employment generation of firms engaged in indigenous innovation activities. Even for variables such as finance, with evidence of overwhelming linkages, there are still shortcomings that require further investigations. Therefore, there is a need to thoroughly examine the drivers of commercialisation on the innovation performance of MSEs in order to profess appropriate interventions. The major aim of this study is to examine the impact of regulation, finance, organisational factors, market factors, and technology as key determinants of successful commercialisation of indigenous innovation in terms of MSE performance in Ghana.

Theoretically, the study adopts Below-the-Radar Theory of Innovation (BRTI), focusing on the bottom of the pyramid (BOP) and the Frugal Innovation Theory (FIT) as the underlying theoretical frameworks. The study assumes that Ghanaian MSEs engaged in indigenous small scale industrial activities are resource-constrained, serves the poor and deal with institutional voids, and that affordability, availability, awareness, and acceptability are key issues and therefore test the effects of such factors in the commercialisation of indigenous innovation in Ghana.

Methodologically, quantitative, and deductive reasoning approaches were used. Deductive reasoning has been adopted purposely to be able to test, confirm or reject various hypotheses presented and therefore make stronger claims which would be more impactful for decision makers. Primary data were collected through a quantitative method using a survey technique. Using stratified random sampling method, a total of 537 questionnaires were sent out in May 2021 to MSEs engaged in indigenous small scale industrial activities in the Volta Region of Ghana to collect primary data. Out of the number sent, 453 questionnaires were retrieved generating a response rate of 85%. Descriptive statistics and PLS-SEM were used to analyse the data. Following the Below-the-Radar Innovation views, and controlling for government incentives and commercialisation strategies, the study established regulation, finance, organisational factors, market factors and technology as the main drivers for the commercialisation of indigenous innovation in Ghana.

The findings in respect of the control model suggest government incentives to buyers of indigenous innovation have significant positive effects on all the dimensions of firm performance measured in the study, while incentives to MSEs have mixed effects. Incentives to MSEs have insignificant effect on profitability, significant negative effect on sales and feeling of success, and positive effect on employment. Again, the result of the control model revealed mixed effects of commercialisation strategies on firm performance. Thus, the method of commercialisation is insignificant on sales, profitability and feeling of success, and only has significant positive effects on employment. Similarly, the use of university innovation intermediary services has negative effects on sales but positive effects on profitability, employment and feeling of success, whilst pricing strategy is insignificant on all the indicators. The result of the full model provided evidence that, at a 5% statistical significance level, all the selected variables have impact on MSE performance, except regulation on sales which is insignificant. Some of the commercialisation factors, however, relate negatively to some performance indicators: Regulation has negative impact on profitability; finance has negative impact on profitability and feeling of success; and both organisational factors and technology have negative impact on employment level.

The study has made contributions to theory and policy, practice, and methodology. By using the data from 453 Ghanaian MSEs, the developed empirical model tested regulation, finance, organizational factors, market factors and technology as the main drivers of indigenous innovation performance at the firm level in terms of sales,

profitability, employment and feeling of achieved success. This model and the resultant framework can be applied in any national innovation system in a developing country context by policymakers, entrepreneurs, and other actors. By synthesizing the innovation literature particularly on indigenous innovation and its commercialisation which has limited research attention, the current study also made contributions to the innovation literature. Other specific contributions of the study include applying BRTI theory to deepen the understanding of the role of MSEs in the Ghanaian national innovation system. It highlights MSEs as the conduit for expansion of the industrial sector, contribution to national income, employment generation and sustenance of entrepreneurship in the national innovation system. The study also provided leading empirical evidence from Ghana on the effect of demand-side incentives on innovation performance.

ACKNOWLEDGEMENTS

First and foremost, I extend my profound gratitude to the Almighty God for his grace and blessings without which it would have been impossible to complete a work of this magnitude. I also acknowledge with humility the sacrificial times my supervisors Professor Dennis Yao Dzansi and Dr. Victor Yawo Atiase spared to guide me during this study. I acknowledge with great honour the value they added to this work.

My sincerest thanks also go to the management of both the Central University of Technology (CUT), Free State, South Africa and Ho Technical University, Ghana, who made the programme possible in the first place. Particularly, I am sincerely grateful to Professor Dennis Yao Dzansi and Professor Emmanuel Sakyi whose ingenuity and collaborative efforts made it possible for us to remain at posts and still smoothly undertake the PhD study.

Lastly, but not the least, I appreciate the support and encouragement of my family and friends. These include two great women in my life: my wife Marion Voy who made a lot of sacrifices to support me during this project and my late grandmother, Concordia Morny who contributed to giving me a good foundation in my education. My special thanks go to my friend, Frank Kulor, who continuously reminds me of my potential in the industry-academia space. To all who have supported me in one way or the other, I say thank you. Words cannot express my appreciation.

TABLE OF CONTENTS

Central University of Technology, Free State

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

1-D-1-F	One District One Factory Policy
AGI	Association of Ghana Industries
ASSI	Association small scale industries
AU	African Union
BOP	bottom of pyramid
BRI	below-the radar-innovation
CII	Commercialisation of indigenous innovation
COMAGENT	Method of commercialisation
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research
CSRPM	Centre for Scientific Research into Plant Medicine
CUT	Central University of Technology
EPA	Environmental Protection Agency
EU	European Union
FDA	Food and Drugs Authority
FI	Frugal innovation
GAEC	Ghana Atomic Energy Commission
GFZB	Ghana Free Zones Board
GINBU	Government incentives to buyers
GINMSE	Government incentives to indigenous innovators/sellers
GNIS	Ghanaian national innovation system
GRATIS	Ghana Regional Appropriate Technology Industrial Service
GSA	Ghana Standards Authority
ICT	Information and communications technology

ICT4AD	Ghana ICT for Accelerated Development
INSEAD	Institut Européen d'Administration des Affaires
IP	Intellectual Property
IPR	Intellectual Property Rights
KBI	knowledge Based Institutions
KNIS	Kenyan National Innovation System
KNUST	Kwame Nkrumah University of Science and Technology
MEST	Ministry of Environment Science and Technology
MESTI	Ministry of Environment Science, Technology, and Innovation
MOTI	Ministry of Trade and Industries
MSE	Micro and Small Enterprises
NBSSI	National Board for Small-Scale Industries
NEIP	National Entrepreneurship & Innovation Programme
NIS	National Innovation System
OECD	Organization for Economic Co-operation and Development
PLS	Partial Least Square
PRISTRA	Pricing Strategies
PV	Photovoltaic
R&D	Research and Development
SDG	Sustainable Development Goals
SEM	Structural Equation Model
SME	Small and medium-scale enterprises
SSI	Small Scale industry
STEPRI	Science and Technology Policy Research Institute
STI	Science, technology, and innovation

STIDEP	National Science, Technology, and Innovation Development Programme of Ghana
STIP	Science, Technology, and Innovation Policy
STISA,	Science, Technology, and Innovation Strategy for Africa
TH	Triple Helix
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNIDO	United Nations Industrial Development Organization
USUNIS	Use of University Innovation Intermediary Services
WIPO	World Intellectual Property Organization

CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

Innovation as a driver of industrialisation and socio-economic development has been extensively researched (Hu, 2015; Pece et al., 2015; Cirera & Muzi, 2016; Li et al., 2017; Edler & Fagerberg, 2017; Pradhan et al., 2018; OECD & Eurostat, 2018). Yet, the paucity of country-specific studies in sub-Saharan Africa limits the understanding of innovation in these settings (Bartels, Koria & Vitali, 2016; Bruno & Bruno, 2018; Hu, Danso, Mensah & Addai, 2020). The present study focuses on the commercialisation of indigenous innovation, innovations that originate locally and (or) are owned by the indigenes. Successful commercialisation of innovation refers to widespread adaptation and sales of innovation (Olefirenko & Shevliuga, 2017). It is typically measured at the firm level using sales, market shares, productivity, or profitability (Rass, Dumbach, Danzinger, Bullinger, & Moeslein, 2013). The study investigates the factors that drive the successful commercialisation of indigenous innovations by drawing sample data from the Volta Region of Ghana.

From a global perspective, innovative activities have been very high in the last decade (Global Innovaation Index, 2020). Meanwhile, the appalling innovation performance of many Sub-Saharan African countries such as Ghana is also reported (UNIDO, 2015; MESTI, 2017a; Bartel et al., 2016; UNESCO. 2018; Quaye, Sekyere & Acheampong, 2017; Global Innovation Index, 2020). In Ghana, excessive imports, and its associated economic problems of trade imbalances, weakening currency and high unemployment levels have led to calls for the promotion of made-in-Ghana goods or goods made from indigenous innovation (Ayelazuno, 2014). Some experts view the problem to be more of the commercialisation and not just the creation of innovative activities (Shpak, Kniaz, Myroshchenko, & Kolomiyets, 2014).

The reality is that the best way out of the country's long-standing challenges is entrepreneurship and indigenous innovation (NEIP, 2017). The focus is on micro and small enterprises (MSEes) in the small-scale industry (SSI). Theoretically, the prominence of SSIs is enhanced because of its perceived capacity to create employment for people at the bottom of the pyramid, and the capacity to withstand foreign exchange shocks which extends from intensive use of indigenous innovation (Ackah et al., 2012). Since indigenous resources and practices only become relevant when the resultant outputs create economic value, attract users, and get accepted on the market (Osoro, Kirama, Knoben & Vermeulen, 2015; Olefirenko & Shevliuga, 2017), it is important decision-makers understand the phenomena of innovation commercialisation. For these reasons, the commercialisation of indigenous innovation cannot be overlooked in Ghana.

This study is an attempt to unravel the intricacies of indigenous innovation in Ghana by identifying its commercialisation drivers and how these drivers affect the performance of firms that produce goods and services based on indigenous innovation in Ghana. Data was collected from indigenous innovation-based small-scale industries in the Volta Region. The aim is that, understanding the factors of commercialisation of indigenous innovation would help the promotion of these types of businesses.

Innovation is critical in achieving most of the 17 Sustainable Development Goals (SDGs). For example, SDG 9 recognises the investment in innovation as a crucial driver of economic growth and development. Innovation also has a strong linkage with development and poverty alleviation (SDG 1) in terms of resolving the day-to-day challenges of humans (Raghupathi & Raghupathi, 2017). Thirdly, in agriculture, innovation helps indirectly dealing with food security (SDG 2) (Adolwa, Schwarze, Bellwood-Howard, Schareika & Buerkert, 2017).

1.2 BACKGROUND OF THE PROBLEM

Despite the strong linkage between innovation and development, African countries continue to perform poorly in innovation drive (Nwuke, 2015; Cornell University, INSEAD & WIPO, 2018). Unsurprisingly, scholars continue to call for African countries to develop their indigenous innovation systems to support and sustain their development agenda (Feige & Vonortas, 2017; Botchie, Sarpong & Bi, 2017).

Conventional wisdom is that in commercialising innovation, one is more likely to fail than succeed (Orlova, 2014; Sparks, 2017). There is increasing recognition that most indigenous innovations fail to get to the commercialisation stage and even when they do, such firms do not perform well (Spinuzzi, Pogue, Nelson, Thomson, Lorenzini & French, 2016). This viewpoint suggests, among others, the need to understand the determinants of successful commercialisation of indigenous innovation in Ghana. Bruno and Bruno (2018) highlighted the need for a better understanding of the commercialisation of innovation to successfully address its challenges. Understanding the factors that drive successful commercialisation of indigenous innovation is important due to the belief that innovation originating in the developing world will become a major driver of economic development for these countries (Cirera et al., 2015). The promotion of indigenous innovation has, therefore, now permeated the policy agenda of most developing countries especially in Sub Saharan Africa (Dzansi, Rambe & Coleman, 2015; Fox, Senbet & Simbanegavi, 2016). While generally, Schumpeterian scholars believe that successful creation and commercialisation of innovation crucially requires control of a combination of skills, capital infrastructure and sophisticated consumers (Klepper, 2016), the factors that drive the commercialisation of indigenous innovation in Ghana, is not well understood (Klepper, 2016; Gosens et al., 2018).

With policymakers and citizens complaining that most new products flooding the markets are imported (Ibrahim, 2017; Quaye, Sekyere & Acheampong, 2017), there has been an ineffectual campaign for made in Ghana goods. It is also observed that most new businesses prefer to import and sell goods and services while most of the innovations on the market are brought by foreign-owned businesses (Ibrahim, 2017; Quaye et al., 2017). For these and many more reasons, improving the rate of commercialisation of indigenous innovation has become imperative.

While the call for intensified indigenous innovation is ongoing with varied opinions, (Watkins, Papaioannou, Mugwagwa & Kale, 2015; Huang, Hao & Leid, 2017), it is costly, risky, and path-dependent, and it is often argued that it is more efficient for developing countries to rather acquire foreign technology (Huang et al., 2017). Others have also raised the concern of the promotion of indigenous projects that are merely "re-inventing the wheel" (Amankwah-Amoah, 2016).

In exception of South Africa, African countries perform poorly in innovation development. For example, no African country ranks in the top 20 countries for patent applications, only two patents were granted to African countries by the U.S. Patent and Trademark Office and Africa is the worst performer of all the global regions in terms of I.P. generation and ownership (Nwuke, 2015). UNIDO (2015) observed high barriers to innovation exacerbated by a weak national innovation system is choking the rate of innovative economic activities in Ghana. Dutta et al. (2016) observed that Ghana's innovation performance has over the years been exceedingly low. The Value added per agriculturual worker of Ghana is only a third of the Philippian and a tenth of Brazil (World Bank, 2019). The Global Innovation Index, which assesses world economies based on their innovation capabilities, ranked Ghana 107th in 2018, 106th in 2019, 108th in 2020 out of 143 countries in terms of innovation performance (Cornell University et al., 2017; 2018; 2019; 2020).

The commercialisation of indigenous innovation is gaining significant relevance in the innovation discourse due to the increasing recognition of its role in entrepreneurship and job creation; knowledge transfer and further application; and economic growth (Chukhray & Stegnytskyi, 2015; Azarmi, 2016; Edler & Fagerberg, 2017; Olefirenko & Shevliuga, 2017). Cirera and Muzi (2016) highlighted the scarcity of literature on indigenous innovation commercialisation measures in sub-Saharan African countries such as Ghana. They suggested lessons could be learnt from other countries where applicable. Fu et al. (2016) analysed the contribution of innovation to a firm's performance among both formal and informal sectors and identified structural peculiarities common to most African countries. Oduro and Nyarku (2018) provided some evidence of some link between incremental innovation practices and the performance of some Ghanaian firms in terms of customer loyalty, sales growth, competitiveness, and global market reach.

1.3 PROBLEM STATEMENT

There is a dearth of indigenous innovation commercialisation studies on Ghana (Fu, Mohnen & Zanello, 2018; Weyori, Amare & Garming, 2018), which may be due to the few indigenous innovations that get commercialised in Ghana. This is ironic given numerous sponsored research remaining on their shelves (Jinbaan, Donkoh, Mabe & Kodwo, 2016; Weyori et al., 2018). The problem is, therefore, not the lack of innovation but its commercialisation. To fully comprehend any innovation, commercialisation problems, the process should involve investigating the causative factors (Bergek, Hekkert, & Jacobsson, 2015; Onufrey & Bergek, 2015). However, in the case of Ghana, the factors that drive the commercialisation of indigenous innovation is not well understood (Klepper, 2016; Gosens et al., 2018). This situation arises amid evidence of indigenous innovative activities in Ghana, with most of the innovations not getting commercialised (Jinbaan et al., 2016; Weyori et al., 2018).

The reasons the Ghanaian indigenous innovations are not being commercialised is an important research concern that needs to be investigated (Klepper, 2016; Gosens et al., 2018). Surprisingly, the literature search revealed only a handful of previous empirical studies relating to the phenomenon in Ghana (Anim-Somuah, 2010; Amankwah-Amoah & Sarpong, 2015; Jinbaan et al., 2016). The paucity of research on the subject creates a knowledge gap. In terms of practice, a lack of reliable information from the empirical study would make the formulation of appropriate policy to aid the commercialisation of indigenous innovation difficult, if not impossible.

Therefore, the problem for this study is to understand the phenomenon of successful commercialisation of indigenous innovation in Ghana. The study uses data from small and microscale businesses from indigenous innovation in the Volta Region to investigate the commercialisation drivers of indigenous innovations in Ghana.

1.4 RESEARCH AIM, QUESTIONS AND OBJECTIVES

1.4.1 Aim

This study intends to present the conceptual framework and empirical model that delineate the drivers of successful commercialisation of indigenous innovation. Based on the problem statement and background highlighted above (sections 1.2 and 1.3), the aim is to examine the factors that drive or constrain the capacity of small-scale businesses for indigenous innovation; contribute towards the successful commercialisation of indigenous innovation in Ghana; and extend the literature on indigenous innovation. To develop an applicable framework for the commercialisation of indigenous innovation, it is important to examine the factors that drive or constrain the capacity of indigenous small-scale businesses from the national innovation system (NIS) perspective and evaluate the efficiency of the existing models for the Ghanaian small-scale industry sector.

Relative to commercialisation of indigenous innovation, the national innovation framework literature emphasises activities such as entrepreneurial experimentation and materialisation; market formation; resource mobilisation; and demand legitimation; as well as importance of a wide variety of actors, including universities, research institutes, industry players, government agencies, financiers, consultants, certification bodies, maintenance industries, societal pressure groups, and consumers for the effective functioning of NIS (Teixeira, 2014; Gosens et al., 2018). Asheim et al. (2016) explain that the strength and quality of these elemental features and interactions between actors are important in determining effectiveness and efficiency in innovation generation and diffusion. Literature on national innovation systems is more prevalent in industrialised and emerging economies, but there are valuable lessons and significant implications for developing countries such as Ghana. Some authors argue that the innovation system approach should be adapted to the realities of developing countries and that NIS should be viewed through local cultural and institutional lenses rather than simply copying or following the latest policy fashion (Bartels et al., 2016).

The linkages between knowledge-based institutions (KBIs), as the main source of ideation and invention, and the production system are paramount for an effective national innovation system (UNIDO, 2015; OECD & EUROSTAT, 2018). The Triple Helix (TH) models extended the Aalborg-OECD approach and demarcated institutionally the three separate spheres of actors, which are government, industry, and KBIs; then actor interrelations and how these are strongly influenced by the market and technological innovation and vice versa (Teixeira, 2014; Bartels et al., 2016). According to available evidence, Ghana has almost all of the key institutional elements required for a functioning national innovation system. The country has recognised the importance of the innovation system in fostering technological and industrial development since its independence, has formulated a number of explicit policies, and has articulated its STI priorities (UNIDO, 2015; 2016; Quaye et al., 2019). However, the evidence over the years shows very weak linkages between KBIs and the production system and very low levels of innovativeness in business enterprises (Quarmine et al., 2014; Asare, 2016; Osei-Amponsah et al., 2016). The problem is not the innovations *per se* but their commercialisation. The Ghanaian innovation systems as public goods have not yielded the required expected externalities, leading to a huge innovation commercialisation gap. A model that analyses the factors that can drive the successful commercialization of indigenous innovative activities in countries such as Ghana is clearly needed.

Primarily, drawing upon the BOP theory and the theory of frugal innovation, the study examines the impact of the main commercialisation drivers on the successful commercialisation of indigenous innovation and firm performance in the Volta Region of Ghana. The resultant empirical model answers the research questions and achieves the aim of the study. Based on the presented aim, the following research questions or objectives are formulated.

1.4.2 Main and subsidiary research questions

1.4.2.1 Research question

How do regulatory, financial, organizational, market, and technological factors impact on the successful commercialization of indigenous innovations in Ghana?

1.4.2.2 Subsidiary research questions

1. What is the impact of regulation on the successful commercialisation of indigenous innovations in Ghana?
2. What is the impact of finance on the successful commercialisation of indigenous innovations in Ghana?
3. What is the impact of organisational factors on the successful commercialisation of indigenous innovations in Ghana?
4. What is the impact of market factors on the successful commercialisation of indigenous innovations in Ghana?
5. What is the impact of technology on the successful commercialisation of indigenous innovations in Ghana?
6. What is the influence of government incentives on the successful commercialisation of indigenous innovations in Ghana?
7. What is the influence of firm commercialisation strategies on the successful commercialisation of indigenous innovations in Ghana?

1.4.3 Main and subsidiary research objectives

1.4.3.1 Research objective

To examine factors that constrain the capacity of MSEs for successful commercialisation indigenous innovation and develop a framework and empirical model that can be applied to national innovation systems.

1.4.3.2 Subsidiary Research Objectives

The subsidiary objectives are to:

1. Examine the role of regulation in the successful commercialisation of indigenous innovations in Ghana.
2. Examine the role of finance in the successful commercialisation of indigenous innovations in Ghana.
3. Examine the role of organisational factors in the successful commercialisation of indigenous innovations in Ghana.
4. Examine the role of market factors in the successful commercialisation of indigenous innovations in Ghana.
5. Examine the role of technology in the successful commercialisation of indigenous innovations in Ghana.
6. Examine the influence of government incentives on the successful commercialisation of indigenous innovations in Ghana.
7. Examine the influence of firm commercialisation strategies on the successful commercialisation of indigenous innovations in Ghana.

1.5 NOVELTY OF THE STUDY

The study intends to develop and test a novel framework to promote/stimulate commercialisation of indigenous innovation for use by entrepreneurs, academics, and policymakers in the developing country context with specific reference to Ghana. To the best of the researcher's knowledge, which results from an extensive literature search, no such framework exists for Ghana bearing in mind that it is impossible to develop a one-size-fits-all framework. However, the framework could be adapted by other developing countries to suit their context. The study would be the first to comprehensively examine the pattern of below the radar innovation promotions and test applicability of the bottom of the pyramid and frugal innovation theories in Ghana

1.6 EXPECTED OUTCOMES OF THE STUDY

The outcome of examining the commercialisation of indigenous innovation in Ghana would be useful to multi-stakeholders and all players in the innovation system in developing countries. It would generate important insights for policy efforts of various African Governments towards the realisation of SDG 9, on industry innovation and infrastructure and invariably other 16 SDGs as indigenous innovation is multi-faceted and key in achieving most of the 17 SDGs. Innovation has a strong linkage with development and poverty. The research work would also lead to an extension of literature, and publication of papers in the areas of new venture creation, emerging technologies in entrepreneurship, higher education in entrepreneurship and entrepreneurial marketing.

The scientific outcomes of the study would be the several research articles that will be produced. In respect of social impact, the study also proposes a framework for commercialisation of indigenous innovation that can be used by new entrepreneurs and academic institutions in Ghana. The overall outcome of the study can be a basis for advocacy on more demand-side incentives to promote indigenous innovations. In addition, the study could lead to design and redesign innovation support projects that will directly benefit MSEss in the Volta Region of Ghana.

1.7 ORGANISATION OF THE STUDY

This thesis comprises 8 chapters including the introduction. The general organisation of the contents in the chapters is presented below.

Chapter 1: The introduction, provides the background to the study and raises the arguments and pertinent issues relating to indigenous innovation and its commercialisation in the developing countries. Specifically, it offers general introduction to the study, provides background to the research problem, and states the research problem, the research questions, related objectives, and the aim of the study. The chapter also presents the expected scientific outcome and social impact of the study.

Chapter 2: Commercialisation of indigenous innovation, highlights the gap in commercialisation of indigenous innovation in literature. It includes concepts of innovation, classifications of innovation, indigenous innovations, national indigenous innovation systems, and the role of indigenous innovations in economic development, and the process of indigenous innovation commercialisation. First, it presents a discussion on the concept and classification of innovation with the aim of providing a broader understanding of various forms of innovations and highlighting what can constitute indigenous innovation. The chapter also presents discussions on national innovation systems relative to indigenous innovation commercialisation process, which extends understanding of the role of indigenous innovations in economic development.

Chapter 3: The chapter focuses on Ghana and examines the Ghanaian national system of innovation (GNSI) and commercialisation issues. The specific issues discussed in the chapter includes Ghana's science technology and innovation (STI) challenges, GNSI and policy regimes, GNSI actors and actor linkages, innovation performance, barriers to innovation and commercialisations gaps in the Ghanaian small-scale industry (SSI) sector.

Chapter 4 This chpater presents the theoretical review and explains the theoretical framework and concepts that underpin the study. First, it outlines and explains the main elements of the emerging below-the-radar innovation (BRI) theories in general. This is then followed by discussions of the bottom of pyramid (BOP) proposition and frugal innovation models and their relevance to indigenous innovation commercialisation in Ghana.

Chapter 5: The chapter presents the conceptual framework that underpins the study. It explains commercialisation of indigenous innovation and firm performance. The key drivers of indigenous innovation commercialisation of regulation, finance, organisational factors, market factors and technology are identified. In a broad perspective, the chapter suggests the rationales for the direct relationships between the identified drivers and indigenous innovation and firm performance. The testable

Central University of Technology, Free State

hypothetical relationships between the drivers and indigenous innovation performance of firms are herein introduced. Other factors that can influence the hypothesised relationships and need to be controlled are also identified and introduced.

Chapter 6: The outcome of the conceptual framework in chapter 5 leads to the selection of appropriate methodology applied in chapter 6 which focuses on the research design of the study. The specific issues discussed include the justification for the adopted research philosophy, approach, and methods. It also discusses the various constructs in the study, the questionnaire items, data collection procedures and data analysis tools. The breakdown of the various hypnotised paths is also presented and discussed in the chapter. The chapter also presents pilot study findings and assesses the validity and reliability of the constructs in the study by presenting the measurement model with the composite factor analysis (CFA) results. The pressing ethical issues to be addressed in investigating indigenous innovation and small businesses are also outlined in this chapter.

Chapter 7: Chapter 7 presents the in-depth analysis of the empirical assesMSEnt of the research model. Starting with demographic and other background information, it discusses the results of the descriptive findings using SPSS statistical analytical tool. Afterwards, it outlines the criterion for partial least squares structural equation modeling (PLS-SEM) and, based on these criteria, makes inferential analysis with the help of Smart PLS 3.3.3. The chapter quantitatively examines the impact of commercialisation drivers on indigenous innovation and Micro and small enterprise (MSE) performance in the Volta Region of Ghana. The detailed synthesis and discussion of the findings obtained in the study are also presented, and in so doing, the findings are rigorously complemented with existing literature to rationalise the aims and objectives proposed in the study.

Chapter 8: The chapter concludes the study and highlights the major research findings, contribution to knowledge, as well as implications for policy, practice, and researchers. It presents the summary of the framework for commercialisation of indigenous innovation. It also discusses the limitations of the study and offers directions for future research based on these limitations.

1.8 CHAPTER SUMMARY

Chapter one put the concept of innovation into different perspectives, distignuished indigenous innovation from foreign innovation, and argued that innovations originating locally and owned by the indigenes can have a different impact in low-income economies. It pointed out that the problem in most low-income economies is not innovative activities per se but their commercialization; stressed that socioeconomic values are only created when innovations are successfully commercialized; and raised the issues surrounding the commercialization of indigenous innovation in developing countries .

From the literature it is recognised that while Ghana, just like other Sub-Sahara African countries, has a lot of untapped opportunities, most traditional knowledge and innovation are not fully commercialised, the country has numerous sponsored research outputs remaining on shelves, and the country has a high innovation commercialisation gap. Having identified the gap that not much is known in the literature on the commercialisation of indigenous innovation in Ghana and Sub-Saharan Africa in general, the study intends to investigate the factors that drive or constrain the capacity of small-scale businesses for the commercialisation of indigenous innovation and extend the literature on indigenous innovation. Subsequent chapters will put the pertinent issues on the commercialisation of indigenous innovation in developing countries into proper context.

CHAPTER 2: COMMERCIALISATION OF INDEGENOUS INNOVATIONS

2.1 CHAPTER INTRODUCTION

The first chapter highlights innovations originating locally or owned by the indigenes as indigenous innovation. It broadly raised the issues surrounding the commercialisation of indigenous innovation in developing countries and emphasized that socioeconomic values are created only when the resultant outputs of science, technology and innovations are successfully commercialised. To understand the determinants of commercialisation of indigenous innovation of low-income economies, it is important to synthesize and put the concept of innovation into the perspectives of these settings

The review undertaken in this chapter, therefore, includes concept of innovation, classifications of innovation, indigenous innovations, national indigenous innovation systems, and the role of indigenous innovations in economic development, commercialisation and the process of indigenous innovation commercialisation. The aim here is to provide a broader understanding of innovation and its commercialisation, particularly indigenous innovation in the context of low-income economies. This exercise assisted the researcher to determine the research gaps.

2.2 THE CONCEPT OF INNOVATION

Innovation in general has been well explained and analysed in the literature (Schumpeter, 1934; Hall & Jaffe, 2018; Walker, 2014; Gault, 2018; OECD and Eurostat, 2018). The term innovation itself is quite a complicated concept as the word is extensively used and many people have intuitive sense of it. The word date back to 1540 and came from Latin word *innovatus innovare*, to change from/to (Online Etymology dictionary, 2019). Earlier scholars such as historian Walt Rostow studied technological transfer in 1800s and seminal economic theorist Friedrich Hayek wrote on adaptation, a new product borne of some new observation (Phelp, 2017). However, Joseph Schumpeter was the first author to emphasize the importance of innovation as an incentive to economic growth (Schumpeter, 1934). Schumpeter's view of innovation –as means to incorporate the creation of a new goods or new quality of goods; the creation of new method of production; the capture of new sources of supply, a new organisation of industry; and opening of a new market—has been widely accepted and still influences today's theories of innovation (Cirera & Muzi, 2016; Gault, 2018).

Generally, the concept of innovation relates to the generation and commercialisation of new ideas and the process of diffusion and adoption of existing knowledge and technologies by all firms (Lhuillery, Raffo & Hamdan-Livrament, 2016). More broadly, innovation is viewed as an attempt to try out new or improve products, processes, or ways of doing things. These include improvements in areas such as logistics, distribution and marketing as well as changes new to local context (OECD & EUROSTAT, 2018, Cornell University et al., 2015).

In explaining the determinants of commercialisation of indigenous innovation, it is imperative to put the concept of innovation into the perspective of low-income economies. Until recently the literature has overly painted R&D and hi-tech picture of innovation, creating the impression that innovation is an industrialised country phenomena and only associated with leading centres of excellence in the scientific world (Nordling, 2014; Cirera & Muzi, 2016). Schumpeter and others in the Schumpeterian tradition emphasized innovation as technological change, process, and interrelated sub processes (Cirera & Muzi, 2016). Organisation for Economic Co-operation and Development (OECD) in its original Oslo Manual overemphasized new or significantly improved products or processes as innovation (Lhuillery, 2016). Even in the context of Africa, the Science, Technology, and Innovation Strategy for Africa (STISA-2024), a decadal vision adopted by all African Governments, views innovation as science and technology related invention or early-stage research and development (R&D) and places science and technology at the epicentre of Africa's development (African Union, 2014).

This rather incomplete view of innovation made some authors perceived developing countries as countries that are not able to utilise knowledge generation, transmission and application for economic growth and social improvement (Muhammad et al., 2016; Chatterji, 2016). Again, based on R&D and the high-tech over focus, some have questioned the relevance of innovation to low-income countries (Chatterji, 2016) The “high-tech myopia” can make low-income countries incurred huge cost, investing in internationally competitive high techs and end up not reaping any benefit (Nordling, 2014, Markard, et al., 2015). Worse of all, based on these incomplete views, most developing countries focus on R&D spending as a measure of innovation (Nordling, 2014; Ockwell & Byrne, 2016).

The broader definition of innovation as an attempt to try out new or improve products, processes, or ways of doing things, even if the contribution to the global knowledge frontier is negligible (OECD & EUROSTAT, 2018), means innovation is an aspect of every economic activity. Recent literature also recognised innovation is relevant in the low- income economies as elsewhere, important at all stages of development and called for innovation capacity to be built early in the development process so that the developing countries can possess the learning capacities for catch up (Edler & Fagerberg, 2017; OECD & EUROSTAT, 2018).

Ockwell and Byrne (2016) observed that in contrast with other types of innovation, publicly funded R&D, particularly the so-called basic science, makes vanishingly small direct contribution to African economies. They however also noted R&D is very relevant in terms of improved innovation absorptive capacity, if highly trained researchers move to work in private firms. R&D and high technology inventions are certainly key part of innovation and form part of the science technology and innovation (STI) fabric but only a small part of innovation. More recent innovation literature recognised that innovation is not just about high-technology products for well off customers and glamorously celebrated scientific breakthrough, but it goes well beyond firms, industries, universities, and research centres (Stirling, 2015; Cornell University et al., 2015; Ockwell & Byrne 2016).

Innovation literature is extensive, as the term is related to different fields and used as a buzzword by policymakers and the media. The concept also has many changing variables and different classifications some of which are conflicting (Dzhandzhugazova, Ilina, Latkin & Kosheleva, 2016). Some of the most common criteria that have been used to classify innovation are: type of innovation, depth of changes, continuity, type of novelty to the existing market and innovation time-to-market (Romanova & Chernova, 2015). Other criteria for classifying innovation are magnitude of impact Innovation system (national, regional, and technological innovation systems), firm-level innovation versus grassroots innovation; and foreign versus indigenous (Dzhandzhugazova et al., 2015; Romanova & Chernova, 2015; OECD & EUROSTAT, 2018). Most innovations, however, can be characterised or may manifest in many forms.

2.3 CLASSIFICATIONS OF INNOVATION

2.3.1 Schumpeterian and OCED classification

OECD adopted Schumpeterian definitions and identified four types of innovations to regulate the concept: Product innovation (new and substantial enhancement of products, new sources of supply; process innovation (new methods of production); marketing innovation (the exploitation of new markets): and organizational or management innovation (new ways to organize businesses) (Dzhandzhugazova et al., 2015; Romanova & Chernova, 2015).

Romanova and Chernova (2015) built on the OECD's classification and classified innovation in respect of the type of novelty to the existing market and identified 6 forms of innovation: Material and technical innovations; economic innovations; organisation and management innovations; legal innovations; social innovations; marketing innovations. Material and technical innovations was refered to as creating new materials, products, services and technologies, new ways to deliver services, improving the old ones. Economic innovations are also explained as the emergence of new markets as a result of new products, technologies, or economic processes such as new ways to buy and sell goods, (Romanova & Chernova, 2015). Dzhandzhugazova et al. (2017), for example, cited expanding organisations from the centre to the periphery and erasing "blank spots" in the geographical space in the hospitality industry as examples of economic innovation.

Organisation and management innovations has also been explained as new solutions and approaches in managing or organising the working process (Romanova & Chernova, 2015). According to Romanova and Chernova (2015) organisation and management innovations are implementable in the form of improving the business models used by organisations in terms of what goods and services are offered, how they are offered and how revenue is generated.

Romanova and Chernova (2015) saw newly introduced laws and regulations, as well as significant changes in the existing ones and businesses figuring new ways of exploiting existing regulation as legal innovations. Similarly, other authors such as Dzhandzhugazova et al. (2017) advanced the argument that simultaneously implementing the international conventions and national legislations in the particular field or industry, integrating the national legislations into the system of international law are forms of legal innovations.

Some scholars described new ideas and solutions with the purpose of addressing the social and cultural challenges which the society faces as social innovations (Adrian, Mariano & Hernán, 2014; Orlova, 2016): For example, implementing new concepts based on the expanding the use of social media, financial inclusiveness using fin-tech, medi-tech and ecotourism to rural areas are often cited as social innovation (Romanova & Chernova, 2015; Dzhandzhugazova et al., 2017)

Romanova and Chernova (2015) described marketing innovations as new or significantly improved marketing methods, encompassing the major changes in the design and packaging of products, applying new sales techniques and product (services) presentations, presenting, and promoting them on the markets, developing new pricing strategies. Afful and Owusu (2017) analysed the most recent Enterprise

Survey and Innovation Follow-Up Survey, using the case of Ghana and observed that market innovation is the predominant type of innovation occurring among African countries.

2.3.2 Radical versus incremental innovation

In terms of depth of changes or degree of impact, innovation can be classified as either radical innovation or incremental innovation. Radical innovation is the innovation that results in a new market infrastructure, create new demand, or have significant impact on the market such as the invention and development of aviation, nuclear energy, computers, the internet, the mobile handset, and biotechnologies (Dzhandzhugazova et al., 2017). According to Ockwell and Byrne (2016) it is mainly the State, not existing firms and entrepreneurs that has been able to kick start and provide the engine of growth of radical innovation.

Incremental innovation, on the other hand, offers new benefits or improvement to existing technology on the current market (OECD & EUROSTAT, 2018). Incremental innovation is adaptive innovation, adaptive to a new country, industry, firm, and farm or household. An entity is innovative if it adopts an existing technology itself for the first time even if other firms already have it on the market (Ockwell & Byrne 2016). Ockwell and Byrne (2016) reported that follow ups, continuous improvement or incremental changes can add up to significant improvements over time, as incremental innovations attract less cost but are the most dominant form of innovations. Incremental innovation is important in low-income countries because innovation co-evolves with the social practices. It has also been observed that much of the increase in productivity seen over the decades is through the aggregation of myriads of minor changes to innovation and innovation is indeed likely to be more incremental and less radical in low-income economies (Ockwell & Byrne 2016; Cirera & Muzi, 2016; Cornell University et al., 2018).

Central University of
Technology, Free State

2.3.3 Disruptive versus sustaining innovation

In respect of magnitude of impact, innovation has also been classified as disruptive innovation and sustaining innovation (Christensen, Raynor & McDonald, 2015). According to (Christensen et al., 2015), there are, however, unclear understanding of disruptive and sustaining innovations, despite their widespread use in the academic literature and management practice. The focus of Christensen initially was how new technologies came to surpass seemingly superior technologies in a market. Over time however, the term disruptive innovation has been widened to include not only technologies but also products and business models; and explain how complicated, expensive products and services are eventually converted into simpler, affordable ones (Christensen et al., 2015). According to Sparks (2017), a disruptive innovation changes or disrupts the existing market and products and improve them in ways that were never considered, for example, making them more efficient or significantly lowering the price. Spark (2017) opined that, words like evolutionary or transformational explain disruptive innovation best.

It is important to properly distinguish between disruptive and sustaining innovations as they have different competitive effects and should be treated as distinct phenomena (Edler et al., 2016; Dewald & Achternbosch, 2016). Disruptive innovations are new developments that create entirely new markets by their introduction; they have attributes that enable emergence of new markets, whereas sustaining innovation refers to developments that make products and services that customers already value perform better (Christensen et al., 2015; Dewald & Achternbosch, 2016). Development of sustaining innovations are generally led by more well-established industry leaders, lead to better products that can sell for higher margins to premium customers and address the next generation of needs for existing markets. Disruptive innovation, on the other hand, are often intermittent and firms do not have any routine process of handling thm (Christensen et al., 2015).

2.3.4 Firm level versus grassroots innovations

Innovation can also be classified as firm level innovation (or industrial innovations) and grassroots innovation. The nature, emergence, and composition of networks for grassroots innovations are considerably different from firm level innovation (Ornetzeder & Rohracher, 2013). Whereas industrial innovations often result from R&D processes of firms or publicly funded R&D, grassroots innovation is inclusive and emerges mainly from citizens, lay people, hobbyists, craftMSEn, or local entrepreneurs (Ornetzeder & Rohracher, 2013). In terms of commercialisation, grassroots innovation movements seek to achieve wide-scale diffusion, social justices, and transformation of local situations with project-based solutions, however they often struggle against economic structures and political power (Mokter Hossain, 2016). Emerging concepts such as strategic niche management (SNM), niche-to-regime transition theory and multi-level perspective are all applications of the phenomena of grassroot innovation in strategic management (Ornetzeder & Rohracher, 2013; Boyer, 2014).

From development perspective grassroots innovation had a strong linkage with development and has a long tradition in alleviating the day-to-day problems of human lives in developing countries (Raghupathi & Raghupathi, 2017). In recent times the activities of grassroots innovation movements and calls for more inclusiveness in terms of knowledge, processes and outcomes in local communities have brought valuable plurality and reflexivity to innovation policy and politics (Adrian et al., 2014). This has correspondingly reflected in knowledge production: grassroots ingenuity; grassroots empowerment; and structural critique in the innovation literature (Boyer, 2014).

2.3.5 Indigenous versus foreign innovations

In terms of origin and ownership, innovation can be classified as indigenous or foreign. As opposed to innovation that originate or owned by indigenes, foreign innovation refers to developments in high-tech industries and forefront technologies often imported or from inward foreign direct investment (FDI) (Edler & Fagerberg, 2017).

Although the impact of FDI on economic Development in developing countries is still debatable, many nonetheless, believe FDI is helpful to narrow the technological gap with developed countries (Huang et al 2016; Hongyang et al., 2017). They argued that with limited opportunities in developing economies to develop indigenous innovation, there is very little options for these countries than to rely on foreign technology and knowledge, at least in the short run. From the experience of latecomer countries such as Japan, Hong Kong, and Singapore, and more recently Brazil (which relied heavily on subsidiaries and turnkey projects), developing countries can approach frontier technologies and then strategise to shift from imitation to innovation stage (Watkins, Papaioannou, Mugwagwa & Kal, 2015; Pradhan, Arvin & Bahmani, 2018). It is however also clear from empirical evidence that moving from the imitation stage to the innovation stage might not be easy for most developing countries and FDI-based innovation is not the panacea (Edler & Fagerberg, 2017).

There is abundant literature on importance of indigenous innovation in developing countries (Nordling, 2014; Nwuke, 2015; Ockwell & Byrne 2016; Feige & Vonortas, 2017; Botchie et al., 2017). Some experts have made a strong case for African countries for example, to develop their own technologies and indigenous innovations (Feige & Vonortas, 2017; Botchie et al., 2017; Li, Sutherland & Ning, 2017; and Huang et al., 2017). According to Phelp (2017), impact of success of indigenous innovation can be different and higher than that of foreign direct investment or adopted innovation and as a nation can set its level of innovative activity according to its values.

Others have cautioned about the danger of promoting indigenous projects that are merely "re-inventing the wheel" which could lead to development of obsolete technologies and misallocation of resources (Huang et al., 2016; Amankwah-Amoah, 2016). Amankwah-Amoah (2016) for example has suggested that countries such as Ghana should focus on fostering technological leapfrogging that can provide opportunities for the nation to leapfrog certain stages of development and technologies to catch up with fast-developing emerging countries. Others have suggested it is important developing countries create the missing institutions and link existing micro innovative strengths that most of the time remain isolated (Huang et al., 2017).

2.4 CONCEPTUALISING INDIGENOUS INNOVATIONS

The focus of this study is on indigenous innovation which refers to innovations that originate locally and (or) are owned by the indigenes (Nwuke, 2015; Chen, Qian Narayanan, 2017; Danquah Amankwah-Amoah, 2017). According to Edler and Fagerberg (2017), indigenous innovation refers to new changes in local context and a lot of these new things occur in local economies.

A more comprehensive definition of the concept is provided in the recent theory of indigenous innovation (Phelp, 2017). Phelp (2017) posit that a significant innovation is a new thing springing from a new idea that is adopted widely enough to bring significant in real income; and copying, transferring, or even adapting from elsewhere are not innovations (Phelp, 2017). The theory defined indigenous innovation as products and methods newly conceived in a country, which, change practice at home, whether or not abroad. It explained that it is only by creating indigenous innovation that a nation can innovate more than what is possible by drawing on exogenous discoveries, and emphasised that a nation can set its level of innovative activity according to what it values.

Phelp (2017) distinguished between Schumpeterian innovations and adaptation as firms detecting and acting on a new opportunity that fills a need; from indigenous innovation as detecting and acting on an opportunity that brings new practice in an economy. Phelp (2017) noted that although Schumpeterian views later added value to Schumpeter’s influential 1911/12 book and the German Historical School’s views that “scientists and navigators” bring advances to economies, Schumpeterian models still assumed innovation as exogenous to an economy. Thus, even though Schumpeterian views recognised that commercial application of discoveries require entrepreneurs to build the new combination of factors needed to produce the new thing; financiers to supply the finance; and entrepreneurs and financiers being able to calculate which applications are profitable to build (Schumpeter, 1934), they still deem innovation as coming to the nations from outside their economies from explorers and scientists.

The theory of indigenous innovation propounded that contrary to the Schumpeterian exogenous views, innovation is generally internal, or indigenous, to a nation's economy and determined by economic knowledge and advances which is propelled by advances in business knowledge as well as in scientific and other sorts of knowledge. The theory further explained that indigenous innovation, where it occurs, is driven by the new ideas, which progresses through trials and market tests, and driven by innovators' creativity, imagination, ingenuity, and savvy to make and market the new invention. According to Phelp (2017), scientific knowledge, human resources and capital is not sufficient for success of innovation if market conditions do not permit it. The theory emphasised endogenous factors such as business and tacit knowledge as key, as science cannot tell whether there would be a market for new possibilities. The theory of indigenous innovation also recognised that the success in developing, and marketing new things are then diffused over the rest of the economy, adding to general economic knowledge.

Even though Phelp (2017) excluded adaption, the theoretical definition is very relevant to the study because it highlights successful commercialisation as essential part of innovation. Other scholars emphasised adaptive innovation and absorptive capacity of firms as important element of indigenous innovation system in low-income economies (Ince, Imamoglu & Turkcan, 2016; Patterson & Ambrosini, 2015). There is evidence that innovation co-evolves with social practices, adaption and incremental changes can add up to significant improvements over time, adaptive innovation attracts less cost but can increase in productivity (Ockwell & Byrne 2016; Cirera & Muzi, 2016; Cornell University et al., 2018). Indigenous innovation in the context of this study includes modernisation and use of indigenous resources, indigenous practices, and indigenous knowledge as well as creation of domestic standards that reduces the burden of paying fees and royalties to foreign countries.

2.5 ESTABLISHING NATIONAL INDIGENOUS INNOVATION SYSTEMS

2.5.1 The national innovation policy framework

Another way to understand indigenous innovation and its commercialisation is to look at it from the system perspective. An innovation system approach moved the thinking on innovation from linear model of investing in R&D leading to new invention that get commercialised to a recognition that innovation is a result of complex, interactive and cumulative knowledge and learning process with variety of actors (Asheim, Grillitsch & Trippl, 2016; OECD & EUROSTAT, 2018). Innovation systems can be viewed as fertile gardens within which technological change and economic development can prosper (Ockwell & Byrne, 2016). The system perspective emphasised the context within which processes of innovation development and commercialisation occur.

The system approach recognised that innovation is varied, based on learning by doing, using and interaction (DUI) and science and technology (ST); and it comes in multiple forms and results from interdependencies of many actors (Gosens et al., 2018). Some exponents of the system approach, indeed, emphasised, national innovation systems, regional systems of innovation, technological innovation systems and other levels (Acs et al., 2014; Mundabi & Santangeleo, 2015; Bergek, et al., 2015; McCann & Ortega-Argilés, 2015; Asheim et al., 2016; Smith, 2018; Gosens et al., 2018). However, much of the traditional innovation system literature insist on the central importance of national systems (NIS).

The core principle of NIS is that national output and development is dependent on a wide variety of other actors and interrelated activities and not just factors of production. The principle of NIS is rooted in the work of economists such as Adam Smith in 1770s, David Ricardo in1810s, Joseph Schumpeter and John M. Keynes in 1930s and Robert Solow in 1950s. As a concept however, NIS evolved in 1980s and was popularised in the 1990s by Freeman, Edquist, Nelson, Rosenberg and Lundvall (Bartels et al., 2016). The main theoretical underpinning of the concept is that knowledge is a fundamental resource, which is generated and accumulated through an interactive and cumulative process of innovation that is embedded in a national institutional context, and that national context matters for innovation outcomes (Gosens et al., 2018).

Various definitions of NIS pointed out elemental features of skills and knowledge transfer through interactions among core actors and their networks. NIS policy framework has been viewed as an envelope of conforming policies together with private and public organisations, their distributed institutional relations, and their coherent social and capital formations, that can determine the vector of technological change, learning and application in a national economy (Teixeira, 2014; OECD & EUROSTAT, 2015; Bartels et al., 2016). Bartels et al. (2016) described NIS as the incentive structures and competencies of national institutions that determine the vector of technological learning and change in a country.

Gosens et al. (2018) prescribed a framework consisting of a list of activities and variety of actors for a well-functioning and sustainable national innovation systems (table 2.1). Key among these activities relative to commercialisation of indigenous innovation are entrepreneurial experimentation and materialisation; market formation; resource mobilisation; and demand legitimation (Gosens et al., 2018). The literature on this NIS framework also emphasises importance of a wide variety of actors including universities and research institutes, industry players, government agencies, financiers, consultants, certification bodies, maintenance industries, societal pressure groups, consumers and others, for effective and functioning NIS(Teixeira, 2014; Gosens et al., 2018).The strength and quality of these elemental features and interactions between actors are important in determining effectiveness and efficiency in innovation generation and diffusion as the spatial concentration of economic relations are ultimately based on intellectual assets (Asheim, et al, 2016). Gosens et al. (2018) explained a NIS framework is important because effort and success of innovators and other actors can never be understood in isolation and involvement of other actors and their activities, can either limit or propel the results of indigenous innovative activities into a next phase of development.

Table 2.1: Innovation system functions and actor activities

System function	Actors
Knowledge development	• Perform fundamental, proof of principle, prototype R & D activities • Develop instruments, research and engineering design and methods • Perform scientific publishing
Knowledge diffusion networks	• Create and participate in cross-disciplinary and cross-sectorial networks • Exchange and combine new knowledge from different fields of backgrounds
Influence on the direction of search	• Steer technological development, e.g., user-producer feedback, technological roadmaps or preferential policy and regulation • Develop and articulate visions on the future potential of the technology
Entrepreneurial experimentation and materialisation	• Create new products, processes, and services • Patent and license novel technologies • Perform pilot and (commercial) demonstration activities • Establish new firms and production facilities
Market formation	• Identify, utilise and strengthen niche markets • Articulate demand, e.g., by (governmental) launching customers, with consumption quota or policy targets • Create price premiums, e.g., with eco-branding or with fiscal instruments (taxation or tax exemption, subsidies)
Resource mobilisation	• Develop/attract human resources (includes education) • Provide/attract funding, for RD & D and manufacturing facilities • Provide/attract complementary products, services, infrastructure
Legitimation	• Articulate societal benefits and develop societal acceptance of the novel technology, e.g., by participation in public debate • Lobby for/implement preferential policy and regulations

Source: *Adapted from Gosens et al. (2018)*

From the literature it is obvious that NIS are more prevalent in industrialised and emerging economies, however there are valuable lessons and significant implication for developing countries as they aspire to increase innovation to develop their economies. From the perspective of developing countries, NIS have to be seen through the local cultural and institutional lenses and it is important to avoid copying or just following latest policy fashion (Bartels et al., 2016).

Bartels et al. (2016) also highlighted a learning divide and an innovation gap between the developed and the developing countries and pointed out the need for strengthening and increasing the diversity of interactive learning spaces to reduce this gap. The authors also cited works of innovation system scholars such as Lundvall on the systems of innovation and development and the suggested how innovation system approach should be adapted to the realities of developing nations.

The Triple Helix (TH) models extended the Aalborg-OECD approach to NIS, where the emphasis was on knowledge-based institutions (KBIs) to firms playing the main roles in dynamic interactions with other actors (Teixeira, 2014; Bartels et al., 2016). TH demarcates institutionally the three separate spheres of actors which are government, industry and KBIs; then actor interrelations and how these are strongly influenced by the market and technological innovation; and then the complex network of organisational ties, both formal and informal, among the overlapping actor spheres (Teixeira, 2014). In the context of most developing economies, the three actors still seem to be playing the traditional and separate roles, with not much overlap and functional interrelations and thereby not benefiting from exchange of knowledge transfer, which is the basis for development (Bartels et al., 2016). This is also evidenced by the lack of technology transfer or licensing offices within universities and limited activities of venture capitalists in these countries.

Most of the literature on innovation system in developing countries, in recent years, have focused on Asia and Latin America. The few works dedicated to systems of innovation in the African context include (Bartels et al., 2016; Ockwell & Byrne, 2016). Others argued that while IS might have been officially adopted by less-successful developing countries, the practice still follows old innovation paradigms and barely addresses systemic problems (Intrakumnerdi & Chaminade, 20017). In sum, from the system perspective, innovations can be considered as part of a system-like whole with key dynamic elements evolving scientific, technical, social, cultural, political, and other forms of knowledge, and occurring within an environment of institutions constituted by policies, laws, regulations, and norms. As opined by Ockwell and Byrne (2016), innovations to some large extent depend on the behaviour of firms; can enable new choices and behaviours in society and institutions evolve in responses to influence developments of innovations. Another important insight from the innovation system literature is the core role of innovation systems in creating the enabling environment and conditions to nurture knowledge flows between firms and other key actors within a country and with relevant actors internationally.

2.5.2 The legal framework

Exponent of innovation system considered NIS as a structure consisting of organisations as the actors of the system; and the institutions as the rules of the game within the system (Lindholm-Dahlstrand et al., 2016). This meant that legal frameworks are essential elemental features of any functioning national innovation system. Recognition of importance of NIS in fostering technological and industrial development made some countries codified some of the key elements into laws (Gosens et al., 2018). The constitution of the United States for example empowered its Congress to enact laws to promote and protect the progress of science and the useful arts (Gail & Roi, 2017). Although the broad and ecclesiastic nature of NIS made it impossible to be framed into a single legislation, most countries have enshrined their national innovation campaign in national strategic plans and are increasingly developing science, technology, and innovation (STI) policies. STI policies set out the set of actions that a government can take to deal with a range of problems in the intersecting and complementary domains of science, technology, and innovation to achieve a clearly defined national objectives with private incentives (African Union Commission, 2015).

STI policies in developing countries can be classified into sectorial, horizontal, and mixed policies (Nwuke, 2015; Madar, Subari, Baqutayan, & Mohamed, 2016). Sectorial policies involve attempts of government to choose and pick “winners” and “losers”, which may reflect government-identified national development, priorities. Horizontal science, technology and innovation policies are general, support across sectors, and use market approach in providing impetus for creating new sectors (Nwuke, 2015). Examples of mixed policies include education and human resource development, local content and taxes, and subsidy policies or legislations that do not target specific sectors. Mixed policies and legislations combined the attributes of horizontal and sectorial ones and are set out in specific acts or theme-specific policy documents (Magro, Navarro & Zabala-Iturriagagoitia, 2014).

Some countries instead of explicit STI policies, or in addition, nest STI aspirations in national policy on education, training and human resource development, biotechnology, energy or information and communications technology (ICT) and so on (Cervantes & Hong, 2018). A country’s specific policies or legislation may also be outlined in national development plans, annual budgets, industrial policy, trade policy, intellectual property legislation or acts establishing relevant institutions (Chaminade, Padilla-Pérez, 2017).

Relative to indigenous innovation and its commercialisation, three types of legal issues (or regulation) have been analysed in the literature (Edler et al., 2016). These are first, regulations to promote innovation such as IPRs and specific regulation to protect new innovations in the market as postulated in Porter’s Hypothesis; second, regulation to achieve specific objectives such as environment and health and safety standards which can create innovation pressure and opportunities; and third, regulations that can create burdens for innovative activity (Edler et al., 2016; Gail, Van Norman & Roi, 2017; Fu et al., 2016).

Central University of Technology, Free State

2.5.3 Patency and intellectual property

An important concept to the study of commercialisation of innovation is the protection of innovation. Porter's Hypothesis which emphasized Intellectual Property rights (IPRs) and specific regulation to protect new innovations in the market, has been reiterated in the literature (Edler et al., 2016). The uncertainties of commercialisation of innovation have been well emphasised and Knightian uncertainties posit that it is not known in advance which technologies that would turn out to be important innovations (Knight 1921; Klepper, 2016; Kerr et al., 2014). Indigenous innovation has long and uncertain maturity time lag (Lindholm-Dahlstrand et al., 2014; Gosens et al., 2018). The theoretical underpinning here is: it is curiosity and hope of reward that drive innovation and its commercialisation and these interests of inventors must be protected when the resultant new products or services realised their commercial potential (Gail & Roi, 2017). An important step in the commercialisation process is therefore establishment of Intellectual Property (IP) rights or other protection over innovation.

IPRs for protection of innovation historically developed via trade secret and patent laws (Sridevan, 2015; Babirak, 2016; Yang, Tsai & Mukherjee, 2016). Trade secrets are innovations, processes, and specialized knowledge developed within a business and kept confidential and are part of a business's armamentarium in achieving competitive advantages in the marketplace (Gail & Roi, 2017). Patent law, on the other hand grants exclusive privileges or monopolies for enterprises evolved as a way for an inventor to deny others the right to take advantage of their invention. This motivated the inventor to share his or her invention with society without fear (Benny, 2016).

Intellectual property rights and appropriate conditions are largely embodied in national patents, copyrights, trademarks, and designs rights laws (Gosens et al., 2018). With increasingly globalized environment and rapid technological progress, however, the ability of traditional intellectual property regimes to stimulate innovation and promote technology has been questioned (Yang et al., 2016; Inglesi-Lotz, Hakimi, & Karmani, 2020). Indeed, the impact of IPRs on successful commercialisation is more prominent in industrialized countries. Recent studies have also pointed decreasing value of patents (Inglesi-Lotz et al., 2020). Even in the United States, businesses view trade secret as a better mechanism for protecting innovations. Firm size, nature of economic activities, weak enforcement and cultural values makes the traditional intellectual property regimes such patenting less applicable in low-income economies (Benny, 2016; Inglesi-Lotz et al., 2020).

Another complexity of IPRs and commercialisation of innovation in developing countries is the fact that it is not just about monetary value of technological invention, but innovation activities contribute to outcomes that are not just about new pieces of technological hardware (Stirling, 2015). Stirling (2015) asserted that innovation involves change of many kinds including cultural, organisational, and behavioural as well as technological and pointed that innovation is something that goes well beyond the activities of firms, industries, universities, and research centres. Some other authors also argued that the over emphasis on R&D and intellectual property metrics are demonstrably flawed in their ability as meaningful proxies for innovation output (Acs et al., 2014; Runco, 2014). They further argued that fixation on such policy foci would not yield significant benefits in building technological capabilities in developing countries.

Some scholars have distinguished between tacit and codified knowledge: Codified knowledge, as ideas and knowledge that is articulated in some way and can be covered by intellectual property rights (IPRs); Tacit knowledge as skills or human embodied knowledge acquired through experience or institutionally embodied knowledge and management systems capabilities developed through generations of employees (Muthuveloo, 2017). Innovation system literature characterised the process of tacit knowledge acquisition as one, learning by doing (e.g., by engaging in production processes); two, learning by using (e.g., adjusting get new technologies to fit specific tasks); and three, learning by interaction as actors interact and work with other actors across innovation systems (Foster & Heeks 2013; Wang et al., 2015). The subset of knowledge that deals with how to produce and distribute goods and services has often been labelled in the literature as "technology". Technological knowledge includes knowledge about physical processes known as “hardware” and how to organise/manage known as “software” (Ockwell & Byrne 2016). Ockwell and Byrne (2016) argued that mastery of the hardware is of dubious value if it is not embedded with the software. Reviewing the basic definition of codified and tacit knowledge coupled with anecdotal evidence Ockwell and Byrne (2016) emphasised the centrality of tacit knowledge as opposed to IPRs as the key barrier to innovation development, adoption and commercialisation in developing countries using the case of PV in Africa.

Despite the anecdotal evidence, however, IPRs still continue to dominate many discussions on technology and innovation in developing countries. The two opposing views are that: one, some (often developing country) observers claim that developing countries must have free access to IPRs and technologies to catch up; and two, (often industrialised country) observers argued that the key barrier to innovation and technology transfer to developing countries is their weak IPR protection regimes deterring technology leading firms and investors (Ockwell & Byrne, 2016). The traditional intellectual property rights may not be appropriate for low-income economies. The benefit of innovation is greater in these economies when innovation diffuses through society, increasing the allocative and productive efficiency. However, it is private interest and potential rewards that drive innovation and its commercialisation. There is therefore the need for appropriate protection regimes that would maintain an equilibrium between the interests of the innovators and widespread diffusion.

2.5.4 The role of technology hubs in local knowledge acquisition

The concept of innovation (or tech) hub is still emerging and has so far been explained in the literature as physical and communal spaces where budding entrepreneurs and technology enthusiasts gather to obtain and share knowledge, skills, and resources to develop ideas and build businesses (Jiménez & Zheng, 2021; Schmitt & Muyoya, 2020). Increasing venture capital funding for start-ups has led to emergence of technology hubs with several top tier, 2nd tier, and 3rd tier- ecosystems and ecosystem cities emerging in developing countries in the last decade (Bayen & Giuliani, 2018).

Announcements of new hubs by both Google and Facebook; visits of Sundar Pinchai of Google and Mark Zuckerberg of Facebook to Lagos' ccHub and Nairobi's iHub; French president Macron visit to Accra's Impact Hub and iSpace; and Alibaba's Jack Ma visit to East Africa in 2018, all illustrate importance and growing interest in tech hubs (Nwaka, 2021). Variation of tech hubs are university incubators and technology parks which have also been key in strategic efforts in many countries to promote commercialization of innovation (Jamil, Ismail, & Mahmood, 2015; Olefirenko & Shevliuga, 2017). Osoro, et al. (2015) noted that incubators appear to work when there is a complementary innovation system in the country.

Arguably tech hubs provide inclusive environments for innovation and a level playing ground for skills and knowledge sharing (Burgess, 2015; Atiase, Kolade, & Liedong, 2020). The rhetoric around tech hubs is that they are efficient vehicles for attracting capital and expertise, and they are now leading the debate around technology and progress (Bayen & Giuliani, 2018; Schmitt & Muyoya, 2020). Over the last decade tech hubs have indeed played a role in improving innovation ecosystems and operating environments; attracting support for technology advancement; and attracting venture funding for tech start-ups **(**Madaio, Grinter, Finin & Zegura, 2016; Bayen, & Giuliani, 2018). The potentials of tech hubs in respect of driving economic growth in African countries by linking motivated entrepreneurs with the required business skills, technology and networks has also been highlighted in the literature (Obeysekare, Mehta & Maitland, 2017; Bayen, & Giuliani, 2018; Schmitt & Muyoya, 2020). Correspondingly, the number of tech hubs recorded in African countries jumped from about 220 in 2016 to 442 in 2018 (Bayen, & Giuliani, 2018).

The tech hubs, particularly in African countries have employed hybrid business models including, seeking for grants, public private partnerships, co-working space, consulting services, skills development, national, regional, and continental peer learning networks, some of whose sustainability have been questioned (Bayen, & Giuliani, 2018; Schmitt & Muyoya, 2020). Empirically tech hubs have been very fragile **(**Kelly & Firestone, 2016; Amankwah-Amoah, .2019). Madaio et al. (2018) for example observed that between 2016 and 2018, 150 hubs ceased operations while new ones emerged in Africa. The dichotomy between high impact and fragility of the hubs has led to some scholars calling for further research into high economic potential of tech hubs and their vulnerability to closure **(**Amankwah-Amoah, .2019; Schmitt & Muyoya, 2020).

Despite few criticisms on some of their income generation model, and concerns about sustainability the general discourse around tech hubs have been broadly optimistic. A strong urge to rethink flawed business models has indeed driven many hubs and incubation programmes to narrow down their offering and target specific niches. Increasing interest of universities in establishing incubators and hubs can add to improve sustainability of the concept and increase access of innovators to infrastructure in terms of university labs and workshops. In most countries tech hubs are serving as niche innovation intermediaries that in addition to creating communities to develop, test and implement new technology, are also functioning as networks to discuss and form new ideas around innovation (Schmitt & Muyoya, 2020).

2.5.5 The technology absorption capacity of firms

Another relevant concepts that dominated the applied literature on innovation and economic development in the 1980s and 1990s which can explain commercialisation of innovation in developing countries is absorptive capacity (Ockwell & Byrne, 2016).

The term has been defined as a set of organisational routines and processes that enable firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organisational capability for enhancement of the innovation outcomes (Leal-Rodríguez, Roldán, Ariza-Montes & Leal-Millán, 2014; Patterson & Ambrosini, 2015). With good absorptive capacity local firms can obtain necessary information and make external knowledge useful and take advantage of new opportunities in the market (Ince, Imamoglu & Turkcan, 2016). Patterson and Ambrosini (2015) explained abortive capacity as a dynamic process which enables firms create new resources by searching, acquiring, assimilating, transforming, and exploiting external knowledge with internal resources, and act as a process framework for innovation. These definitions imply that innovation is an outcome of absorptive capacity. Ince et al. (2016) conforming to earlier studies highlighted absorptive capacity as an essential requirement for innovation at firm level. The authors argued that absorptive capacity enables firms to leverage their innovativeness by establishing collaborative networks with external actors, following the new technological trends and knowledge realising the similarities between external and their existing knowledge base.

Even though the focus of absorptive capacity was on firms, it has been considerably applied to countries and used in development economics as the ability of a developing country to absorb new innovations more generally (Edler & Fagerberg, 2017; Muthuveloo, 2017). It became associated with the ability to absorb knowledge and international technology spill overs, as the role of knowledge for growth and development became more widely recognised (Muthuveloo, 2017). Ockwell and Byrne (2016) also supported the absorptive capacity innovativeness link views at national levels and contended that absorptive capacity is dependent on the prior related knowledge, which reflects cumulative R&D. They reiterated the term's connotation of searching, assimilation of what is found (the innovation) and its commercial application and therefore argued it connote the ability to exploit and create knowledge more generally.

Some other innovation scholars however distinguished between a country's ability to compete on technology and ability to exploit technology commercially regardless of where the innovation was first created and argued that the skills required for creating and managing knowledge differ from those related to its exploitation (Watkins et al., 2015; Muthuveloo, 2017). Phelp (2017) posit that copying," "transferring" or even "adapting" from elsewhere are not innovations

2.5.6 Examples of national indigenous innovation systems

Although NIS emerged from OECD countries perspectives, the work on the Asian Tiger economies and, subsequent emergence of China, and to some extend India and Brazil provide diverse collection of evidence on national innovation systems as the means to facilitate innovation, and hence economic development (Watkins et al. 2015). Impressive rapid economic growth of China in the last three decades has changed the global economy landscape. Not only has China opened to international trade and investment strategically and gradually but it has also at the same time put a premium emphasis on indigenous knowledge creation and innovation (Fu et al., 2016; Gosens et al., 2018). One of the main targets of the Chinese innovation system is to improve both indigenous innovative strength and the absorptive capacity for foreign technology (Gosens et al., 2018). Chinese indigenous innovation campaign is enshrined as a national strategy that put science and technology development at the centre of rebalancing China's industrial structure and development pattern (Tzeng, Wang, Hsu & Yuan, 2019; Cheong, Li, Ung & Tang, 2020). In terms of influencing the direction, the policy framework of Chinese innovation system contained a comprehensive list of China's most serious development problems together with an exhaustive list of goals for solving them through science and technology (Bazavan, 2019). The policy framework called for using the guiding principle of "zizhu chuangxin", or indigenous innovation, to leapfrog China into a leadership role in science-based industry and lay the foundation for China to become a science and technology power by the mid of the Century (Baark, 2016).

The Chinese indigenous innovations system has been driven by a series of mega projects and import substitution action plan of co-innovation and re-innovation of foreign technologies (Tzeng et al., 2019). The government procurement market has been a key driver and technologies and were supplied by foreign companies seeking to profit from the massive government outlays (Baark, 2016; Bazavan, 2019). There was a push for a "buy China policy" for government procurement coupled with the expansion and creation of China's own technology standards to get out of the burden of paying license fees and royalties to foreign companies (Bazavan, 2019). The success story of China has important implications for the world in terms of their experiences in guiding the development process.

The recent Science, Technology and Innovation Strategy for Africa (STISA-2024), places science, technology and innovation at the 'epicentre of Africa's development

(African Union, 2014). Kenya for example established the National Council for Science and Technology in the late 1970s expanded their higher education sectors by setting up universities and dedicated science and technology research institutes to tackle development. Kenya is one of the first countries to have created explicit science, technology and innovation policy and made institutional and legal arrangements for its implementation by 2008. Shaped by NIS perspectives Kenyan STI policy recognised heavy investment in scientific and technological research and the purchase of technology from abroad were not sufficient to achieve its innovation and development goals (Nwuke, 2015). KNIS has four strategic focus: one, institutional re-engineering focusing on filling in the policy formulation and implementation gaps and addressing the weaknesses; two, strategic resource mobilisation; three, strategic knowledge and technology governance focusing on IPRs management, technology development, transfer and diffusion, and modernisation of indigenous resources, practices and knowledge; and four, cross-cutting issues for enhanced linkages and collaboration, for integrated disaster management and the application of effective public communication and advocacy for STI (Wachinga, 2019; Wandera, 2020).

KNIS has indeed recorded some rhetoric successes in areas such as horticulture, fresh fruit, and vegetable export as well as pharmaceuticals (Tigabu, Berkhout & van Beukering, 2015; Park & Gachukia, 2021). However, like most other African countries national innovation system institution are established and some elements exist but the outcome are disjointed innovation system where research institutions and enterprises are not able to communicate effectively (Nwuke, 2015; Kruss & Gastrow, 2016).

Generally, literature on innovation system in Africa highlighted three predominant issues associated with the adoption or development and commercialisation of new innovation: the systemic nature of innovation and its role in relation to broader techno logical change; the socially situated and co-evolutionary nature of new innovation and competition with existing dominant technologies; and the role the key actors (individuals or organisations) might play in driving transformative socio-technical change the attending to issues (Ockwell & Byrne, 2016). It is also evident that business enterprises in most African countries lack sufficient technological capabilities and are unable to articulate their technical needs, while the research institutions do not have much interest in what business enterprise do and are more attracted to the prestige of showing knowledge contribution to the international scientific frontier (Bartelset al., 2016).

2.6 INDIGENOUS INNOVATIONS IN ECONOMIC DEVELOPMENT

The debate surrounding the link between innovation (especially technological innovation) and economic development dates to over a century and yet it is still a burning issue. Writers on German industrialisation over a century ago recognised the role of innovation and were highly optimistic about the possibilities for technological change and economic catch-up by poorer economies (Hu, 2015; Edler & Fagerberg, 2017). The neoclassical economists during the inter war and post war periods shared similar views and viewed innovation as a public good. The neoclassical growth theory (Solow 1956) posited that innovation and free market can make catch up and convergence in the global economy occur automatically and quickly (Pece et al., 2015). Subsequent analysis of Solow's work iterated that, meeting the development needs in developing countries requires economic growth and this growth can arise from a combination of increase investment and innovation (Cirera et al., 2015; Hu, 2015; Pece et al., 2015; Tiwari & Herstatt, 2017).

With time, however, the optimistic view of innovation impacts for developing countries did not really fit the evidence. Some scholars following the Schumpeterian tradition were of a different strand and argued that technological catch up is not automatic but requires considerable organisational and institutional effort (Cirera & Muzi, 2016; Li et al., 2017; Pradhan et al., 2018). Rather than viewing it as public good, innovation and technological knowledge created by organised R&D or acquired through learning, is argued in the Schumpeterian tradition as specific capabilities of private firms and their networks/environments. Innovation scholars in Schumpeterian tradition, for exammple, argued that innovation is not easily transferable, cannot be exploited by anybody everywhere free of charge and firms, industries and countries need to develop various capabilities and complementary conditions in order to succeed and escape the low development trap (Edler & Fagerberg, 2017; Pradhan et al., 2018).

These innovation scholars in the Schumpeterian tradition argued that successful exploitation of innovation for development depends on the ability of a country to generate the necessary capabilities. They reiterated the need for new institutional instruments for catch up in developing countries (Teixeira, 2014; Nordling, 2014; Watkins et al., 2015; Ockwell & Byrne, 2016). Watkins et al. (2015) for example, observed that even though developing countries can imitate frontier technologies from developed countries, there are also various problems that prevent them from reaping the potential benefits to the full extent and these countries must develop new institutional instruments for overcoming the obstacles. Some of the instruments and condition highlighted in this respect are public and private sector actors, education and training, development of financial systems and investment in infrastructure (Edler & Fagerberg, 2017).

Generally, the fact that innovation drives economic growth and addresses socio-economic challenges is not contestable. There is ample empirical evidence in the literature which prove that growth-enhancing innovations address social challenges and substantially influence opportunities for entrepreneurial activities and their effect on poverty reduction (Cirera & Muzi, 2016; Edler & Fagerberg, 2017; Raghupathi & Raghupathi, 2017). These impacts of innovation are observable in different sectors in developing countries (Raghupathi & Raghupathi, 2017). Innovation in agriculture is, for example, relevant for addressing socioeconomic challenges and fostering growth at the same time, as it does not only raise agricultural productivity but also directly addresses food scarcity among the country's poor (Adolwa et al., 2016). Specifically, India's Green Revolution led to the introduction of high-yield varieties and seeds and increased use of fertilisers and irrigation, and this resulted in a substantial increase in grain production; and opportunities for innovation have arisen in lower-technology sectors with high export opportunities (for example the production of palm oil and derivative products in Malaysia (Raghupathi & Raghupathi, 2017).

Despite the demonstrable evidence of short and long-term impacts of innovation, some authors are sceptical on the relevance of high-tech and frontier technologies on developing countries. They pointed out the risk of over focusing on high-tech industries which can indeed be costly to developing countries without much benefits (Huang et al., 2016). OECD recognised different types of innovation play different roles at various stages of development (OECD & EUROSTAT, 2018). It suggested low-income countries must focus on adaptive and incremental innovation in responding to specific local conditions; inclusive innovation for low and middle-income households to improve welfare and access to opportunities; and social innovation to improve the effectiveness of business and public services (OECD & EUROSTAT, 2018).

Some innovation scholars in Africa also opined that in line with various growth models, innovation is the outcome of a direct investment into the mobilisation of critical resources that has a bearing on human capital development (Rahman & Zaman, 2016; Asongu & Roux, 2017). While the phenomenon of weak innovation systems and low rate of commercialisation of innovation may be quite general in most developing countries the precise nature differ in industries/sectors and levels of development in countries (Ntuli et al., 2015; Nwuke, 2015; Fu et al., 2016). Nwuke (2015) argued strongly that the constraint to growth in sub-Sahara Africa is due to the deficiency in innovation and technology adoption and noted market size, market homogeneity and factor supply are serious constraints in exploiting commercialisation of innovation.

2.7 Commercialisation of indigenous Innovations

Available statistical and empirical evidence and expert views suggest that the problem for many economies is the commercialisation and not the creation of indigenous innovative activities (Shpak et al., 2014). It is commercialisation that converts innovations from research into products and processes that when accepted on the market and adopted, would build an industry and lead to industrialisation (Olefirenko & Shevliuga, 2017). Since innovation only become relevant when the resultant outputs create economic value and attract users (Osoro, Kirama, Knoben, & Vermeulen, 2015), it is imperative decision-makers understand the phenomena of

Central University of Technology, Free State

commercialisation and incorporate it at every stage of the process to reap the full economic benefit of innovation.

Commercialisation is starting to gain significant relevance in the innovation discourse due to the increasing recognition of its role in knowledge transfer, entrepreneurship, job creation and economic growth (Chukhray & Stegnytskyi, 2015; Azarmi, 2016; Edler & Fagerberg, 2017; Olefirenko & Shevliuga, 2017). Re-echoing Schumpeterian 1910s view, Osoro et al. (2015) opined that commercialisation of indigenous innovation should be an important aspect of growth strategy for every government as it is the avenue for innovations to facilitate economic development.

Commercialisation is overwhelmingly seen as turning scientific discoveries into marketable products and services in the literature (Mohannak & Samtani, 2014). Mohannak and Samtani (2014) explained innovation commercialisation as the process of turning scientific discoveries and inventions into marketable products and services generally through licensing patents to companies, assignment of university intellectual property or by creating start-up companies.

Other scholars offered marketing approach to explain commercialisation of innovative activity. Kalynychenko (2014) outlined elements of commercialisation as marketing, project management, process observance and application of design, scenario and network planning. Marketing of innovation has been explained as disseminating information in a targeted manner about the innovation to demystify it in terms of function, cost, and advantages over existing products (Olefirenko & Shevliuga, 2017). Olefirenko and Shevliuga (2017) considered the sale of an innovative product as widespread sale and wide adaption of the product as successful commercialisation of innovation. Olefirenko and Shevliuga (2017) opined that for innovation to be successfully commercialised it should be embraced by innovative product pragmatists who forms large share of the market but are difficult to convince, and not just innovative product enthusiasts who might only be a small part of the market.

Some authors also analysed commercialisation of innovation from technical, market, and business perspectives (Pavlenko, 2015; Osoro, et al., 2015 Olefirenko & Shevliuga; 2017 Phelp, 2017). Scholars such as Osoro et al. (2015) explained that commercialisation is involved at stages preceding and following market adaption of innovation. The technical side of commercialisation deals with innovation and its factor such as ability of agents to absorb scientific or technological information and ability to source complementary assets and support capabilities. Most Innovations may be technical in nature, but it is important to incorporate business models in its commercialisation strategy to align the technical decisions with economic outcomes so that the firm can achieve profit (Pavlenko, 2015; Osoro, et al., 2015 Olefirenko & Shevliuga, 2017). Some other scholars see commercialisation as taking a newly discovered knowledge to commercial level through proven business applications for the betterment of mankind, science, and businesses throughout the world (Sparks, 2017).

Again, Marx and Hsu (2014) examined commercialisation in respect of cooperating or competing with incumbent firms in the market. Marx and Hsu (2014) argued in the sense that successful commercialisation and innovation's future value are determined by market environment, incumbent firm's integration costs, friction, and access to complementary assets.

Commercialisation is viewed as a process of launching of 'invention' (technical output) so that both the innovators and customers can realize value (Phelp, 2017). Phelp opined that a product could be excellent in terms of quality, and it might be skilfully marketed, but if few customers in the marketplace are interested in it, that product would still likely fail. He mathematically summarized innovation as invention plus commercialisation (innovation = invention + commercialisation). Phelp (2017) further explained that invention is discovering of new knowledge and commercialisation is launching of invention so that customers and the economy can realise the value.

As emphasised many times earlier, inventions only become innovation when resulting new products and activities are adapted by users and accepted on by the market, thus commercialisation is final stage of the innovation puzzle. According to Phelp (2017), not only the discovery of opportunity, but also the decision to exploit opportunity is crucial. Even though innovation per se does not necessarily mean market success, innovation and commercialisation are so intertwined and commercialisation is involved at stages preceding and following market adaption of innovation (Osoro et al., 2015).

2.8 THE PROCESS OF INDIGENOUS INNOVATION COMMERCIALISATION

From the literature commercialisation encompasses various processes and involve various agents but three actors (established firms; academic and research institutions; and entrepreneurs), have been mainly identified in the process (Dahstrand et al., 2016; Dogan, 2017). Dahstrand et al. (2016) opined that most indigenous innovation occur and get commercialised in established firms and in academic/research institutions. Commercialisation mostly occur through corporate venturing or corporate spinoff, thus when incumbent firms via expansion of existing lines of business and creation of new business lines or when employees leave their employer to find a new firm based on knowledge and ideas acquired in the firm respectively (Dahstrand et al., 2016).

In respect of innovations from academic and research institutions which is touted as the major source of inventions and innovation, innovations get commercialised through technology transfer which encompasses a variety of activities including licensing and academic spinout business, that move academic discoveries into the public (Mohannak & Samtani, 2014; Chukhray & Stegnytskyi, 2015; Gail & Roi, 2017). Academic and research institutions have a mission to ensure that their discoveries, inventions, and new science applications lead to useful products and services for the public. This is the so called third missions of universities (Barr, Baker, Markham & Kingon, 2014; Brown, 2016).

Chukhray and Stegnytskyi (2015) also highlighted the role of universities and research institutions in developing and commercialisation of innovative products, processes, and scientific research. Chukhray and Stegnytskyi (2015) noted that many businesses would like to acquire new technologies and capabilities from academic and research institutions and other firms in different industries to maintain and enhance their competitiveness. Innovation output and commercialisation activities of academic and research institutions is however under constant scrutiny as industry and university research worlds become less and less dissimilar (Chilana et al., 2015; Osoro, et. al., 2015). Jamil et al. (2015) observed that industry has since 1990s been moving to develop flexible organisational structures to facilitate knowledge development and transfer.

Entrepreneurs, new people entering business, is by far the most common agent of innovation commercialisation in local economies. According to Olefirenko and Shevliuga (2017), successful commercialisation of innovation or projects are likely to be initiated and led by either owner manager or top entrepreneurial managers in a firm. Dahlstrand et al. (2016) citing earlier scholars such as Carlsson and Stankiewicz in the 1990s, recognised that entrepreneurs are very necessary and are, for example, helpful in transforming networks of agents into synergistic clusters of firms and technologies within an industry or group of industries. Dahlstrand, et al. (2016) articulated the role and function of entrepreneurship or entrepreneurial experimentation by entrepreneurs in fostering creation, selection and scaling up of new technologies and innovations, and deem it central in an innovation system that can generate innovations and economic growth. Even though most national innovation systems emphasised the role of entrepreneurs as central actors in the system, some authors doubt the extent to which entrepreneurs, particularly in developing countries, are Schumpeterian innovators (Cooke, 2016; Smith, 2018). Cooke (2016) contended that most are not innovative and are likely to stay small and further argued primacy of entrepreneurs in innovation system might be misplaced and suggested that the emphasis should rather be on the enterprises.

Theoretically, commercialisation of new innovations occurs through the process of diffusion and translation (Spinuzzi et al., 2015). According to the diffusion model, good ideas spread by virtue of being self-evidently good (Lusch & Vargo, 2014). Thus, when one sees that an innovation delivers a value, he/she adopts it and an innovation's claim to value is understood as a property of the innovation itself. Lusch and Vargo

(2014) explained that when people adopt innovations, they adapt them to local needs and for indigenous innovation to go further and be successfully commercialised it requires translation.

According to actor-network theorists the principle of translation is a definition of roles, a distribution of roles and the delineation of a scenario (Spinuzzi et al., 2015). They further explained that translation involves four moments: Problematisation—reshaping and stating a problem or activity in terms specific to a particular discourse; Interessement—relating an actor's interests with another set of interests; Enrolment—coordination of actors with related interests; and Mobilisation—consolidation of interests of the group through the representation of a spokesperson. Again, from the perspective of Spinuzzi et al. (2015) expanding from diffusion to translation is often difficult for innovators, as they tend to be experts in their technical domain but new to commercialisation. Spinuzzi et al. (2015) therefore recommend entrepreneurship development programmes to teach innovators to produce arguments and written genres such as pitch decks, technology assesMSEnt and commercialisation reports, company websites, product descriptions, patents, and certifications to interest appropriate stakeholders.

From system perspective some scholars explained commercialisation process as entrepreneurial experimentation in the system of innovation (Acs, Autio & Szerb, 2014; Mason & Brown, 2014; Stam, 2015; Stam & Spigel, 2016; Dahlstrand et al., 2016). They opined that economic success occurs through creation of variety of innovative activities, selection and retention of the winning innovations and businesses, while letting go the losing ones in dynamic and hierarchical market.

Marx et al. (2014) and Dahlstrand et al. (2016) argued that the commercialisation and entrepreneurial experimentation process consist of both 'technical' and 'market' part. The technical part relates to the supply side in terms of the system's capacity to develop variety of innovation and business ideas to be put on the market for selection (Dahlstrand et al., 2016). Dahlstrand et al. (2016) explained the market part as the demand side in terms of the efficiency of selection and scaling up of innovations and businesses on the market. They liken the process of innovation commercialisation to sorting or filtering process, where viable and innovative high-impact innovations are selected by market forces and scaled up. Kerr et al. (2014) emphasised the selection stage as crucial as there are often no established business models and there is uncertainty about synergies with existing technologies and products.Others explained that commercialisation is involved at stages preceding and following market adaption of innovation and identified the stages of commercialisation as idea generation, technology development, market opportunities seeking, market promotion and market sustenance (Osoro et al., 2015).

From modern practice the process of innovations commercialisation can be generally summarised in three stages: stage 1, evaluation and selection of the best ideas of innovation development; stage 2, search and formation of stable sources of support of innovations development; and stage 3, production of innovative products and their implementation (Pavlenko, 2015; Olefirenko & Shevliuga, 2017). Olefirenko and Shevliuga (2017) emphasised searching and formation of stable sources of support as key bases of success. They identified financial, organisational, and regulatory supports and described them as triangle of support with the state playing a significant role. Financial support for the innovations commercialisation process involves ensuring favourable conditions for firms in terms of concessionary credit for small and medium enterprises, support for innovation mediation mechanism between innovators, developers, and the business community, and all of these depend on the level of state integration in the innovation system (Soofi, 2017; Olefirenko & Shevliuga, 2017).

Organisational supports for innovations commercialisation relate to creating favourable conditions in terms of clusters of knowledge-based institutions (KBI), industrial parks and new companies (Olefirenko & Shevliuga, 2017; Pradhan et al., 2018). Organisational support also involves stimulation of research and innovation activities and promoting integration of science, technology, and innovation policy with the country's industrial policy in mind (Nwuke, 2015; Edler et al. 2016).

Regulatory support of innovation commercialisation process involves legislation to create the legal framework for the developers and provide the basis for the expansion of innovation activities and entities on the market. Regulatory support is so important in the commercialisation process because it is the basis of affordability, acceptability, availability, and awareness (the 4As of innovation) as the innovator may not be the developer of the innovation (Edler et al., 2016; Olefirenko & Shevliuga, 2017).

2.9 CHAPTER SUMMARY

Understanding of innovation has expanded in the last two decades. Some progresses have been made, and the concept is also increasingly analysed in the context of low-income economies (Global Innovation Index, 2018). These have led to growing calls in the literature for African countries to develop their own indigenous innovations (Feige & Vonortas, 2017; Botchie et al., 2017; Li, Sutherland & Ning, 2017; and Huang et al., 2017). Some argued that the impact of success of indigenous innovation can be different and higher than that of foreign direct investment or adopted innovation (Phelp, 2017). At the same time, others have cautioned about the dangers of merely re-inventing the wheel, development of obsolete technologies and misallocation of resources, and rather favour technological leapfrogging strategies (Huang et al., 2016; Amankwah-Amoah, 2016). There is therefore the need for the term indigenous innovation to be well-defined, explained and put into right perspectives.

Recent innovation literature highlights the need for innovation factors to be continuously evaluated to provide an important tool for decision-makers such as entrepreneurs and innovators as well as policymakers in developing economies who have put innovation at the centre of their growth strategies (Global Innovation Index, 2018). However, commercialisation of innovation is largely associated with scientific discovery, marketing of hi-tech products and R &D and not well dealt with in the context of low-income economies. Understanding factors of commercialisation of indigenous innovation in low-income economies would therefore contribute to fill the gap in the literature. In sum, the current chapter synthesised the literature and distinguished indigenous innovation from Schumpeterian innovation. Having recognised that indigenous innovation requires comprehensive system of scientific, business, and other sorts of knowledge as well market conditions and capital, chapter three will focus on national innovation system and commercialisation issues in Ghana

CHAPTER 3: INNOVATION SYSTEM AND COMMERCIALISATION ISSUES IN GHANA

3.1 INTRODUCTION

The preceding chapter presented discussions on national innovation frameworks and some important strategies such as national innovation policies, patency and intellectual property, technology absorption capacity of firms, tech hubs and their roles. “Zizhu chuangxin”, the Chinese indigenous innovations system, and aspects of the Kenyan National Innovation System KNIS) have been highlighted as successful examples in the literature. The preceding chapters also recognised Ghana as one of the first African countries to have put in place some key elements for science, technology, and innovation (STI) system from the onset of its independence (Nwuke, 2015; Bartel et al., 2016; Oduro, 2020). Yet, the country’s innovation performance has over the years been exceedingly low (Dutta et al., 2016; Cornell University et al., 2017; 2018; 2019; 2020).

As emphasised in the discussion, successful commercialisation and the resultant socioeconomic development necessarily required effective and efficient application of science, technology, and innovation. The purpose of this current chapter, therefore, is to explain Ghana’s science technology and innovation (STI) challenges by providing a discussion on the Ghanaian national innovation system and policy regimes. The review undertaken here includes Ghana’s science technology and innovation (STI) challenges, the Ghanaian national innovation system and policy regimes. In essence, the chapter also analysed the actors in the Ghanaian innovation system, examined barriers to innovation and its commercialisation as well as innovation performance in the small-scale industry sector in Ghana. The exercise helped the researcher to understand the innovation system, innovation policy regime patterns and impacts as well as commercialisation gaps in Ghana.

3.2 SCIENCE, TECHNOLOGY, AND INNOVATION (STI) POLICY IN GHANA

3.2.1 The STI challenge in Ghana

Achieving Ghana's ambitious industrialisation policy goal of empowering MSEs to expand productive employment and technological capacity within a highly competitive manufacturing sector; necessarily required effective application of science, technology, and innovation (STI). Ghana's industrial policy goals also include promoting agro-based industrial development and ensuring value-addition to exports, increase productivity and reduce poverty (MOTI, 2015). The country has also since its independence put in place some of the key elements, even if disjointed, for an efficient and effective STI system (Bartel et al., 2016; Osei, Yunfei, Ansah & Kwarteng, 2016; Oduro, 2020). The attempt to address the challenge of industrial productivity and competitiveness has been shown by several policy initiatives and notable among them are National STI Policy (MEST, 2010) and Ghana Industrial Policy (MOTI, 2011). For example, one specific objective of the National STI Policy of 2010 is to develop STI capacity to support the building and construction sector, including the development of local raw materials and equipment, and to encourage their use in the local building industry (MESTI, 2017a). To date, however, the overall effect of innovations making Ghanaian businesses more productive is still yet to be seen and there is ample evidence that suggest the role of STI in the country's development (Oduro & Nyarku, 2018; Okoe & Boateng, 2016).

From an analysis on Ghana's long-term growth and development efforts in the last two decades, it is evident that economic growth has averaged about 6 per cent. Ghana's growth has also been volatile: It even hit 14 per cent in 2011 and then felt to 4 per cent in 2014 before picking up and averaging 7 per cent before the COVID-19 pandemic (World Bank, online). The Country attained middle-income country status in November 2011 and average good growth rate; significant progress on the MDGs; increasingly attractive investment prospects; and the newly acquired status as net oil exporter have been highlighted as the success factors (UNIDO, 2015a, African Business, 2015; World Bank, 2016). However, the source of this growth was mostly factor accumulation with technological advances playing only a marginal role (World

Bank, 2016; World Bank 2019). Low productivity particularly in agriculture, farmers' socio-economic conditions, poor infrastructure, poor physical environment, are strongly evident (Newman, Page, Rand, Shimeles, Söderbom & Tarp, 2016; World Bank, 2016; World Bank, 2019).

According to World Bank (2016), in spite of Ghana 's middle-income country status and its recently acquired status as a net exporter of oil, the country has a huge productivity gap that must be overcome in order to catch up with other middle-income countries. Clearly to achieve ambitious goals in Ghana's new industrialisation policy goals of one district one factory, requires a more effective application of science, technology and innovation (STI) in the economy in order to drive productivity and diversify the economy (Aryeetey & Kanbur, 2017; Béland, Foli & Kpessa-Whyte, 2018; Eshun, 2019).

3.2.2 The STI policy regimes in Ghana

To understand the drivers of indigenous innovation commercialisation in Ghana, it is useful to understand how STI policy regime evolved and its impacts over the years. Science Technology and Innovation (STI) Policy of Ghana is expected to drive its socioeconomic development through development, adoption, commercialisation, and application of innovation (MESTI, 2017b). From the literature four distinct STI policy regime patterns can be identified. First is the Nkrumah era (1957–1966); second is the immediate post-Nkrumah period (1967 to the 1990s); third is the dawn of the Fourth Republic (from 2000 to 2010); and the fourth is the still unfolding digitalisation era (early 2010s to present) (Nwuke, 2015; UNIDO, 2015; Amankwah-Amoah, 2016; World Bank Group, 2019).

It can be confirmed from the literature that the formulation of science and technology policies to foster indigenous innovation and development began immediately after independence with even greater intensity (Nwuke, 2015; Amankwah-Amoah, 2015; Amankwah-Amoah, 2016). With vigorous and coherent science and technology set out by Ghana's first independent regime, Kwame Nkrumah's regime, the country got to then cutting edge of technology and education by early 1960s (Boso, Story & Cadogan, 2013). Nkrumah era was indeed characterised by centrally planned and implemented STI policy, introduction of the concept of science for development, development of science and technology infrastructures, funding to promote local innovation and R&D activities, technology, and knowledge transfer from foreign to indigenous firms, capacity building of universities and training schemes (Amankwah-Amoah, 2016).

The initial progress of Nkrumah regime was however not sustained, with a plausible explanation being the strategy was a politician-led one with very little link to industry and institutions and destined to go down with the Nkrumah Government (Amankwah-Amoah & Sarpong, 2015). Another constraint to STI in Nkrumah era was that policies were biased towards resource-rich large firms and state-owned firms and some argued the industrialisation agenda of Nkrumah was simply too ambitious and unstainable (Simons, 2014; Amankwah-Amoah & Sarpong, 2015).

The second distinct STI policy era in Ghana was the immediate post-Nkrumah period that ranged from 1967 to the 1990s. As the initial progress could not be sustained, by the 1970 the industrial sector shrunk and by early 1980s the Ghanaian economy was described as a collapsed economy. During the immediate post Nkrumah era, the three main policy tracks: science policy, industrial policy, and innovation policy in Ghana, diverged and expertise in these areas decayed and dwindled as political instability and economic decline made skilled scientists, academics and engineers left the country for greener pastures (Amankwah-Amoah, 2016).

Even though the post Nkrumah era saw various declarations to harness value in science and technology (STEPRI, 2015) and indeed major promotion of "made-in-Ghana" products, particularly in 1970s during Acheapong era and in the 1990s, there were no explicit policy and there were also some evidence of technological backwardness (Amankwah-Amoah & Sarpong, 2015; CSIR, 2015). The immediate post Nkrumah era was characterised by the dismantling of major STI initiatives during the Nkrumah period, divergence of science policy and industrial policy low priority afforded to science, innovation and technology and lack of effective advocacy (Amankwah-Amoah, 2016).

The third observable pattern of STI policy regime in Gahanna expands from the dawn of the Fourth Republic to early 2010s. The 2000s saw some re-prioritisation and policy convergence of science, technology, and innovation. The first major national science and technology policy document was developed and launched by the government in 2000 (MEST, 2010). The policy had the aim of upgrading the expertise and capacities and provided explicit and legally standing framework to guide government and encourage `collaboration from industry and government. Other key objectives of the National STI Policy were to develop quality of life through innovation, human capital development and skill formation in science, expand industrial base of the country and promote an information society (MEST, 2010).

In terms of education, the STI policy attempted to ensure 60% university students and 80% of students in the vocational institutions studied science and science-related subjects. It also prescribed that 2% of the country's GDP is allocated towards investment in science and technology. In sum, 2000s and early 2010s saw renewed focus on the development of indigenous capacity. Nonetheless, these efforts were still constrained by inadequate expertise to oversee full implementation, inadequate attempts to help local firms in catching-up process, inability of the government to meet budgetary allocation and misallocation of the scarce resources (Quaye, Yamga. & Tetteh, 2020).

The fourth and still unfolding pattern is the digitalisation era. The two key policy documents were revised: the national science and technology policy in 2017; and Ghana industrial policy in 2011 and 2015 (UNIDO, 2015b; MESTI, 2017a; MESTI, 2017b). Both revised policies recognised promoting STI and development of the industrial sector would require strengthening public research institutions; improving the ability of private firms to carryout R&D and absorb technology; supporting the outsourcing of science and technology; provision and expansion of business development services to industrial firms; and supporting firms to undertake and exploit

S&T for innovation (UNIDO, 2015a; UNIDO, 2015b MESTI, 2017b). Both policies have strategies to enhance ICT usage, strengthening educational and training institutions to develop the requisite skills to support the application of ICT and creation of an effective linkage between ICT, technology transfer and industry (UNIDO, 2015; MESTI, 2017b).

Correspondingly from 2012, there has been bolder attempts to create incentives and conditions to foster public–private collaboration. The era also is seeing improved access to venture capital funding, emergence of technology hubs and public–private collaboration. A separate ministry for business development and the National Entrepreneurship & Innovation Programme (NEIP) has been initiated to provide an integrated national support for start-ups and small businesses (NEIP, 2017). NEIP focuses on providing business development services; start-up incubators and funding for young businesses to enable them grow and become successful (Adu, Boakye, Suleman & Bingab, 2020).

The era has seen ICT made a compulsory subject at all levels of education, Accra Digital Centre built and the establishment of the first national technology park which serves as an incubator for local innovation and entrepreneurship (KNUST, 2014; Omane-Boamah & Atta-Boateng, 2020). Although the National Information Communication Technology for Accelerated Development Policy was set in 2004, it was from 2014 that digitalisation of the economy took the centre stage of policy implementation and now that conspicuous efforts are being made to deploy both digital infrastructure and applications in terms of E-Commerce and E-Government (Ewurah, 2017; Karakara & Osabuohien, 2019). Some of the digital infrastructure included 1000km of rural fibre network which runs through the eastern part of the country, metro fibre network within Accra and Tema and development of the Accra Digital Centre (Omane Boamah & Atta-Boateng, 2020). These digital interventions, although painstakingly slow are beginning to show dividend by making life more convenient for citizens, enabling critical services to be extended to the needy in remote communities and accounting for productivity and improvement of the working environment of workers in both the public and private sectors (Karakara & Osabuohien, 2019; Omane Boamah & Atta-Boateng, 2020).

The emergence of mobile money payment system in the recent era has also not only extended financial services to unbanked areas but it is also enabling indigenous small business to embrace E-Commerce, easing financial management and supporting small business growth (Karakara & Osabuohien, 2019; World Bank Group, 2019; Bawumia, 2020). Ghana has in 2020 become one of the first countries in Africa to introduce universal quick response (QR) codes for all merchants including those in the informal sector which gives their customers the option of scanning through a smartphone or using USSD to make payment without a need for expensive point of sale (POS) infrastructure (Bawumia, 2020).

3.3 NATIONAL INNOVATION SYSTEM AND INSTITUTIONS IN GHANA

3.3.1 Ghanaian national innovation system (GNIS) and policy framework

Empirical works on the Ghanaian innovation system is scanty, however it is useful to provide some understanding of Ghanaian National Innovation System (GNIS) in terms of policy frameworks, its components, and the linkage between the actors. Recognising the importance of NIS in fostering technological and industrial development, Ghana has over the years signed up to many international declarations including the current Science, Technology and Innovation Strategy for Africa (STISA-2024), which places science, technology and innovation at the 'epicentre of development (African Union, 2014). It has formulated explicit science, technology, and innovation policy, enacted other innovation related sectorial policies and made several institutional and legal arrangements for their implementations (Nwuke, K. 2015; Amankwah-Amoah, 2016).

Key among these policies and legal arrangements for constitution and functioning of GNIS are the National STI Policy (2010) and the National Science, Technology and Innovation Development Programme of Ghana (STIDEP) 2011-2015 (2010); the

Ghana Industrial Policy (2011) and the Industrial Sector Support Programme 2011-2015 (2011); the Ghana ICT for Accelerated Development (ICT4AD) Policy (2003); the Education Strategic Plan I & II, 2010-2020 (2010); Council for Scientific and Industrial Research(CSIR) Act, 1996. Act 521; Technical Universities Act, 2017 (Act 922); acts establishing the various universities, for example University of Mines and Technology, Tarkwa Act - 2004 (Act 677) and the University of Health and Allied Sciences (UHAS), 2011 (Act 828); and the Patents Act, 2003 (Act 657).

Recent NIS surveys and studies on Ghanaian innovation system highlight policy management and effect of diffused ICT among others as very important to successful functioning of GNIS (UNIDO, 2015; MESTI, 2017a; OECD & EUROSTAT. 2018). There have been several policy initiatives to enhance Ghana's industrial productivity and competitiveness through science, technology, and innovation development (Aryeetey & Kanbur 2017; NDPC, 2014; MESTI, 2017b, MOTI, 2018). The bases of most of these initiatives are the Technology and Innovation Policy (2010) the Ghana Industrial Policy (2011) (Oduro-Marfo, 2015 Ackah, Adjasi & Turkson, 2016). Most of these policies recognised promoting STI and development of the industrial sector would require strengthening public research institutions; raising of the ability of private firms to carryout R&D and absorb technology; supporting outsourcing of science and technology; provision and expansion of business development services; and supporting industrial firms to undertake and exploit science and technology for innovation (Amankwah-Amoah, 2016, UNIDO, 2015; MESTI, 2017a).

Some identifiable commercialisation incentive elements in the revised versions of STI policy include: effort to streamline funding to achieve economies of scale in the support for development of science and technology in industry; encouragement of public and private procurement of products and services from Science and Technology institutions and encouragement of the private sector to support the funding for R&D activities, especially catering for the needs of the micro, small and medium enterprises (MMSEs), which can be nurtured for the commercialisation of novel products or processes (Oduro-Marfo, 2015; Amankwah-Amoah, 2016; MESTI, 2017b, Udimal, Jincai, & Ibn Musah, 2019). The STI Policy has also strategised the creation of a venture capital fund with a sole purpose of harnessing the commercialisation of new technologies from scientific and technological institutions (MEST, 2010; MESTI, 2017a; Divakaran, Schneider & McGinnis, 2018).

Attempts to coordinate various policies also led to formulation of the Co-ordinated Programme of Economic and Social Development Policies (2017-2024) and a number of special initiatives one of which is the One District One Factory policy (1-D-1-F) (Government of Ghana, 2017; MOTI, 2018). The 1-D-1-F is an expression of local industrial development, which aim to establish, at least, one factory or enterprise in each district of Ghana as a means of creating economic growth poles that would accelerate development (MOTI, 2018; Eshun, 2019).

Regarding Science and Technology in education, there is evidence that there have been policy efforts within the last two decades to revitalise laboratories and workshops and increase investment in science and technology (Lingstone & Frimpong, 2020). The education sector policy, the Education Strategic Plan 2010-2020, was set out to improve teaching and learning; modernise and extend ICT, science education, technical and vocational education, and training; and to enhance skills development at all levels (UNESCO. 2018; Lingstone & Frimpong, 2020). The education policy outlined strategies to strengthen linkages between tertiary educations, industry and integrate entrepreneurship and career counselling into academic programmes in all tertiary institutions and to further promote ICT in education at all levels.

It has been widely acknowledged in the literature that for Ghana to move from weak industrial economy towards information and knowledge-driven economy, it will need to develop and implement comprehensive integrated ICT-led, socio-economic development policies and strategies (Aryeetey & Kanbur 2017; Dale & Khuong, 2016). The National Information Communication Technology for Accelerated Development Policy (ICT4AD) Policy (2003) was set out in 2003 and continuously revised; Ewurah, 2017; Republic of Ghana, 2017; Karakara & Osabuohien, 2019). The ICT4AD policy in the innovation system is to address the key developmental challenges of under-developed physical communications infrastructure and limited human resource skills capacity in ICT among others. The inclusion of ICT in analysis of GNIS goes beyond the concept of access, to addressing all issues attributable to digital divide including storage, the ability to compute and transmit digital information, the quantity of hardware, and the corresponding performance with respect to all four NIS Actors in the Triple Helix type 4 (Dale & Khuong, 2016; Ewurah, 2017).

It is clear that the Government of Ghana recognised the importance of technology-driven industrialisation, from the various policies and its strategic posture towards the application of STI through the national innovation system in the economy. Indeed, plethora of innovation policies with respect to industry, STI, ICT, education exist (Lingstone & Frimpong, 2020). It however appears the available policy instruments are neither calibrated nor configured to successfully overcome constraints to innovation. The policy incentives, instruments, and regulation to achieve the policy objectives also appear to be seriously truncated (UNIDO. 2015a). Despite nice policy craft, resource application in GNIS has been generally problematic (Quaye et al., 2020). The policy prescriptions echelon is not yet obvious in regulatory, fiscal, and monetary policy incentives (UNIDO, 2015a; Quaye, Akon-Yamga, Daniels, Ting & Asante, 2019). In exception of few instances, unquantified and non-indexed policy directives, recommendations, and incentives, appeared to be rendering policy management in terms of coordination, prioritisation, operationalisation and control difficult (Jowi, Obamba, Sehoole, Alabi, Oanda & Barifaijo, 2016; Lingstone & Frimpong, 2020).

3.3.2 Institutions and actors in GNIS

In understanding commercialisation of indigenous innovation in Ghana it is important to examine the key actors and their roles in the Ghanaian National Innovation System (GNIS). Certianly, the traditional innovation system approach recognised the dual roles of institutions as the actors and rules of the game in an innovation system (Dahstrand et al., 2016). Even from Triple Helix (TH) type 4 perspective, Ghana has some of the key institutional elements: the government, the knowledge base institutions (KBIs), industries and arbitrageurs, necessary for a functioning national innovation system (UNIDO, 2015; Bartel et al., 2016; Okoe & Boateng, 2016; Sarpong, Razak, Alexander & Meissner; 2017; Oduro & Nyarku, 2018).

3.3.2.1 The government and related agencies

Government in GNIS is represented by the Ministries and relevant public institutions directly or indirectly responsible for innovation and their officials. The key ministries include Ministries of Trade and Industry (MOTI), the Ministry of Science and Technology and Innovation (MESTI), the Ministry of Economic Planning and Finance, the Ministry of Education, Ministry of Business Development, and some other sectorial ministries (MESTI, 2017a). Until recent the MESTI and MOTI have been the main implementing ministries for STI policy and innovation development together with sector ministries carrying out sectorial policies and programme. However, in 2017 President Nana Akoffour Addo Government recognising a need for bolder steps created a separate ministry, the Ministry of Business Development and initiated National Entrepreneurship & Innovation Programme (NEIP). The Ministry and NIEP are to provide an integrated national support for start-ups and small businesses (NEIP, 2017). NEIP focuses on providing business development services; start-up incubators and funding for young businesses to enable them grow and become successful (Asante and Affum-Osei, 2019; Botchway & Hlovor, 2019; Adu, Boakye, Suleman & Bingab, 2020).

The primary functions of the Government in the innovation eco system is the provision of public infrastructure and services, organisational support, regulatory supports and funding for the actors as well as creating enabling policy environment (Soofi 2017; Olefirenko & Shevliuga, 2017). In addition to funding its direct institutions, KBIs and other actors in the innovation system, the Government has made several policy efforts to promote science and technology and innovation (Amankwah-Amoah, 2016). Ghana’s main institutions for technology development, regulation and support includes Ghana Standards Authority (GSA), the Food and Drugs Authority (FDA), the Environmental Protection Agency (EPA) and The Registrar-General’s Department. The GSA is for the overall management and coordination of standardisation issues;

the FDA for regulating the manufacture of food products, pharmaceuticals, coMSEtics, and chemicals (Public Health Act, Act 851, 2012); the EPA for assessing the environmental impacts of technologies and of innovation activities environmental protection agency (EPA Act - Act 490, 1994). The Registrar-General's Department serves as the custodian of intellectual property law, as the register of businesses, houses industrial property information, provides information, and thus play a crucial role in commercialisation of innovation activities in Ghana.

Two key important institution that provide organisational support and services aiding diffusion and commercialisation of innovations are the Ghana Free Zones Board (GFZB) responsible for establishment and operation of export processing zones; and the National Board for Small-Scale Industries (NBSSI) with a focus on promoting the development of micro and small-scale enterprises (MOTI, 2018). Other institutions for technology development and innovation support in Ghana are the Public Utilities, Regulatory Commission, the Ghana National, Procurement Agency, and the Ghana Export Promotion Council. These institutions together are to play a crucial role in determining the development, diffusion and adoption of modern technology and placing of new products on the market in Ghana (UNCTAD, 2019).

3.3.2.2 Research and knowledge based institutions

According to Teixeira (2014), existence of KBIs and their relationship with industry is very important for national innovations system. The knowledge community in GNIS is represented by public as well as privately funded research institutes, think tanks, universities, and innovation-related faculties (UNIDO, 2015). Key among the research institutions dedicated to generating R&D and apply science and technologies for socio-economic development in Ghana are the Council for Scientific and Industrial Research (CSIR) and its related research institutes (CSIR Act, 1996. Act 521; Bartel et al., 2016). The CSIR consists of 13 research institutes covering most sectors of the economy, and are to coordinates all scientific research, take on technological innovation activities with the private sector; and promote the commercialisation of the results (CSIR Act, 1996. Act 521). The original CSIR Act establishing the Council appeared to have narrowly focused on R&D, however, this was later amended to emphasise the need to focus more on working with the private sector, and taking on technological innovation activities (UNCTAD, 2019). In addition to the 13 institutes constituting the CSCIR other key public research institutions forming part of the national innovation system in Ghana are the Cocoa Research Institute of Ghana (CRIG) to focus on the country's economic backbone, the cocoa sector; the Ghana Regional Appropriate Technology Industrial Service (GRATIS) Foundation, the Ghana Institute of Clinical Genetics; the Centre for Scientific Research into Plant Medicine (CSRPM); and The Ghana Atomic Energy Commission (GAEC) dedicated to nuclear research for agriculture, health and energy purposes (CSIR, 2015).

GRATIS Foundation is expected to play a key role in development and diffusion of appropriate technology in Ghana. The GRATIS Foundation evolved out of the GRATIS Project, project funded by the Government of Ghana, the European Union (EU), and the Canadian International Development Agency in 1987 to promote small scale industrialisation in Ghana through the creation of technology-transfer units in universities and other R&D institutes (UNIDO, 2015b). The GRATIS regional technology transfer centres are currently in nine regions of Ghana, including the Volta Region, the study area. The Foundation is to transfer appropriate technologies to small-scale industrialists through training, manufacturing, and the supply of machine tools, plants, and equipment, as well as coordinate the activities and provide backstopping to its network of regional technology transfer centres (UNIDO, 2015b).

Public R&D is also expected to be conducted in public universities. Ghana has 10 public universities, 10 Polytechnic/Technical Universities and a number of private Universities (Bartel et al., 2016; Mensah & Gordon, 2020). Three of these: Ho Technical University, University of Health and Allied Sciences and Evangelical Presbyterian University are in the Volta Region, the study area. The first mission for establishing traditional universities, producing a highly skilled and competent labour force; and the second mission of generating new knowledge are all essential to innovation development and commercialisation (Cloete et al., 2015). Indeed, ensuring that new knowledge and innovation are applied by society and led to economic development is what is known as the third mission of universities (Barr et al., 2014; Brown, 2016).

There have been different calls for a developmental role for universities (Sá, 2015; El-Jardali, Ataya & Fadlallah, 2018). The Association of African Universities Declaration at the end of the Accra Conference in 1973, declared that all universities must be development universities (Cloete et al., 2015; Sá, 2015). UNESCO under the leadership of UN Secretary General Kofi Annan championed a series of World Conferences on Higher Education in 2000s that called for innovations in universities as a primary tool for Africa's development (Bunting et al., 2014; El-Jardali et al., 2018). Ghanaian universities largely focus on the traditional mission of producing highly skilled and competent labour force for the professions and the bureaucracy; and journal publications (Mensah & Gordon, 2020).

Despite the highlights of the third mission of the universities in World Conferences, policy documents and even Statuary Acts on Higher Education, the role of universities in Ghanaian innovation ecosystem is not clear (Asare, 2016; Technical Universities Act, 2017 (Act 922); University of Mines and Technology, Tarkwa Act - 2004 (Act 677). It is not clear whether they should play a direct instrumentalist role or an engine of development role (Muller et al., 2017). Proponent of direct instrumentalist (or service role) contend that universities have a concentration or even a surplus of expertise which should be directly used to solve pressing problems, while the engine of development' role is explained that universities should focus on strengthening knowledge production and innovation in knowledge economy (Muller et al., 2017).

3.3.2.3 Necessary industries and private sector

GNIS recognised the industry especially Medium- and High-Tech Industry as essential (UNIDO, 2015). Representing the industry in Ghana's national system of innovation are mostly Ghanaian MSEs and the financial institutions (Bartel et al., 2016). While the science and technology institutions have specific mandates to generate and develop innovation they are also to support, encourage and promote the private sector to commercialise innovation (CSIR Act, 1996. Act 521). Indeed, the private sector has over the years been widely acknowledged as a key partner in the commercialisation process as well as enhancing national competitiveness (Government of Ghana, 2017; MESTI, 2017b; Eshun, 2019).

Recognising the Ghanaian private sector generally has limited and low capacity to undertake and absorb science and technology for innovation, the Government has over the years implemented various forms of private-sector engagements including investment, capacity building, knowledge sharing and innovation (Amankwah-Amoah, Debrah, Honyenuga & Adzoyi, 2017; MESTI, 2017b). The evidence however is not a vibrant industry and private sector in the innovation system as most of the intervention suffer from inadequate funding, coordination among related agencies, corruption, and politicisation of the policy (UNIDO, 2015; Ofori, 2019; Amankwah-Amoah, 2019).

3.3.2.4 Arbitrageurs

Arbitrageurs are not represented in the traditional Triple Helix model but is of crucial importance as the innovation process requires internal and external knowledge intermediaries. Arbitrageurs are represented in GNIS by financial institutions, venture capitalists and knowledge brokers (Bartels, et al., 2016 Amankwah-Amoah, 2019). Arbitrageurs complement the traditional Triple Helix model by the provision of funds, links, and knowledge sources (Divakaran et al., 2018).

Weak financial intermediation and asymmetry of innovation has been pointed out as one major constraint to commercialisation of innovation (Baoko, Acheampong & Ibrahim, 2017; Ávila, Filho, Brandli, Macgregor, Molthan-Hill, Özuyar & Moreira, 2017; Choudhary & Jain, 2020). Venture capitalists, for example, fill this gap through the provision of links and funds which can improve performance of innovative firms in terms of acceleration of growth, survival rate and increase the effectiveness of their innovation processes (Divakaran et al., 2018; Donkor, Donkor, Kankam-Kwarteng & Aidoo, 2018).

3.3.3 Actor linkages in the Ghanaian national innovation system

Generally, it is observable from the literature that GNIS is characterised with low density relationships between the actors, perforated, truncated and some instances absent actor linkages (UNIDO, 2015; Quaye, et al., 2019). There is evidence of strong relationships between the Government, government agencies and the traditional KBIs (research institutions and higher education institutions) and indeed few observable externalities. However, the Government has very weak linkages with other Actors in the GNSI (Amankwah-Amoah, 2016; Quaye, et al., 2019). Thus, the business enterprises and industrial community and arbitrageurs in terms of financial institutions, venture capitalists and knowledge brokers all do not have strong link with the Government (Divakaran, Schneider & McGinnis, 2018).

The linkages between KBIs, as the main source of ideation and invention and the production system is paramount for an effective national innovation system (UNIDO, 2015; OECD & EUROSTAT, 2018). However, the evidence over the years in Ghana has been very weak linkages between KBIs and the production system and very low levels of innovativeness in business enterprises (Quarmine et al., 2014; Asare, 2016; Osei-Amponsah et al., 2016). Despite some sporadic successful examples such as contribution of CRIG in developing new disease resistant cocoa varieties and some innovations in oil palm processing, the research institutions have been weak and ineffective in fostering the necessary research and innovation development bridges with MSEs (Quarmine et al., 2014; Asare, 2016). Osei-Amponsah et al. (2016) in analysing how research output for innovation of national research system meet societal needs in Ghana observed that the uptake of the research outputs, in the form of technologies and improved practices have been poor because most of the research institutes focus mainly on specific production constraints and are faced with organisational challenges, and do not have the capacity to analyse the actual constraints and opportunities of small businesses, or assess the institutional contexts in which small businesses operate.

The private sector and industry depend on KBIs in terms of acquiring the necessary skills that bring innovation into operations. However, most of the research and tertiary institutions lack adequate infrastructure for advanced industrial study of science and technology, which had led to limited skills base in the economy at large (Ababio, 2016; Abugre, 2018; Udimal, et al., 2019).

Over the years there have only been very few benefits in terms of externalities to the production system arising from the public goods from supporting KBIs; the signal system by which KBIs can respond to market demand or by which businesses can make demand on KBIs are absent or dysfunctional; the marketing orientation of KBIs is poor resulting in limited exploitation of their knowledge assets; and potential for patent, license and royalty earnings is not being realised (Ávila, et al., 2017; Abugre, 2018; Mensah & Gordon, 2020). The implication of this disconnect is the perception of research from KBIs as public goods is not yielding much externalities leading to calls for reconfiguring funding of KBIs to performance-based structures (Oduro-Marfo, 2015; Ackah, Adjasi & Turkson, 2016; Abugre, 2018; Mensah & Gordon, 2020).

There are indeed some resemblances of intra actor relationship within the business enterprises as evident by existence of Association of Ghana Industries (AGI), Association of small-scale industries (ASSI), chamber of commerce, private sector foundation in almost all regions in Ghana (Ackah et al., 2016). However, relative isolation of business enterprises from other GNIS actors is still observable (Oduro-Marfo, 2015; Mensah & Gordon, 2020). A recent innovation survey report observed that in general Ghanaian business enterprises are poorly able to influence policy instruments for promoting and accelerating business R&D and institutional innovation (Cornell University et al., 2018; UNCTAD, 2019). It is also evident from the literature that business enterprises play extremely limited role in setting public procurement policy; encouraging collaboration between GNIS Actors; and the overall governance of the GNIS (Oduro-Marfo, 2015; Amankwah-Amoah et al., 2017). Business enterprises projecting to the Government the factor constraints to innovation they confront; scrutinising regulatory regimes that govern the relationship between public resources and the private sector with respect to innovation; agitation for enabling the

Central University of
Technology, Free State

removal impediments to public private-sector partnerships for innovation initiatives; and, fostering human capital mobility from Business Enterprise, are largely absent (Donkor, et al., 2018).

3.4 INNOVATION PERFORMANCE IN GHANA

Despite the wealth of contributions on innovation and its outcomes in the last three decades it is still arguable that the understanding of the form and impact of innovation in developing countries such as Ghana is limited. A number of government reports, international papers and authors have raised concerns about Ghana's innovation performance (Oduro-Marfo; 2015; Mountjoy, 2017; MESTI, 2017a UNESCO. 2018; Cornell University et al., 2018; Quaye et al., 2019).

UNIDO observed that Ghanaian innovation system in general is weak with asymmetric actor linkages, low density relationships between the actors and this overall weakness exacerbated by high barriers to innovation is stifling the rate of innovativeness in economic activity (UNIDO, 2015). According to the World Bank's data, the Value added per agriculture worker of Ghana is only a third of the Philippian and a tenth of Brazil (World Bank, 2019). Dutta et al. (2016) observed that Ghana's innovation performance has over the year been exceedingly low and noted that the country's ranking on innovation index has been low since the inception of the Global Innovation Index (GII). The GII assesses world economies based on their innovation capabilities and has ranked Ghana 107th in 2018, 106th in 2019, 108th in 2020 out of 143 countries in terms of innovation performance (Cornell University et al., 2017 Cornell University et al., 2018; Cornell University et al., 2019; Cornell University et al., 2020).

The GII framework has five main factors defined as enabler pillars for measuring innovation inputs based on various aspects of the environment conducive to innovation within an economy, and two factors for measuring innovation output performance. The input factors include institutions, human capital and research, infrastructure, market sophistication, and business sophistication. The output factors also include knowledge & technology outputs and creative output. Each of these main factors again has three specific variables which are again defined into several specifics. Thus, in all GII currently has about 80 indicators which capture the multi-dimensional facets of innovation. Table 3.1 provide a snapshot of Ghana's innovation performance on the Global innovation index.

Table 3.1: Ghana's Innovation performance 2020

	SCORE	RANK
OVERALL		**108**
INPUT		**113**
INSTITUTIONS	**46.5**	**121**
Political environment.	52.9	83
Regulatory environment	30.7	127
Business environment.........	55.2	118
HUMAN CAPITAL & RESEARCH	**17.2**	**104**
Education	36	92
Tertiary education	13.7	108
Research & development (R&D).	1.9	97
INFRASTRUCTURE.	**32.5**	**96**
Information & communication technologies (ICTs)	55.6	87
General infrastructure	19.2	103
Ecological sustainability.	27.3	87
MARKET SOPHISTICATION	**37.1**	**111**
Credit	26.9	115
Investment	31.1	89
Trade, competition, and market scale	52.7	104
BUSINESS SOPHISTICATION	**17.9**	**113**
Knowledge workers.	15.1	109
Innovation linkages	21.5	61
Knowledge absorption	17.1	117
OUTPUT		**93**
KNOWLEDGE & TECHNOLOGY OUTPUTS	**12.6**	**104**
Knowledge creation.	4.4	112
Knowledge impact.	16.8	93
Knowledge diffusion	16.7	86
CREATIVE OUTPUTS.	**16.1**	**90**
Intangible assets	24.5	75
Creative goods and services	10	77
Online creativity	5.2	108

Data Source (Cornell University et al., 2020)

According to the GII data, Ghana's performance has even worsened in the last three years, particularly in terms of innovation input performance as the country ranked 108th, 109th and 113 in 2018, 2019 and 2020 respectively. Ghana has over the years scored very low and, in some instances, ranked very low even among low-income countries in terms of R&D spending, global R&D companies, credit to private sector, cost of doing business, competition and market scale, patent application and University ranking (Dutta et al., 2016; Bartel et al., 2016; Cornell University et al., 2018; Cornell University et al., 2019; Cornell University et al., 2020).

According Bartel et al. (2016), the relative positions of Ghana on the innovation indexes are not out of tune of sub-Sahara African countries and other "factor-driven" economies. For example, in 2019, Ghana ranks 11th among the 26 economies in sub-Saharan Africa. Bartel et al. (2016) pointed out that typically factor-driven" economies have limited capacity to innovate and add value to the goods and services they produce; have unsophisticated local enterprises with limited managerial and organisational capacity; have minimal commercial and technological links to the global economy; use low-wage, poorly educated and unskilled labour to produce; and export unprocessed raw materials.

The seemingly poor performance of countries such as Ghana might also be due to the generally limited understanding of innovation in these settings (Bruno & Bruno, 2018) and paucity of specific innovation studies and analysis on Ghana (Bartels et al, 2016; Hu, Danso, Mensah & Addai, 2020). In spite of limited understanding of innovation and scepticism of whether or how these innovations are spreading in developing countries, there are some evidence that something is happening (Afful & Owusu, 2017; Fu, Mohnen, & Zanello, 2018; Hu et al., 2020; Cornell University et al., 2020). Afful and Owusu (2017) analysed the Ghana Enterprise and Innovation Follow-Up Survey and uncovered that market innovation is occurring and the predominant particularly among the manufacturing sector in Ghana. Using probit regression model they however also show that product and process innovation are weak and dependent on R&D and called for government R&D to subsides for companies.

The work of Fu et al. (2018) provided some evidence that innovation, most of it albeit below the radar, is happening and it is helping businesses survive and grow in Ghana. Fu et al. (2018) also added that much of this innovation, particularly in the informal sector, is happening 'under the radar'. That is, it typically involves the adaptation of existing technologies, rather than development of brand-new or 'new-to-firm' technological innovations.

Hu et al. (2020) shed some lights on some sustainability-oriented innovations happening in star-rated hotel firms in Ghana. Even from the GII data Ghana has shown some strength in electricity and energy usage and development of micro finance loans in terms of innovation input pillars; and income growth, gross capital formation, global brand value in terms of innovation output performance (Cornell University et al., 2020).

3.5 INNOVATION AND COMMERCIALISATION BARRIERS IN GHANA

A number of obstacles to innovation including access to credit; under-skilled employees; perceived economic risks of innovation; inconsistent innovation policy; and low levels of collaboration with universities and research institutions have been raised as barriers to innovation in Ghana (UNIDO, 2015; Bartel, 2016; Fu, Mohnen, & Zanello, 2018). Others have highlighted start-up cost, government funding in terms of research institutions and bureaucratic processes (Fu et al., 2018, Nyarku & Oduro, 2017; Oduro & Nyarku, 2018; Quaye, Akon-Yamga, Daniels, Ting & Asante, 2019). In addition to low level of innovativeness in the Ghanaian economy due to barrage of barriers it is further evident that only few innovations occurring get successfully commercialised (Jinbaan et al., 2016; Weyori et al., 2018; Quaye et al., 2020). Indeed, empirical evidence and expert views suggest that the problem for many economies such as Ghana is not the creation of indigenous innovative activities, but it is their commercialisation (Shpak et al., 2014; Quaye et al., 2020).

The unconquerable gap between discoveries and successful commercialisation is what is termed in the literature as the innovation commercialisation gap (Orlova, 2014). Innovation commercialisation gaps in Ghana may be sufficiently and practically explained by limited funding and high investment risks, thus unwillingness of stakeholders in the innovation system to take on the substantial risk and make pre commercialisation investment (Quaye et al., 2019). It has also been observed that many innovators do not include innovation's value extraction in the market as part of innovation process and this has accounted for innovation-commercialisation gap in the market (Orlova et al., 2016; Quaye et al., 2020).

Commercialisation gap, though not well discussed in the literature, is a widespread phenomena and a common concern in developing countries (Gosens et al., 2018). Sparks (2017) reiterated other scholars such as Jacob Heller and Christine Peterson and described the commercialism journey as "Valley of Death". Sparks (2017) opined that creative genius do not sustain innovation and business practices and principles are required to harness the power of the creativity to become competitive in the marketplace. He compared the commercialism of any invention to the concept of raising a child in Africa: "it takes a village to raise a child" and it takes a village of support to raise and successfully commercialise a creative idea.

While few innovation studies on Ghana have raised number of barriers to innovation in terms of reasons for low indigenous innovative activities (UNIDO, 2015; Bartel, 2016; Fu et al., 2018 Johnson, 2018; Quaye et al., 2020), the issues of commercialisation gap or limited commercialisation has been virtually not directly dealt with. Few in the literature have accused Ghanaian academia which is supposed to act as gatekeepers and producers of innovation and technology of having a myopic focus on fundamental research and care less about development phases beyond scientific or technical breakthroughs (Oduro-Marfo, 2015; Fu, et al, 2018). The research agenda of the Ghanaian universities and research institutes are not driven by industry needs (Mensah & Gordon, 2020). There are also evidence to suggest the research outputs in Ghana are skewed towards basic and social science research and less on applied research; and the scientists and faculties focused mostly on publication and show very little interest in commercialisation of results (Cloete et al., 2015: Bloom et al., 2015, Mensah & Gordon, 2020).

As a matter of fact, some academics and researchers fight efforts for commercialisation by over focusing on scientific rigor and generalisability in research and care less about eventual transferability of discoveries to users or customers (Chilana et al., 2015 El-Jardali & Fadlallah, 2018). Chilana et al. (2015) observed that even where there are few great innovations in the universities there is very little hope of developing them into commercial products. Most universities and other actors in the innovation ecosystem in Ghana also lack proper infrastructure as the required infrastructure is very expensive and equipment can quickly get outdated. There is also a lack of a coherent policies on tech transfer from research and academic institutions to start-up businesses (Oduro-Marfo, 2015; Bartel, 2016).

In addition to low academic entrepreneurship and the chasm of issues in the commercialisation process described in the literature as the valley of death, a number of other issues contribute to low level of innovative activities and high commercialisation gap of indigenous innovation in Ghana. Key among these factors is the lack of well-trained scientists, engineers, technicians, and researchers (Rahman and Zaman, 2016, Li et al, 2017; Danquah and Amankwah-Amoah, 2017; Cornell University et al., 2018; Cornell University et al., 2019; Cornell University et al., 2020). The country scored as low as 0.4 and ranked 123rd on ISO 9001 quality certification on the global innovation index (Cornell University et al., 2020). Agenda 2063, STISA-2024 and Ghana's revised STI policy all call for radical policies for Ghana to address the deficit in scientific training at all levels of education and improve the workforce with better and improved technical skills (African Union, 2015; Ockwell & Byrne 2016; MESTI 2017).

Over 90% of businesses in Ghana are small businesses (Ghana Statistical Service, 2015); and small businesses do not have the capacity to produce products at a large scale (Quaye & Mensah, 2019). Commercialisation of innovation involves building teams, hiring of technical employees with vision and technical skills; and dealing with taxes, employee problems, logistic problems, and competition all of which are overwhelming for small businesses and innovators in developing countries such as Ghana (Spark, 2017).

3.6 INDIGENOUS INNOVATION AND MSE IN GHANA

As explained earlier in chapter two, indigenous innovation in the Ghanaian context includes modernisation and use of indigenous resources, indigenous practices and indigenous knowledge and it is generally agreeable that new MSEs are most effective in commercialising these innovation (Dahlstrand et al., 2016; Cooke, 2016; Smith, 2018; Donkor et al., 2018). Both the revised industrial policy and the revised STI policy recognised small scale industry as a key actor in achieving the policy goals (MESTI, 2017b).

Data from the Registrar general and Ghana Statistical Service also showed micro and small enterprises (MSEs) predominate the Ghanaian business environment and about 30% of the Ghanaian economy are small scale industrial activities (Ghana Statistical Service, 2015; Addo, 2017). Textile & garment, pottery & ceramics, carpentry, arts & wood works, metal fabrication, fisheries, water & beverage and agro processing are some of the specific common small scale industrial activities, particularly in the Volta Region of Ghana (Ghana Statistical Service, 2015; Quaye & Mensah, 2019). These industries no doubt play important roles and a number of studies have examined their relevance in terms of use and value addition to indigenous resources, application and preservation of indigenous knowledge, contribution to employment and household income, poverty reduction, gender empowerment and economic expansion in the socio-economic development process of the country (Osei, Yunfei, Ansah, Appienti & Kwarteng Forkuoh, 2016; Amegbe, Owino & Nuwasiima, 2017; Donkor et al., 2018; Thorbecke, 2018; Quaye & Mensah, 2019; Tsatsenko, 2020). Osei et al. (2016), for example, used firm level data among manufacturing MSEs in Ghana and the structural equation model to demonstrate a strong link between product innovation (development of new product, introduction of new product and improvement of existing product) and firm performance in terms of sales and employee growths.

On the other hand, there are also overwhelming evidence that the small-scale industry is plagued with low growth rates, stale development of innovation, stagnation, limited commercialisation, low returns, and firm exit (Addo, 2017; Tsatsenko, 2020).

Generally, the performance of manufacturing and industry in Ghana has been stymied throughout the country's history (MESTI, 2017a; Osei & Jedwab, 2016; Ackah, Atta-Ankomah & Appiah Kubi, 2020). The initial industrialisation strategy of import substitution with state owned enterprises was replaced in the early 1980s with an export-oriented industrialisation policy of which small scale industries were to play key roles (Tsatsenko, 2020). However, after a short sign of industry growth, the renewed hopes for industrial development were dashed and the value added of manufacturing and industry continuously declined from the mid-2000s (Osei & Jedwab, 2016; World Bank, online).

The current Government programme of One District One Factory to drive the country's industrialisation agenda also connote the use of indigenous resources, indigenous practices, and promotion of indigenous small-scale industries (MOTI, 2017). While the Government has so far demonstrated its renewed commitment to local industrialisation the programme is still plagued with inadequate funding, poor coordination, poor choice of project and location, corruption, and politicisation of the policy (Ofori, 2019). Numerous factors including access to credit, weak managerial ability, limited ability to comply with regulation and standards and weak domestic demand among others have been posited to explain limited commercialisation and the resultant stymied growth and performance of small-scale industry in Ghana (Nyarku & Oduro, 2018; Atiase, 2018; Atiase et al., 2019; Oduro, 2020).

Limited commercialisation, low growth, and poor performance in the MSE secor have led to calls to do more and transform the MSE sector in terms of innovation and commercialisation if it is to contribute more meaningfully to economic development of the country (Donkor et al., 2018; Easmon, Kastner, Blankson & Mahmoud, 2019; Quaye & Mensah, 2019). Donkor et al. (2018), for example, have called for greater awareness about the importance of innovation capability and recommended further investigation into why Ghanaian MSEs owners and caretakers are not pursuing innovation capability activities in spite of overwhelming positive impact on their financial performance. Easmon et al. (2019) examined the export performance of Ghanaian MSEs and suggested that they have to hone their innovation and marketing skills in order to enhance their performance. Quaye and Mensah (2019) in examining the Ghanaian small-scale industry, observed that indigenous knowledge faces the risk of fading out, highlighted need for capabilities in product designs, promotion, pricing and retailing innovations in the industry. Quaye and Mensah (2019) suggested employing innovative retail strategies, such as eco-friendly advertising, product re-branding and digital platforms can sustain and enhance market performance.

3.7 CHAPTER SUMMARY

It is clear from the innovation literature on Ghana that the country has almost all the key institutional elements necessary for a functioning national innovation system. It is generally however observable that GNIS is still fragile and characterised with asymmetric distribution of actor linkages and in some instances absent actor linkages (UNIDO, 2015; 2016; Quaye et al., 2019). It is also evident from the literature that Ghana has since its independence recognised the importance of innovation system in fostering technological and industrial development, formulated a number of explicit policies and indeed articulated its STI priorities. In terms of policy remedies, generally however, the instruments are apparently neither successful in overcoming barriers to innovation nor addressing organisational constraints. The implication of the weak actor linkages and unsuccessful policies is that the Ghanaian innovation systems as public goods is not yielding the required much expected externalities leading huge innovation commercialisation gap.

Available literature largely also portrayed a poor picture on Ghana's innovation performance (Oduro-Marfo; 2015; Mountjoy, 2017; MESTI, 2017a; UNESCO, 2018; Cornell University et al., 2018; Quaye et al., 2019). Although Ghana's performance has indeed been stymied there are few evidence that some form of innovation is happening and it is helping businesses survive and grow in Ghana (Afful & Owusu, 2017; Fu, Mohnen & Zanello, 2018; Hu et al., 2020; Cornell University et al., 2020). Most of these observable innovations are below the radar and incremental rather radical and technological. There is also growing evidence that the full economic effects of commercial exploitation of innovation in poorer countries, in general, does not only depend on the innovation itself, but also on the creativity of the actors and users in the commercialisation process (Edler & Fagerberg, 2017). The scepticism of how innovations are spreading in countries such as Ghana might be due to limited understanding. Therefore, there is a need for further investigation of the form and impact of innovation in these settings.

The literature has also raised and analysed a number of obstacles as barriers to innovation and its commercialisation. Although weak domestic demand has been raised, the demand side factors have not been well analysed. The few demand side policy prescriptions are also not yet obvious in regulatory, fiscal, and monetary policy incentives (UNIDO, 2015; Quaye et al., 2019). There is therefore the need to further investigate how demand side policies could be used to stimulate commercialisation of indigenous innovation drawing on examples from countries such as China.

Clearly from the literature although Ghana has some of the key institutional elements for a functioning national innovation system, the GNIS is disjointed and fragile and there is still a lot of institutional voids and organisational constraints. The chapter also examined the barriers to commercialisation of indigenous innovation and identified that small and micro firms predominate the sector. These firms face weak demand, fragmented market, lack access to finance and other resources and capacity to produce at a large scale. The next chapter therefore discusses the bottom of the pyramid (BOP) and frugal innovation both of which underpin this study.

CHAPTER 4: THE THEORETICAL FRAMEWORK

4.1 CHAPTER INTRODUCTION

The focus of this chapter is the explanation and discussion of the theoretical frameworks that support the study. Chapter two distinguished indigenous innovation, as detecting and acting on an opportunity that brings new practice in an economy, from Schumpeterian innovation as exogenous advances brought into an economy by scientist and explorers. From the discussion, it emerged that in the context of low-income countries such as Ghana, successful commercialisation of innovation is driven by ingenuity and savvy to make and market an invention; and that scientific knowledge, human resources and capital alone are not sufficient for success if market conditions are not favourable (Patterson & Ambrosini, 2015; Ockwell & Byrne, 2016; Ince et al., 2016; Phelp, 2017; Cornell University et al., 2018).

A comprehensive theoretical model that fully explains how innovation occurs, gets commercialised, diffused, and creates impact in low-income economies is still emerging (Phelp, 2017). An emerging framework that explain outlier trends in innovation in various global settings, termed as below-the-radar theory of innovations (BRTI) (Collier, 2007; Kaplinsky et al., 2010) underpin this study. Below-the-radar innovation (BRI) are innovations that are well below the radar of scientific and capital investment of larger scale and often policy but can potentially create massive exchange value (Clark et al., 2009; Bianchi, Bianco, Ardanche & Schenck, 2017). BRI views range from innovations at the bottom of the economic pyramid (BOP) (Prahalad, 2005); frugal innovation (FI) (Prahalad, 2005; Baker & Nelson, 2005; Sharma & Iyer, 2012; Radjou, Prabhu, Ahuja & Roberts, 2012; Bhatti, 2012); grassroots innovation (Seyfang & Heseltine, 2012; Von Hippel, 2005) to inclusive innovation (Christensen et al., 2006). In examining the drivers of successful commercialisation of indigenous innovation in Ghanaian MSE industry, BOP and FIT variants of BRTI would be relevant. The chapter therefore focuses on explaining below-radar-theories of innovation (BRTI). It discusses the bottom of the pyramid (BOP) theory, frugal innovation (FIT) versions, as well as the relevance of BRTI models to the study.

4.2 BELOW-THE-RADAR THEORY OF INNOVATIONS (BRTI)

The study considered below-the radar theories of innovation (BRTI) as the basis for examining the drivers of successful commercialisation of indigenous innovation in Ghana. In spite of the scepticism of innovation in developing countries as portrayed in the literature, some authors at least, recognised something is happening and called for more understanding (Bruno & Bruno, 2018; Fu et al., 2018). There are few evidence from Ghana also that some innovation is definitely happening, and it is helping businesses survive and grow (2018; Afful & Owusu, 2017; Fu et al., 2018; Hu et al., 2020), albeit most of it in the informal sector, incremental and below-the-radar.

It is quite clear from the literature that orthodox innovation theories have not adequately explained the issues, redressed the global imbalance in innovation hegemony and provided a direction for innovation systems in developing countries to effectively meet the needs of the poor, the “bottom billion” (Kaplinsky et al., 2010). Generally, three theoretical modes or explanations have been provided to explain the development and transfer of knowledge, innovation, and new technology (Etzkowitz & Leydesdorff, 2000; Kaplinsky et al., 2010). These are: one, academic science and technology investigator-initiated and discipline-based knowledge production labelled mode1 innovation process; two, the context-driven, problem-focused, interdisciplinary and experience and practice oriented labelled as mode 2 innovation process; and three, the triple helix of the nation state, academia, and industry (Kaplinsky et al., 2010).

The inadequacies in these orthodox explanations have led to the emergence of a series of the below-the-radar theories of innovations (BRTI) (Collier, 2007; Kaplinsky et al., 2010). BRTI recognised that in low-income economies minor changes in any of the elements in Schumpeterian conceptualisation, be it a process of production, product variety, organisational aspects or access to new/broader markets, can bring considerable impact on the sector (Kaplinsky et al., 2010; Radjou et al., 2012; Bhatti, 2012). In low-income economies, it is the modest and non-technological innovations, often ignored by science and technology indicators that translate into substantial increase in the ability to produce and compete on a sustained basis, generating income and better living standards and creating continuity in translating and popularising the knowledge (Harilal, 2017). BRTIs are the prime movers in most local economies in developing countries (Clark et al., 2009).

BRTI encompass new and disruptive forms of innovation which simultaneously meet the needs of a very different group of consumers (Kaplinsky et al., 2010). Among other below the radar-innovation models, innovations at the bottom of the economic pyramid (BOP) frugal innovation (FI) theories would be particularyly relevant for the study, examining the drivers of successful commercialisation of indigenous innovation in Ghana.

4.2.1 Innovations at the bottom of the pyramid (BOP)

The study is largely anchored on innovation at the bottom of the pyramid theory. Ghanaian MSEs engaged in indigenous innovation activities largely cater for the poor who have affordability constraints and cannot as such charge premium prices to recover high distributive margins which are often required for commercialisation of innovation (Okoe & Boateng, 2016; Wimschneider et al., 2020; Anderson, 2020). Moreover, these firms face fragmented market, and distribution, promotion and product reach are serious challenges. Firms in Ghana also faced very high cost of doing business (Nyarku & Oduro, 2017; Guy, Agyapong & Mmieh, 2018; Chan et al., 2018) at the same time MSEs have to devise means of serving income constrained customers, promote and distribute their products. Commercialisation of indingeous innovation in Ghanaian SSI therefore offers interesting context to test and study the BOP views.

The central argument in BOP proposition is that the poor are potential consumers and, since they are a large portion of the population, they (at the BOP) represent a huge unexploited market. The poor are however excluded from mass consumption because of their very limited purchasing power (Prahalad, 2005). Prahalad propounded that if a firm can find a way to turn the poor into consumers, it finds a fortune and an almost unlimited market. He further contended that meeting the needs of the poor can be a win-win process as the firms would have new and unsaturated markets and the poor would have access to consumer goods that were inaccessible because of high cost. Prahalad's proposition also stressed that for innovations to be appealing to the BOP, they must be designed to do more with less and for more people (Prahalad & Mashelkar, 2010; Prahalad, 2012). The initial BOP formulation contended that poverty and its consequences could be overcome through profit-based market dynamic led by Multinational Corporations (MNCs). The main assumption in the proposition is that MNCs seeking new vast markets in developing countries will benefit the poor by transforming them into consumers.

The original Prahalad's BOP proposition, however, have some sharp criticisms ranging from its top-down approach as well as the very basic assumption of the poor as consumers; ambiguity, as the low income people in the developed world Prahalad's referred to as the poor appear to be emerging middle class and not the poor in developing countries; and lack of institutional perspective as the proposition did not describe the institutional, cultural and even historical settings that are at the base of poverty (Karnani, 2007a, 2009, 2011; Kolk et al., 2006; London & Anupindi, 2011). In response to these bold criticisms of BOP approach in the Prahalad version, London (2009) argued that instead of exploiting the fortune at the BOP, there is a need to create a fortune at the BOP. With empirical work Hart and London (2011) discovered that successful initiatives at the BOP required a strong commitment to and alliances with local ventures and institutions. Hart and London (2011) discovered that MNCs devoted to serve the underserved are more successful if they create alliances and networks with local agents and NGOs. The BOP approach, by introducing local actors as intermediaries, humanises the action of MNCs.

The BOP innovation concept has been largely embraced by NGOs and grassroots movements in the last three decades. The popularity of BOP and BRI in general has also led to the idea of social business or pro-poor business, a phenomenon of businesses marrying profits with social aims and seeking to target the poor as a source of sales and profit (Blowfield & Dolan, 2014). This is based on the BOP presumption that business activities can contribute to poverty alleviation by integrating the neglected poor of the world into efficient value chains and market (Hahn, 2012).

There have been attempts by some scholars to validate the Prahalad's theory and there is an increasing empirical research activities on below the radar innovation (Anderson and Markides, 2007; Radjou et al., 2012; Hang, Mazzarol, Volery & Reboud, 2014; Lim & Fujimoto, 2019; Anderson, 2020). Prahalad himself tried to identify specific patterns of innovation at the BOP by analysing the case of China, India, and Brazil (Prahalad & Mashelkar, 2010). From the perspectives of firms and innovators, below the radar solutions should be designed, produced, delivered, and maintained to meet the needs of underserved consumers and the firms themselves being able to function in constrained environments (Bhatti, 2012).

Anderson and Markides (2007) in an attempt to define a theoretical framework to address innovation at the BOP tested the hypothesis that there are common challenges and approaches in serving low-income customers in developing markets and that these can be articulated and refined to get better business results. The investigation (Anderson & Markides, 2007) identified a set of common factors that characterised innovation at BOP: affordability, acceptability, availability, and awareness (4As) and concluded that by leveraging the 4As, firms can achieve growth and profit. Here the independent variables are the 4As and the dependent variable is the business results, business growth and profits.

4.2.2 Frugal innovation theory (FIT)

Prahalad and Mashelkar's call for BOP innovations to be designed to do more with less and for more people highlighted the notion of frugal innovation. The frugal innovation framework is also adopted to underpin this study of the commercialisation of indigenous innovation in Ghana for a number of reasons. First, MSEs in the small-scale industry in Ghana, are resource-constrained and have to use resources in a different manner. Secondly, MSEs in Ghana face a high cost of doing business at the same time have to devise means of serving income constrained customers. Moreover, While MSEs face a lot of regulatory and institutional voids in the commercialisation process, the benefit of regulatory compliance to them is unclear. In the context of the study, the potentials of regulatory compliance and enforceability for enhancing consumer acceptance and export potentials is somehow recognised (Donbesuur et al., 2020). However, regulatory voids have been raised even more vociferously as constraints to new venture creation and commercialisation of indigenous innovation in Ghana (Oduro & Nyarku, 2017; Johnson, 2018). Therefore, an integrated framework such as frugal innovation theory is required to analyse the impact of these factors on the successful commercialisation of indigenous innovation in Ghana.

The notion of frugal innovation was not entirely new as the idea of scaling up the production of consumer goods to reach the lowest level of social pyramid was introduced by Fritz Schumacher in the 70s (Schumacher, 1973). The theory of disruptive innovation which suggests that existing mainstream markets are the wrong place to look for major new waves of growth also emphasised creating new business opportunities to overcome the saturation of traditional markets (Hart & Christens, 2002). However, the BOP proposition provided an anchor to analyse the concept of frugal innovation in detail and highlighted innovation capabilities of common people and communities (Knorringa et al., 2016). The concept has since been highlighted in business management community and became scientific interest. In sum, innovations that redesign products and use resources in different ways, redefine business models, reconfigures value chains and create scalable and sustainable inclusive markets are are refered to as frugal innovations (Bhatti, 2012; Radjou & Prabhu, 2014).

The frugal innovation processes led to emergence of a range of new products such as Nano car, portable ultrasound devices, mobile money services and single-use or mini pack products and made them accessible to budget constrained consumers (Prahalad, 2012). The phenomena of frugal innovation have been hailed as transformational disrupting processes, business models and even entire economies as it can dramatically cut costs at the same time safeguard user value and technological sophistication (Radjou & Prabhu, 2014: Zeschky, Winterhalter & Gassmann, 2014).

Frugal innovation theorists' postulate that because the low-income settings have institutional and resource constraints, innovation has to follow a path different from the capital-intensive and research and development-led process (Kaplinsky, 2011; Bhatti, 2012). The proponent of frugal innovation posited that in contrast to the view that innovation occurs only when slack resources, supporting institutions and high-income users as the first target segment exist, there is enough potential to demonstrate that for frugal innovation models, all the above conditions are not necessary to producing globally useful solutions (Prahalad, 2005; Khanna & Palepu, 2006; Bhatti, 2012).

Impliedly for consumers in low-income economies, a frugal solution, in addition to low cost, includes innovation functioning with few resources, against lack of necessary infrastructure, and within complex or different institutions (Bhatti, 2012). Radjou and Prabhu (2014) observed that the phenomena of frugal innovation has challenged all aspects of innovation, from the idea to business model, marketing and consumption and the whole innovation cycle. This is also evident in significant reduction in the cost of development, manufacturing, distribution ownership or usage and disposal of new or improved products (Tiwari et al., 2014).

The discourse on frugal innovation has been quite prominent on Asia and Latin America markets and to some extend cost-conscious consumers in Western countries (Govindarajan & Ramamurti, 2011; Radjou & Prabhu, 2014). Because of its focus on involving low-income producers and consumers in the value chain, there have been calls for African countries to embrace frugal innovation in their development agenda. The implication of frugal innovation is however not clear cut. While its potentials to alleviate poverty have been hailed, critics posit it can exacerbate exploitation and inequality and insist more empirical approach is required (Papaioannou, 2014, Abdelnour & Saeed, 2014; Chataway et al., 2014; Knorringa, Peša & Leliveld, 2016). Abdelnour and Saeed (2014) demonstrated how with a simple stove the poor can impede global warming, reduce sexual violence, improve family health, and develop sustainable markets; but at the same time from different perspective justified how the stove panacea expanded a global industry and transferred the world's most serious problems into the private lives of the most vulnerable in a humanitarian camp in Darfur.

According to Prahalad (2005), there are three main challenges for innovation in developing countries—first, resource constraints; second, the challenge and opportunity of dealing with institutional voids; and third, the need to address the needs of the bottom of the pyramid. According to Khanna and Palepu (2006), despite these extreme conditions, entrepreneurs, and firms in emerging market are developing innovations which are resolving their local needs, and at the same time profiting to the extent that they can expand to neighbouring developing nations and even beyond to developed markets.

Prahalad's propositions for frugal innovation suggested variables such as resource availability, institutional factors, and the income of the consumer from his mention of resource constraints, institutional voids, and the needs of the bottom of the pyramid, respectively, for successful innovations.

4.3 RELEVANCE OF BRTI TO THE STUDY

BRTI have been used to analyse the case of China, India and Brazil and is increasingly attracting empirical research activities (Prahalad & Mashelkar, 2010 Anderson & Markides, 2007; Radjou et al., 2012 Hang et al., 2014; Lim & Fujimoto, 2019; Anderson, 2020). It highlights the common challenges and approaches in serving low-income customers in developing markets and, therefore, is very applicable to this study as the context is a low-to-medium income economy. MSEs engaged in the commercialisation of indigenous innovation in Ghana, are resource-constrained, serve customers who are income constrained and have to deal with institutional voids, and therefore offers interesting context to study the commercialisation of indigenous innovation and test BRTI. Both the BOP and FIT emphasised the need to understand

and address the needs of the bottom of the pyramid when designing innovation and offering value to them (Prahalad & Mashelkar, 2010).

In a study to test BOP proposition, Andersonand Markides (2007) identified and explained affordability, acceptability, availability, and awareness (4As) as a set of common factors that characterised innovation at the bottom of the base: and concluded that by leveraging these factors, firms can achieve commercial success. Anderson and Markides' explanation of BOP is adopted to underpin the study of commercialisation of indigenous innovation for a number of reasons. First, Ghanaian MSEs face organisational challenges which have reflected in the limited indigenous innovation getting commercialised and this relates to availability. Second, MSEs in Ghana largely cater for the needs of the poor but face a high cost of doing business which relates to affordability. Moreover, most indigenous Ghanaian products have challenges of poor finishing, branding and promotion, distributional challenges, and high prices relative to imports which relate to acceptability and accessibility. Indeed, a number of studies (Fu et al., 2018, Oduro & Nyarku, 2018; Quaye et al, 2019) highlight these factors as constraints to the commercialisation of innovation in Ghana

Frugal innovation models present an approach to innovation and explain how useful solutions get commercialised despite and because of extreme social needs, resource constraints and institutional voids. Indigenous innovation in small scale industry in Ghana are incremental rather than radical and mostly not protected from competition by patents, extreme product differentiation, or other barriers and innovators do not have a lot of pricing discretion as buyers at the bottom of economic pyramid are unable to pay substantial premium for a product. Moreover, entrepreneurs and innovators in most local economies in Ghana attempting to commercialise their innovation must devise low-cost strategies to deal with resource constraints and institutional voids to deliver products and services to low-income users with little purchasing power. BRI models can therefore be applied to understand successful commercialisation of innovation in these settings.

Proponents of frugal innovation explain that an environment is resource-constrained if it provides new challenges without providing additional or new resources (Baker & Nelson, 2005). While all economies are resource-constrained, the lower-middle-income economy of Ghana is even more so. In addition, as new ventures mobilise resources and undertake commercialisation, they act within and against existing political and business regulations, or the lack thereof (Baker & Nelson, 2005; Baker et al., 2003). There are several problems in local economies in Ghana that are not addressed or even recognised by existing institutions. Frugal innovation models explain how innovative firms go against the norm and occur in the absence of institutional support.

Commercialisation of innovation is both demand and supply sides issues. However, there is less focus on demand side in the innovation literature and the aim of the current study is to equally explain the demand side of indigenous innovation. BRTI theories explained both exploiting the demand side, as well as the supply side, creating a fortune at the BOP (London, 2009; Hart & London, 2011; Bhatti, 2012). According to both the BOP and Frugal innovation theories exploiting the fortune at the BOP, refers to finding ways to serve consumers and users with affordability constraints by redefining business models, reconfiguring value chains and redesigning products. Since SSIs in Ghana mainly cater for the needs of the poor, BRI theories are the most appropriate models to explain how Ghanaian SSIs can serve customers with their innovation profitably and achieve commercial success.

Creating fortune at the BOP on the other hand refers to the inclusive nature of BRI, engagement and forming alliance with local agents and factors of production (Hart & London, 2011). SSIs are labour intensive, employ more labour per unit of capital and use local resources intensively (Cozzens & Sutz, 2014). SSIs represent over 90% of business establishments in Ghana and employ more than 60% of the country's labor-force (GSS, 2010; GSS, 2015).

There are of course some contentions about the job creating impact of SSIs and indigenous innovation just as there are few scepticisms about BRI. Some scholars have over the years argued that the economic statistics on MSEs are flawed and have not often taken into consideration offsetting factors (Biggs, Grindle & Snodgrass, 1988); and that SSIs employment increases is not associated with increases in productivity (Edusah & Antoa, 2014; Essel, Adams & Amankwah, 2019). Nonetheless, the job creation impact of SSIs in Ghana made the sector a national development policy focus for employment creation, poverty alleviation, and technological advancement (Ackah, Adjasi, & Turkso, 2012; Oppong et al., 2014). The prominence of SSIs is also further enhanced by its perceived capacity to withstand foreign exchange shocks which extends from intensive use of indigenous resources and practices. SSIs are perceived as more viable investment options than foreign exchange-dependent large-scale industries (Ackah et al., 2012). The potential to create fortune at the bottom of the pyramid claim by BRI theories, connote indigenous innovation and thus make the BRI theories very relevant in examining commercialisation of indigenous innovation in small-scale industries.

4.4 CHAPTER SUMMARY

The BOP models highlight affordability (or income constraints), access and availability (existence of demand) and awareness (understanding the needs) of the poor on one hand, and business results on the other hand. The BOP proposition that if a firm finds a fortune it finds a way to efficiently satisfy needs of the poor, has implications for this study because the poor form greater part of the market in Ghana. The poor in Ghana have many needs and if the SSIs can find efficient means to satisfied these needs they would be successful in terms of business result. Similarly, frugal innovation theory emphasised, income constraints, resource constraints and institutional voids and this has implication for the study as the Ghanaian SSIs have to devise low-cost strategies and deal with resource constraints and institutional voids in order to be successful.

The need to create fortune at the bottom of the base highlighted by BRTI implied the use of indigenous resources knowledge and practices. BOP and FIT highlight extreme social needs, affordability, resource constraints, institutional voids, availability, and acceptability. It is clear from the analysis that these theories can comprehensively explain the successful commercialisation of innovation in Ghana. Thus, there is a compelling reason to examine the level and the nature of impact of the highlighted factors on the performance of MSEs. Chapter five would therefore present the conceptual framework and hypothesis regarding the impact of the commercialisation factors on the indigenous innovation performance of MSEs

CHAPTER 5: THE CONCEPTUAL FRAMEWORK

5.1 INTRODUCTION

Chapter four discussed the bottom of the pyramid and frugal innovation versions of below-the-radar theories of innovation (BRTI) that underpin this study. This is because in commercialising indigenous innovation MSEs are influenced by several factors which are emphasised by these theories. These factors include regulatory factors as MSEs in low-income economies must deal with institutional voids. MSEs operating in these settings are also affected by financial and organisational factors as they are resource-constrained and must reconfigure value chains and use resources differently (Bhatti, 2012; Radjou & Prabhu, 2014). The performance of MSEs engaged in the commercialisation of indigenous in Ghana are crucially affected by market factors, as they mainly serve customers with affordability constraints, have difficulties with branding and promotion of innovation and face distributional challenges and price competition. Again, the business result of MSEs is impacted by technology as they must redesign products and use efficient and appropriate technologies (Bhatti, 2012; Radjou & Prabhu, 2014).

The use of indigenous inputs and commercialisation activities of MSEs are so crucial in the industrialisation drive in countries such as Ghana. Undoubtedly, as noted in the previous discussions, it is commercialisation by firms that converts innovations into products and processes which can build an industry and lead to industrialisation (Olefirenko & Shevliuga, 2017)

The focus of this chapter is explanation and discussion of the conceptual framework of the study. It attempts to integrate regulation, finance, organisational factors, market factors, and technology to determine the successful commercialisation of indigenous innovation in terms of sales, profitability, employment level and feeling of success of small and micro enterprises (MSEs) in small scale industries (SSIs). It provided some empirical literature on the variables, analysed the linkages and proposed hypothesis for the study.

5.2 A COMMERCIALISATION OF INDIGENOUS INNOVATION FRAMEWORK

The BRI theories are useful in the formulation of the conceptual framework for successful commercialisation of indigenous innovation. Essentially, BRTI theories stress that for innovations to be appealing to markets in low-income economies, they must be designed to do more with less and for more people (Prahalad & Mashelkar, 2010; Prahalad, 2012) and that innovation can be successful despite and because of extreme social needs, resource constraints and institutional voids (Bhatti, 2012). In a study similar to the current one, Anderson (2007) adopted affordability, acceptability, availability, and awareness as the independent variables and business result as the dependent variable. Similarly, Prahalad (2005), Khanna and Palepu (2006), as well as Bhatti (2012) regarded extreme social needs, institutional voids and resource constraints as independent variables and commercial success as the dependent variables in frugal innovation.

The proposed conceptual framework (figure 5.1) borrows from the above studies shows that successful commercialisation of indigenous innovations is dependent on certain innovation commercialisation drivers, namely regulatory, financial, organisational, market and technological factors. The framework highlights increased sales, improved profitability, employment and better feeling of success as benefits of innovation to the people at the bottom of the pyramid (Hart & London, 2011).

In line with BRTI, in this study, the drivers of successful commercialisation of indigenous innovation in Ghana namely regulation, finance, organisational, market and technological factors relate to extreme social needs, affordability, acceptability resource constraints, institutional voids, availability, and acceptability. On the other hand, successful commercialisation measures of sales growth, profitability and employment growth relate to business results as the dependent variables.

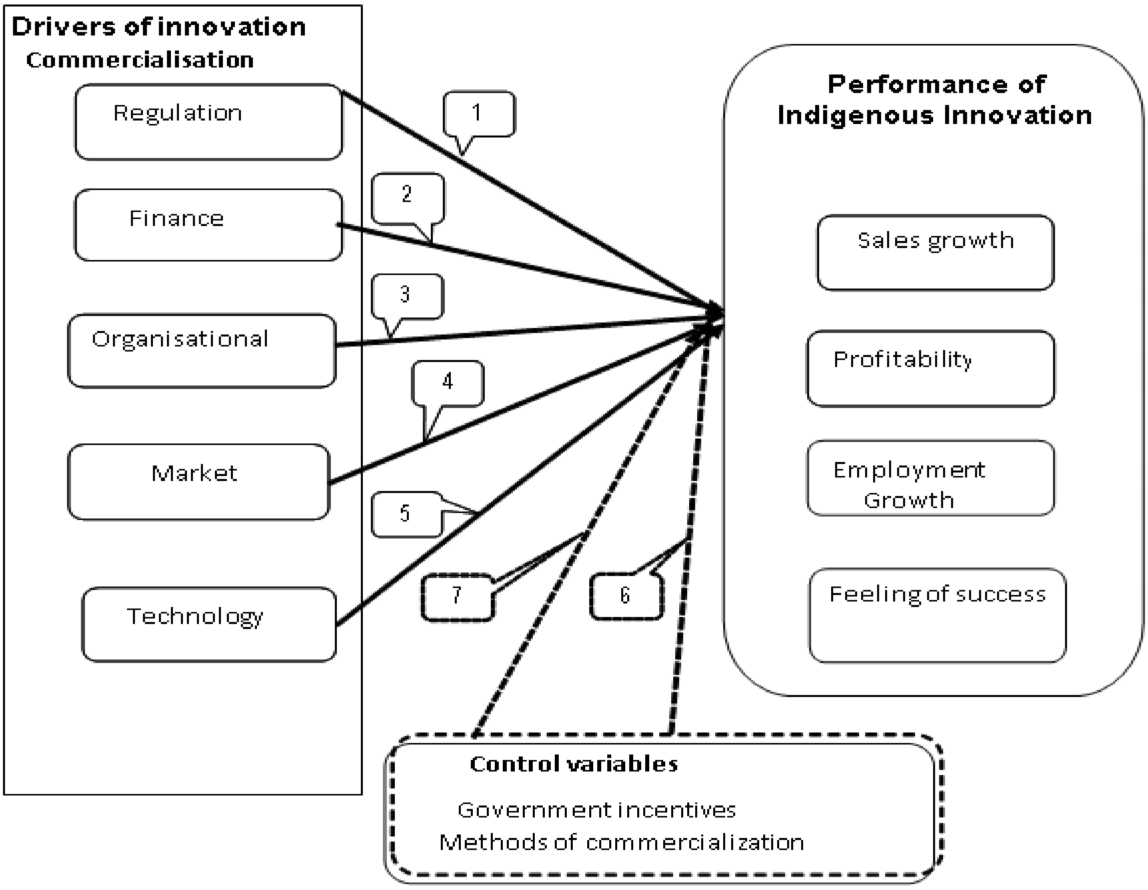

Figure 5. 1: A hypothetical framework for the commercialisation of innovations

5.3 COMMERCIALISATION PERFORMANCE MEASURES

Measuring entrepreneurial success and performance of MSE has for several decades remained a subject of concern for researchers' due to definition and measurement, methodological and inferential challenges in studies of entrepreneurial performance. (Smith & Bititci, 2017; Dijkhuizen, Gorgievski, van Veldhoven, 2018; Atiase 2018), While some MSEs are considered successful if they are merely well-run; others must demonstrate the ability to create products with a large market potential to be considered successful. From the literature, innovation and its commercialisation performance metrics include the number of patents, utility models, trademarks, industrial designs and copyrights as proxies of creative outputs; sales, market share, productivity and profitability as internal firm-level financial performance; and employment; and further application of innovation as messo level economic performance (Lhuillery et al., 2016; Cirera et al., 2016; Cirera & Muzi, 2016; Smith, 2018; Cornell University et al., 2018).

Atiase (2018) citing earlier scholars suggested commercial performance of MSEs can be measured in two ways: an objective manner using parameters such as profitability, competitiveness, efficiency and productivity, and subjective approach using benchmarks such as the satisfaction of stakeholders. Others opined that performance measurement must be multidimensional in nature consisting of financial and non-financial indicators as well as stakeholder satisfaction (Raven & Le 2015; Wach et al., 2016; Dijkhuizen et al. 2018). In terms of examining successful commercialisation factors of indigenous innovation of small-scale industrial activities objectively, sales performance, profitability and employment generation are important (Shpak et al., 2014; Olefirenko & Shevliuga, 2017), as well as, subjectively, feeling of achieved personal success (e.g personal satisfaction and community recognition) (Wach et al., 2016; Dijkhuizen et al. 2018). Based on the literature sales, profitability, employment, and feeling of achieved success can be good proxies for measuring successful commercialisation.

5.3.1 Sales

Among many others, sales variables are the primary measures of successful commercialisation of innovation (Lhuillery et al., 2016; Cirera et al., 2016; Cirera & Muzi, 2016; Smith, 2018; Cornell University et al., 2018). This is because the performance of indigenous innovation and innovation in general is quite difficult to measure in low-income economies as it is not a standard process with defined milestones and checkpoints (Cirera & Muzi, 2016). This is also compounded by the fact that most available input metrics such R&D spends do not give a whole picture and are largely not applicable to MSEs in these economies. Output metrics such as sales revenue from innovation however can easily be tracked, can point out what exactly a firm is getting from innovation efforts (Cirera & Muzi, 2016).

An important key performance indicator for MSEs in low-income economy is sales and its growth. Sales growth metric is a strategic indicator that is used in decision making by innovators and entrepreneurs for strategy formulation and execution as by aiming at a particular percentage revenue growth, a firm can develop a cascade of interdependent metrics at each level. The sales growth metric acts as a rallying call for an entire business including the innovation team, investors, and other external stakeholders. Clearly, it is sales and progress of innovation on the market which supplies the expected economic effect to the industry and the economy (Shpak, Kniaz, Myroshchenko & Kolomiyets, 2014). It is successfully commercialised and market patronised products that impact business output, market dominance, further exploitation, development of new industry, and hence growth and socio-economic development (Osoro et al., 2015). According to Olefirenko and Shevliuga (2017), innovation is successful when it manifests itself in commercialised products that add value to consumers and firms. Olefirenko and Shevliuga (2017) considered the sale of an innovative product as widespread sale and wide adaption of the product as successful commercialisation of innovation.

Few studies confirmed significant relationship between innovation performance and sales growth (Rosli & Sidek 2013; Krasniqi & Desai, 2016; Woschke, Haase & Kratzer, 2016; Nemlioglu & Mallick, 2017; Mahmutaj & Krasniqi, 2020). Mahmutaj and Krasniqi (2020) investigated the impact of different type of innovation on sales growth using small scale manufacturing subsector in Kosovo and found that marketing innovation is positively associated with sales growth, new to firm products are negatively associated, while the link with other types of innovation are not conclusive. Mahmutaj and Krasniqi (2020) hypnotised that MSEs introduce more new-to-the-firm products to achieve growth but the new to market products are negatively associated with firm growth. Nemlioglu and Mallick (2017) observed that not all types of innovation may be beneficial to growth but most innovation have positive effect on growth when combined with good management practices. Akinboade (2015) econometrically examined determinants of the growth of MSEs and highlighted firm growth as crucial for full understanding of policy development in Africa.

In the context of Ghana there are only few empirical studies (Oduro & Nyarku, 2018; Quaye & Mensah, 2019; Donbesuur et al., 2020) on sales growth as innovation performance metrics. Quaye and Mensah (2019) provided some links between innovation and some competitive advantage on the market among MSEs in manufacturing sector in Ghana. Donbesuur et al. (2020) provided some evidence that technological and organisational innovation align to drive international performance of MSEs in terms of sales and findings from the analysis showed that high levels of organisational and technological innovation jointly improve MSEs' international sales performance. Oduro and Nyarku (2018) highlighted the need for MSEs' survival and growth in today's hyper-competitive and resource constrained business environment and provided some qualitative evidence that the incremental innovation practices have improved the MSEs performance in terms of sales growth, competitiveness, and global market reach.

5.3.2 Profitability

It is the aim of every firm to make profit and using profitability to assess the commercial success of innovation and firms has been quite documented in the literature (Popa & Ciobanu, 2014: Valdez-Juárez García-Pérez-de-Lema & Maldonado-Guzmán, 2018). Profitability measures are financial metrics that uses a firm's data over specific period to measure its ability to generate income relative to its revenue, costs, assets, or owners' equity, and they reveal information on the firm's historical performance, for comparison of results with similar business or the industry average (Kenton, 2020).

Theoretically two categories of profitability metrics, profit margin (or margin) ratios and return ratios are discussed. Profit margins include price margin, gross margin, operating margin, pre-tax margin, and net profit margin, and these provide useful information for making operational and investment decisions in the commercialisation process. Return ratios include return on asset (ROA) and return on equity (ROE) and measure how effectively a firm utilises resources to generate income. Generally, entrepreneurs and investors in the commercialisation process tend to follow ROE in assessing whether an innovation is profitable or not (Popa & Ciobanu, 2014). From microeconomic theories, the more assets a firm (particularly MSEs given their size) has, the more its sales and profit potentials as economies of scale can lower costs, increase margins, and improve returns. From BRI perspective, however, MSEs can with less asset improve margins and returns as frugal innovation dramatically cuts costs and reduces technological sophistication (Radjou & Prabhu, 2014: Zeschky, Winterhalter & Gassmann, 2014).

The profitability of every firm including MSEs in SSI is essential to measure their efficient use of resources and effectiveness of their innovation teams. The extent to which an innovation is profitable determines the reward of the innovator and tangible benefits of other stakeholders (Mass & Zhengge; 2016). The interest in profitability of innovation goes beyond internal stakeholders but extend to external backers who can help take indigenous innovation further. For example, investors and creditors are always interested in profitability over time, and projection of future profitability of innovation (Verma, 2020). Sociologically, the potential of innovation and entrepreneurship to change societal structure is dependent on profitability as it is the stream of profits that make the lead innovators rich and to climb the social ladder together with their families. These facts further accentuate the emphasis which should be given to profitability as a measure of successful commercialisation of innovation.

5.3.3 Employment

Growth in relation to firm performance originated from Gibrat's rule of proportionate growth, which determine firm's performance irrespective of firm size (Rosli & Sidek, 2013). In addition to turnover and financial variables, growth is measured in terms of employment, thus the number of employees and this addresses the job concerns and has to do with the working capacity (Mahmutaj & Krasniqi, 2020). The main reason for government policy focus on MSEs and MSEs as significant strategic sectors in the promotion of entrepreneurship and innovation in countries such as Ghana is because of their potential for growth in terms of employment generation (Musah, 2017; Chege & Wang, 2020). Firm growth has also in recent times attracted attention of academics because of its links to new job creation and employment growth is a good innovation performance indicator within the context of MSEs and MSEs, because of its visibility and simplicity to obtain (Mahmutaj & Krasniqi, 2020). The European Commission recognised innovation is key in generating employment and accentuated that only start-ups that begin with innovative products can generate employment growth (European Commission, 2015; Eurofound, 2016).

Although a number of studies have revealed some linkage between MSEs innovation and growth performance, few have isolated employment. Chege and Wang (2020) provided evidence of a strong positive linkage of technological innovations in MSEs and employment creation using seven-step approach literature review and data synthesising. Some studies have measured and examined performance of MSEs in terms of employment growth in different contexts, contributed substantially to the literature on MSEs in Ghana (Owusu et al., 2015; Sibanda & Manda, 2016; Musah, 2017; Adomako, 2020), however the focus of most, do not include innovation. Few, for example Adomako (2020) measured the growth of 845 MSEs in Ghana and found that sustainable innovation is positively associated with MSE growth in terms of employment.

From BRI perspective, frugal innovation reduces technological sophistication and employs more labour per unit of capital. Creating fortune at the BOP involves engaging local agents and using local resources intensively (Hart & London, 2011; Cozzens & Sutz, 2014; Radjou & Prabhu, 2014: Zeschky, Winterhalter & Gassmann, 2014).

5.3.4 MSEs' feeling of success

Empirical studies of entrepreneurial performance are largely within the fields of economics and sociology. While economic studies on entrepreneurial performance focused on financial measures such as profitability or sales, sociologists and organisational theorists also largely emphasised externally visible measures of venture success. Personal feelings or internal measures of success held by the entrepreneurs themselves are largely neglected (Dijkhuizen et al., 2018). There has in recent times, however, been a growing interest in subjective measures in addition to financial parameters of entrepreneurial performance (Gorgievski et al., 2014; Dijkhuizen et al., 2015; Gorgievski & Stephan, 2016). This is perhaps because of the realisation that subjective measures are more predictive of entrepreneurs' decision making and behaviour (Wach et al., 2016). Wach et al. (2016) and Dijkhuizen et al. (2018) also observed that the so-called objective measures of entrepreneurial performance of MSEs are up to date mostly based on self-reported figures. Subjective measures of entrepreneur performance gaining currency in entrepreneurial performance measurement include achieved autonomy, personal satisfaction or fulfilment, customer satisfaction, community impact, employee relations, family security, and flexibility (Dijkhuizen et al., 2018). One thing that drive entrepreneurs and innovators to undertake and create is a feeling of success. Although success may be generally viewed as attainment of wealth, position, honours, or the like, from innovators and MSEs perspectives feeling of success come from both achieved financial success as well as cathartic and meaningful personal feeling and community recognition for being responsible for something new in the world (Connolly, 2015). Some scholars opined that human beings seek results because they derive pleasure from accomplishment (Happiness Research Institute, 2015; Wach et al., 2016).

A study by Happiness Research Institute and Krifa (2019) revealed reaching set goals is the fourth most important influencer for employee engagement, and this no doubt applied to MSEs who also mostly work for theMSElves. Happiness Research Institute and Krifa (2019) further explained that a sense of accomplishment makes people feel proud of their work, feel like they are progressing, and feel they are making a positive step forward for theMSElves, firm, clients, and other stakeholders.

5.4 DRIVERS OF INNOVATION COMMERCIALISATION

5.4.1 Regulation

Generally, regulation refers to implementation of rules by public authorities to influence market activities and behaviours in the economy to maximise collective interest (Edler et al, 2016). Three types of regulation can be identified relative to innovation impact (Pelkmans & Renda, 2014; Edler et al., 2016). First, regulations to promote innovation such as IPRs and specific regulation to protect new innovations in the market as postulated in Porter's Hypothesis. Two, regulation to achieve specific objectives such as taxation, environment, health, and safety standards which can create innovation pressure and opportunities. Traditionally, standards and innovations are perceived to be contradictory, however according to Elder et al. (2016), standardisation can serve as a platform for the innovation process and as tools to coordinate preferences of consumers and other actors on the demand side. Third is regulations that can create burdens for innovative activities. According to Pelkmans & Renda (2014), these include general rules, innovation-specific rules, and sector -specific legislations.

Even though the relationship between regulation and innovation has been well discussed and despite the availability of comprehensive studies and anecdotal evidence, in total, it is not clear if the positive impacts of regulation on innovation outweigh the negatives (Edler et al., 2016). There is recognition from the literature of a variety of regulations and their effects on different kind of sectors and product, firms, sectors, and economies (Edler et al., 2016; Fu et al., 2016). Tang, Qiu and Zhou's (2020) investigation of industrial enterprises in China provided some evidence that in general, environmental regulation negatively influences innovation efficiency and generates detrimental effects on all firms and more on small enterprises in a short-term through reducing cash flows. On the other hand, a study of the antecedents of innovation intentions in Germany's renewable energy sector identified that reliability and continuity of regulation was particularly relevant to entrepreneurs' considerations of bringing new products and services to the market (Grünhagen & Berg, 2011; Mallett, Wapshott & Vorley, 2018).

Regulatory compliance is a necessary ingredient for MSE's growth. Even though some regulation can indeed create new demand as explained by Elder et al. (2016), in the Ghanaian SSI sector, the market is fragmented, volumes are low and regulation in general create constraints and cost burden on supply side for the MSEs and higher price on demand side for consumers (Dahlstrand et al., 2016). The regulatory regime in Ghana has been raised as a constraint to commercialisation and new venture creation, and there are calls for a more flexible system (Oduro & Nyarku, 2017; Johnson, 2018). From BRI perspective too, low cost and price are key for successful commercialisation in resource constrained environment. On the other hand, regulatory compliance and enforceability enhances consumer acceptance and export potentials of SSIs products (Donbesuur et al., 2020).

Most empirical investigations on regulation and innovation performance in Ghana portrayed negative association. Nyarku and Oduro (2017) studied the effect of legal and regulatory frameworks on the growth of Ghanaian MSEs, noted the regulatory regimes negatively affect MSEs performance, and called for more relaxed and transparent regulatory regimes. Johnson (2018) also investigated the institutional factors that affect innovative activity in the technology start-up ecosystem and highlighted regulation and bureaucratic processes as a common challenge in Ghana. These studies have however largely focused on overall innovation performance. Isolating different dimensions of successful commercialisation metrics can yield different results. Adomako (2020), for example, provided some evidence that sustainable innovation is positively associated with MSE employment growth. Donbesuur, Appiagyei Ampong, Owusu-Yirenkyi and Chu (2020) using structural equation modelling on a sample of 204 internationalised MSEs operating in Ghana shows that institutional environment specificity and institutional environment enforceability enhance the complementary effect of organisational and technological innovation on the international performance of MSEs.

The reviewed literature largely suggests unclear overall effect of regulation on innovation and profitability of firms, urging the need for different studies on specific sectors, firms, and economies. Based on the discussion from the literature, the study

Central University of Technology, Free State

also recognised those regulations have different effects on different dimension of successful commercialisation metrics in low-income economies and proposed to test the following hypothesis:

H1a: Regulation is positively related to sales growth of indigenous innovation in the SSI sector.

H1b: Regulation is positively related to the profitability of indigenous innovation for MSEs.

H1c: Regulation is positively related to the employment growth of MSEs in SSI.

H1d: Regulation is positively related to MSEs' feeling of success.

5.4.2 Financial variables

Finance is an important ingredient in every commercialisation process (Mass & Zhengge; 2016; Savona & Pellegrino, 2017; Bruton, Khavul, Siegel & Wright, 2017; Ullah, 2019; Eldridge, Nisar & Torchia, 2019). It refers to the availability of monetary wealth which can be used to fund business activities and factors that enable the entrepreneur to assess and use these resources to achieve results (Ullah & Wei, 2017; Ullah, 2019). MSEs in SSIs commercialising innovation access finance through personal savings, credit or investment from family and friends, grants and/or commercial banks (Allison et al., 2015; Allen, Qian & Xie, 2018). Generally, the literature suggests availability, accessibility, cost and financial knowledge and skills of the innovation team as important financial factors in the firms' commercialisation process (Soofi, 2017; Klyton & Rutabayiro-Ngoga, 2017; Atiase, 2018). Again, the innovation literature highlights access, usage, and cost of credit as critical in the commercialisation process since beyond personal funding, bank credit ironically remains the most available and reliable source of finance to MSEs (Ullah, 2019). Access, usage, and cost of credit are therefore a good financial barometer to measure and study in understanding the linkage between finance and successful commercialisation of innovation.

The link between credit and successful commercialisation in low-income economies have been analysed from availability, usage, and cost perspectives (Hussain & Thapa, 2015; Sekyi, Abu & Nkegbe, 2020). There is abundance evidence of a strong link between credit availability and firm commercial and innovation performance (Nwosu, & Orji, 2017. Babajide, 2017; Ullah & Wei, 2017; Mann, 2018; Ullah, 2019). Fowowe (2017) conducted an empirical investigation of the effects of access to finance on the growth of firms in African countries, using new rich enterprise-level data set from the World Bank's Enterprise Surveys. The investigation revealed financial constraints exert a significant negative effect on firm growth and firms that are not credit constrained experienced faster growth than firms which are credit constrained. Botie and Atiase (2018) observed a strong link between credit availability and technological absorption rate among African countries. Yet, access and cost are still major constraints to undertaking commercial activities in these economies (Nkegbe, 2018; Sekyi et al., 2020). Even though new venture finance is a challenge everywhere, the magnitude of limited access to credit is severely hindering the development and impacts of innovations of firms and other entrepreneurial pursuits in Africa (Soofi, 2017; Klyton & Rutabayiro-Ngoga, 2017; Eton, Mwosi, Mutesigensi & Ebong, 2017).

A number of studies have championed and raised access to finance as the most important factor affecting the growth and performance of MSEs and MSEs in Ghana (Ghana Report, 2014; Boame et al., 2014; Atiase, 2018). It has been observed that banks are not willing to extend credit to small business let alone new businesses and innovations, where the default risks are higher (Atiase, 2018). Eton et al. (2017) explained that credit enables MSEs and MSEs access essential resources, diversify and increase productivity. Some raised asymmetries of information due to poor recording keeping by MSEs and innovators as the problem and recommend financial institutions must provide training to their clients and MSEs must practice documentation to improve credit worthiness (Owusu et al., 2015; Eton et al., 2017). Atiase (2018) investigated the impact of microcredit and entrepreneurship training on the performance of MSEs s in the Volta Region of Ghana and found microcredit to be a significant impact on MSEs performance. Although not specifically on innovation, Atiase (2018) highlighted the combined effect of credit availability and quality of human capital through training on the economic performance of firms in Ghana.

The microeconomic reasoning for the positive credit availability and innovation commercialisation success link is that credit can be used to expand scale of operation that can invariably increase employment and profitability (Savona & Pellegrino, 2017; Ullah & Wei, 2019). Another link between credit and commercialisation of innovation is that credit sales can be used as incentives to users of new innovation to make purchases (Altaf & Ahmad, 2019). Conversely, others have portrayed a negative link, arguing high interest rates and strict repayment schedules can increase the risks of failure in low-income area. High default rate and high working capital requirements and associated cost of finance can also reduce chances of success of commercialisation in terms of financial performance (Altaf & Ahmad, 2019). In Ghana, even in instances where credit is available, the high interest rates and strict repayment schedules have increased the risks of failure (Atiase et al., 2019). Atiase et al. (2019) observed that although accessibility, adequacy, and flexibility of repayment terms of finance has a   positive impact on firm performance and the current cost in Ghana has a negative impact on employment growth among MSEs.

From the literature, the positive link between finance and firm performance is very sound and efforts are being made to increase availability to MSEs. Nonetheless, there are concerns that the cost and impatience of credit might not make it suitable for commercialisation of innovation even if it is accessible to MSEs in SSI. It is therefore important to further examine finance and successful commercialisation links particularly in the context of low-income economies where margins are low, and it takes time to increase scale and build volumes. This study will therefore test the following hypothesis:

H2a: Finance is positively related to sales growth of indigenous innovation in the SSI sector.

H2b: Finance is positively related to the profitability of indigenous innovation for MSEs.

H2c: Finance is positively related to the employment growth of MSEs in SSI sector

H2d Finance is positively related to MSEs' feeling of success.

5.4.3 Organisational variables

Organisation factors are factors which influence a firm's ability to mobilise and deploy resources and capabilities to utilise it works process, team, communication, interaction leadership and other business infrastructure to achieve results (Mass & Zhengge; 2016; Kumar, Singh & Sachin, 2020; Martínez-Azúa, López-Salazar & Sama-Berrocal, 2020). In the context of organising and managing innovation in small firms, the literature suggest knowledge management, inputs management, organisation culture, and commercialisation culture as key (Do, Mazzarol, Soutar, Volery & Reboud, 2018). Although ability of entrepreneurs and small business to organised resources to achieve successful innovation has been conceptually recognised, exceptionally few research (e.g., De Zubielqui, Lindsay and O'Connor, 2014; Do et al., 2018) has examined the relationship between all the relevant organisational factors relative to resource deployment and firm performance. Most studies available on organisational factors, innovation, and firm performance centred on human capital.

Human capital is one important and pivotal organisational factor in innovation commercialisation process. Organisational factors add value to innovative firms through skills application, use of know-how and expertise (Pelinescu, 2015; McGuirk, Lenihan & Hart, 2015). There is evidence that educated and somehow experienced MSE and MSE owners, have higher amount of human capital and efficiency in organising and managing processes, managing information, creating relationships with various stakeholders, spot better growth-related opportunities and can avoid pitfalls (Mahmutaj & Krasniqi, 2020). Commercialisation required people skills, technical and vocational skills, ICT skills for rendering services, mediating, and handling complaints (McGuirk, Lenihan & Hart, 2015). Particularly in resource constrained environment, human capital provides the extra ordinary financial skills required to gather and use resources to undertake commercialisation of innovation and achieve profitability. Similarly, it provides the marketing skills required to properly package, price, promote and place products on the market and achieve sales in income constrained economies.

A number of studies suggest a strong link between organisational factors particularly human capital and innovation performance (Mass & Zhengge; 2016; Ndirangu, 2016; Suseno, Standing, Kiani-Mavi & Jackson, 2020). It is also generally argued that quality of human capital within the wider society can foster innovation, new technology adoption and commercialisation (Rahman and Zaman, 2016; Asongu & Roux, 2017).

Empirically Suseno et al. (2020) examined the impact of human capital and social capital on national innovation performance, using data on OECD countries and confirmed that human capital has a significant effect on national innovation performance. Martínez-Azúa et al. (2020) recently studied the agro-food industry of Extremadura region in Spain, found out organisational factors had a great weight for the achievement of the innovative performance and highlighted the capacities and competences of the agro-food firms' managers. Popa and Ciobanu (2014) provided some evidence on how managerial and investment decisions of owners significantly influenced the profitability and growth of MSEs in Romania.

Owners or managers' ability to use their networks to identify, access and use resources, is important aspects of managing inputs and firms can enhance their innovation performance through alliances and cooperation (Al-Ansariet al.,2014). De Zubielqui, Lindsay and O'Connor (2014) provided some evidence of positive links between MSEs access and use of resources and application of knowledge to new product development (NPD), operations and marketing, and innovation and commercialisation performance.

The empirical evidence from low-income countries are however not so clear. Using data from SSA countries, Danquah and Ouattara (2014) suggest that human capital does not exert statistically significant effect on productivity and profitability and attributed the inconsequential contribution of human capital to the negligible productivity enhancing effects of human capital to type of education and training available in these countries. The authors noted that tertiary education attainment does not contribute to innovation and growth and have no growth enhancing effect in African countries. Others further opined different types of schooling and experience correlate differently with firm performance, blamed inappropriate academic programmes for low innovation, and called for competency-based trainings (CBT) in the vocational, technical schools and universities in Ghana (Alhassan & Habib, 2016; Afful & Owusu, 2017). The work of Ockwell and Byrne (2016) noted that R&D and human capital make contribution to firm performance through improved innovation absorptive capacity, and this happen only, if the highly trained personnel work with or move to work in private firms. The evidence from the literature however is that business enterprises and MSEs in most low-income economies lack sufficient technological capabilities and are unable to articulate their technical needs, while the research institutions do not have much interest in what MSEs do (Bartels et al., 2016).

Nonetheless, others have provided some evidence of positive linkage between human capital and innovation performance at firm level in low-income economies. Gao and Hafsi (2015) argued that the higher the level of owner's education, the better is the outcome of innovation activities and firm growth. Moreover, Akinboade (2015) after analysing 575 MSEs suggests that MSEs' efficiency is affected by the level of education of owners and there can be improved turnover growth with an increased level of owners' education. Ndirangu's (2016) study of determinants of innovation performance of youth enterprise in Kenya observed that a considerable number of enterprises using ICT infrastructure and skills were able to enter new markets, get more customers, and maintain loyalty than their counterparts that were unable to adapt and use digital technology. Asiedu (2016) and Atiase (2018) also suggest in general innovation team members', training, skills, and experience have a beneficial impact on firm performance.

Fatoki (2018) investigated the relationship between entrepreneurial resilience and the success of MSEs in respect of both organisational (firm) and individual levels in South Africa. Entrepreneurial resilience has been explained as the ability of entrepreneur to make decisions, organise resources, withstand and quickly overcome adversity in difficult and uncertain business environment (Branicki, Sullivan-Taylor & Livschitz, 2016; Corner, Singh & Pavlovich, 2017; Ofunoye, 2017; Fatoki, 2018). Fatoki (2018) emphasised that entrepreneurial success is not only about performance of turnover and profit but also feeling of achievement at the individual level provided some evidence that entrepreneurial resilience has a significant positive relationship with individual success.

From the above arguments and research evidence, it can be concluded that there is a general believe that organisational factors have a major effect on commercial success of MSEs and MSEs. It is also evident that MSE owners in SSI in Volta Region of Ghana are largely deficient in level of training and skills, thus the quality of human capital and organisational skills. This has led to proliferation of training programmes by government and NGOs to support the MSEs in the Region within the last decade.

Based on the discussion from the literature and the emerging trends, the study proposes the following hypothesis to test.

H3a: Organisational factors are positively related to sales growth of indigenous innovation in the SSI sector.

H3b: Organisational factors are positively related to the profitability of indigenous innovation for MSEs.

H3c: Organisational factors are positively related to the employment growth of MSEs in SSI sector.

H3d: Organisational factors are positively related to MSEs' feeling of success.

5.4.4 Market variables

This study is underpinned by the theoretical assumption that successful commercialisation of innovation is dependent on the 4As (affordability, awareness, availability, and acceptability of the innovation. From an economic and marketing perspectives, market variables such as cost, market price, and promotional as well as distributional efforts are key in the commercialisation decision of MSEs and can affect both the supply and successful sales of innovation, and hence business results of firms (Hang Do, Mazzarol, Volery & Reboud, 2014).

In terms of cost, commercialisation is defined as the process of converting ideas, research, or inventions into viable products and production systems that retain the desired functionality and manufacturability at low cost (Anderson, 2020). Cost and successful commercialisation of innovation have been analysed from different perspectives (Lehtimäki, Helén, Snell, Erikson & Montonen, 2019; Lim &Fujimoto, 2019; Wimschneider, Agarwal & Brem, 2020). From BRI models, the lower the input cost the more likely it is that innovators would commercialise and vice versa (Lim &Fujimoto, 2019). From competitive point of view, however, high cost of commercialisation can create strategic advantages and the associated large level of investment can lead to better innovation impacts in terms of messo and macro level economic performance of firms (Lehtimäki et al., 2019). Rich and appropriate distributive margins, which is part of cost, can make promotional efforts worth the while for distributors (Wimschneider et al., 2020). Distributive margins consist of physical distribution costs and promotion costs.

According to Anderson (2020), a basic factor in making innovation commercialisation decision is the expected behaviour of production and distribution costs, and key here are all the production outlays in terms of capital expenditures as well as the variable costs after a go-ahead decision. Unlike later imitators, innovator must bear the burden of creating a market (educating consumers on existence and uses of the product) and must have some assurance that these costs can be substantially recovered before the innovation becomes a football in the market. BRI theories stressed the importance of doing more with less (Radjou & Prabhu, 2014; Knorringa et al., 2016). The opportunity to achieve lowest possible commercialisation cost is at the conceptualisation stage as the substantial part of cost is based on the concept/architecture of an innovation. Trying cost reduction at later stage wastes valuable resources, does not really reduce cost again and compromises product and process integrity (Anderson, 2020). There are also growing evidence that confirmed that the outcome of innovation is more dependent on competitive market strategies and firms' capabilities to exploit market opportunities and deal with threats (Sangwa & Sangwan, 2018).

An important puzzle in commercialisation decision is what price range will make the innovation economically attractive to sellers and buyers, and the resultant reaction of makers and sellers of substitutes that the innovation and its price would trigger (Krämer & Kalka, 2017). A case has been made for both low price and relatively high price at early stage in the literature (Boomerang, 2015; Howell, van Beers & Doorn, 2018; Dean, 2020). Low prices enable quick sales to many buyers at the bottom of economic pyramid. Generally, economic reasoning for low price and successful commercialisation of innovation are many and range from the fact that most products have high price-elasticity of demand in the short run; there are substantial cost savings with larger production volume; the need to serve low-income consumers and fit into their expenditure pattern; and creating a strong threat for potential competition (Hang et al., 2014). As indigenous innovation tends to be incremental than radical and innovation may not be protected from competition by patents and other barriers or extreme product differentiation, innovators do not actually have a lot of pricing discretion in low-income setting. Possible retaliation by manufacturers of displaced substitutes in the form of price cutting can also make the new product uncompetitive (Krämer & Kalka, 2017).

Low unit price may indeed speed market acceptance of an innovation. However, there are some evidence that relatively high prices coupled with heavy promotional expenditures in the early stages of market development (and lower prices at later stages) has contributed to successful commercialisation for many innovations (Dean, 2020). For some consumer goods, promotional elasticity is quite high, since customers are by default principally interested in how well the product will work. Launching with a high price can be an efficient market segmentation strategy. While the initial price can help skim out the cream of the market that might not be so sensitive to price, subsequent price reductions can tap into more elastic sectors of the market. Aiming at a good retail price for an innovation can also allow for good distributive margin which can boost distributors' promotional effort in point-of-sale pushing, local advertising, and display (Wimschneider et al., 2020; Anderson, 2020).

Moreover, setting relatively high initial price can be a good financing technique for shouldering the burdens and safeguarding some profits. Some argued relatively high price for innovation at early stage may be reasonable in low-income economies where there is limited protection mechanism for innovation, market is fragmented, it may take time to achieve large volume potentials and there are many uncertainties (Dean, 2020). There are also some suggestions from the literature that the market may be at times be willing to pay a bit more premium for indigenous innovation which can be an important reward for entrepreneurship (Okoe & Boateng, 2016; Balabanis & Diamantopoulos, 2016).

Commercialisation is multi facet strategic process that required the hardware, materials and the production systems as well as the software costs to be low, at the same time the crown jewels of the innovation have to be preserved in the process to make an invention more commercialable (Ockwell & Byrne, 2016; Karnieli & Gur-Lavie, 2015; Anderson, 2020). Strategic management literature emphasised a strong link between market factors and firm performance (Olhager and Feldmann, 2018; Dayanet al., 2017; Sangwa and Sangwan, 2018; Kharub, Mor & Sharma, 2019). Kharub et al. (2019) opined that it is through cost leadership and competitive strategies that MSEs creates efficient-scale facilities, reduction in overheads and expenditures and gain higher returns on assets. Sangwa and Sangwan (2018) in emphasising significant relationship of market factors with firm performances explained that competitive market strategies enable firms to achieve and sustain their desired objectives. Sheng, Zheng and Leopold (2013) observed that firms in underdeveloped environments can generate a return from their innovations with production capabilities, the supply chain, distribution networks, and the ability to provide after-sale service.

Empirically, Liu and Atuahene-Gima (2018) study on a survey of 282 managers of Chinese hi-tech firms' emphasised a strong positive link between cost leadership, customer orientation and creative marketing and innovation performance in dysfunctional competitive environment where innovation and value protections rules do not work. The same study found that differentiation and a competitor orientation are less effective predictors of innovation performance in terms of profitability. Others, for example Anderson (2020), studied 800 innovative firms, identified 120 of them as “cost cutters, and observed that 68% of them did not make profit during the first five years and suggested that there are intangible impacts of excessive focus on cost reduction. Wimschneider et al. (2020) confirmed that although cost-effectiveness and ease of use are key in successful commercialisation of frugal innovation in developing countries other dimensions like distinctive product features, branding and specific marketing activities are crucial for success.

Existing empirical evidence on market factors and innovation performance is largely general and tend to focus more on the financial variables of sales and profitability. There is a dearth of literature on market factors and non-financial measures of performance. Few empirical evidence that touched in non-financial performance includes Weber (2014), Cabrera and Mauricio (2017) and Bin, Chen, Fracasso, and Tomasi (2019). Bin et al. (2019) using empirical data in China provided novel evidence of the role market and regional factors on innovation and firm employment growth. Bin et al. (2019) shows that firms located in provinces with better market conditions tend to expand their employment relatively more. Mauricio (2017) also touched on market factors and women entrepreneurial success. Mauricio (2017) affirmed earlier views that success is business owner’s intrinsic construct and extrinsic targets and suggested that ascent to market and growth platforms is link to women entrepreneurs feeling of success.

In Ghana high cost of doing business has been highlighted for the low innovative activities and business failure (Nyarku & Oduro, 2017; Guy et al., 2018; Chan, Darko, Olanipekun & Ameyaw, 2018). Chan et al. (2018), for example, emphasised high costs as one of the most critical barriers to commercialisation of green building technology (GBT) in Ghana. Seeking the views of 43 professionals and reviewing literature Chan, et al. (2018) identified and investigated 20 critical barriers to adoption of GBTs in the Ghanaian construction and found high costs among the top three most critical barriers.

Donkor, Donkor, and Kwarteng (2018) ascertained that market dynamism has a significant positive relationship with firm performance. A study on commercialising agricultural research innovation in Northern Ghana suggest a low market price and weak effective demand as a constraint to the commercialisation of innovation in Ghana (Jinbaan et al., 2016). Jinbaan et al. (2016) investigated farmers` willingness to pay and researchers' willingness to sell and demonstrated that commercialisation of innovation is unlikely to be successful if the price users can pay is less than what innovators demand on the market.

From the literature more empirical evidence is required to understand the impact of market factors in terms of the 4Ps (or from BRI perspective the 4As) and various dimensions of success of commercialisation. The study, therefore, proposes the following hypothesis to test in relation to market factors and successful commercialisation.

H4a: Market factors are positively related to sales of MSEs in the SSI sector.

H4b: Market factors are positively related to the profitability of MSEs in SSI sector.

H4c: Market factors are positively related to the employment of MSEs in SSI sector.

H4d: Market factors are positively related to MSEs' feeling of success.

5.4.5 Technology variables

The role of technology in successful development and commercialisation of innovation is highly recognised in every industry and economy (Marx et al., 2014; Osoro et al., 2015; Dahlstrand et al., 2016; Azarmi, 2016). Technology, generally consist of artefacts or hardware in the form of tools and containers, the processes and input for making these artefacts, and the knowledge of using the artefacts and the process to enhance human capabilities (Nightingale, 2014; La Shun, 2017). To MSEs embracing technology is a function of both internal and external scope, which are linked to the development of products and services they offer (Bergek et al., 2015). Technology is also touted in the literature as the big bang that can propelled MSEs to endless possibilities and as a valuable tool for excelling in the marketplace (Ndirangu, 2016).

From innovators and entrepreneurs' perspectives, technology can be for specific purpose, thus equipment and processes in a specific industry or general purpose such as information technology that can be embraced by any firm to enhance efficiency (Coccia, 2018). Specific purpose technology can support indigenous knowledge and traditional ways of working and lead to innovative products. For example, there are evidence that the improvement in plastic technology has aided traditional caterers and food processors to package traditional drinks and foods and introduce new products for supermarkets and events markets in Ghana (Kwaku & Fan, 2020).

Kerr et al. (2014) emphasised the importance of synergies of innovation with existing technologies and related products for successful commercialisation. Others explained innovations and sometimes entirely different technologies compete and complement each other in various ways, which means that their coevolution can influence the dynamics in the marketplace (Binz et al., 2014; Gosens et al., 2018). Proponent of technology innovation system explained a strong structural coupling (thus shared elements between innovations and existing technologies) is necessary for the development and commercialisation of innovation in both developed and low-income economies (Onufrey, 2014; Binz et al., 2014; Gosens et al., 2018). It has been observed that higher degree of structural couplings can increase a firm's access to system level assets and its innovation performance (Onufrey, 2014).

It is also noted from the literature that technology contribute to improvement in operation, increase speed and increase productivity (Wadho & Chaudhry, 2018; Takahashi, Muraoka & Otsuka, 2020). Embracing general purpose technology such as information and communication technology (ICT) has no doubt contributed to improve business processes and results of MSEs. There are growing evidence of SSIs embracing digital technology, at least, in terms of using social media to advertise, promote their businesses, network with stakeholders, and using mobile money payment system in Ghana (Zaglago, 2019; Coffie, Hongjiang, Mensah, Kiconco, & Simon, 2020). Digital technology does not only increase access and expand their markets but promotes customer loyalty; encourage prompt payment and improved cash flow; and makes MSEs more efficient.

The positive links between technology and successful commercialisation has been well acknowledged. However, for some MSEs and SSIs embracing new technologies can increase their operational and financial risks and may thereby impact negatively on their performance (Chan et al., 2018). New technologies are displacing SSIs and speedily fading out indigenous knowledge. Quaye and Mensah (2019) offered some evidence that indigenous knowledge in the Ghanaian small-scale industry faced the risk of being fading out by new technology. From the literature there are also counterbalancing augments for technology and employment (Bogliacino, 2014; Ciriaci et al., 2016; Calvino & Virgillito, 2018; Roy et al., 2018). Calvino and Virgillito (2018) for example observed that the literature largely portrays non constant effects of innovation on employment.

There is almost dearth of literature on technology and feeling of success in business, particularly in developing countries. Few emerging technology adoption studies analysed in general and individuals' physiological motivations and behavioural aspects of technology acceptance (Terras & Ramsay, 2015; Tirgu-Mures, 2017; Khan, Hameed, Yu, Islam, Sheikh & Khan 2018).

Tirgu-Mures (2017) reviewed models and frameworks that explained adoption and use of new technologies and innovations. The overview provided by Tirgu-Mures (2017) suggest that technology adopters are strongly motivated by self-efficacy achievement, emotions and other social factors as explained by the theories of planned behaviours and interpersonal behaviour. Tirgu-Mures (2017) also observed that even the Technology Acceptance Models (TAM) that claim to eliminate users' subjective norms, interestingly highlight social constructs such social influence (or image) in explaining the suggested objective variables of perceived usefulness, perceived ease of use, and attitude towards use that motivate technology adoption and acceptance. Khan et al. (2018) also provided some evidence of strong relationship between usage behaviour of Massive Open Online Course (MOOCs) and perceived reputation of individuals using structural equation model and responses of over 400 participants.

Based on the discussion from the literature and the evidence, embracing specific or general-purpose technology can propel MSEs even in SSI. It is for example evident that embracing digital technology helped expanded the market reach, improved payment, and cash flow, and made MSEs more efficient. At the same time, it is evidently clear that some aspects of technology have raised the bar, increase cost, and competition had adverse impact on indigenous knowledge and MSEs in small scale industry in Ghana. To clarify the overall impact of technology on SSI and indigenous innovation in Volta Region of Ghana the study will test the following hypothesis:

H5a: Technology is positively related to sales of indigenous innovation in the SSI sector.

H5b: Technology is negatively related to the profitability of indigenous innovation for MSEs.

H5c: Technology is positively related to the employment growth of MSEs in SSI sector.

H5d: Technology is positively related to MSE owners feeling of success in SSI sector.

5.5 CONTROL VARIABLES

5.5.1 Government incentives

Incentivising firms in the form of direct grants, tax incentives, concessional credit and other schemes to support firms increase innovation capabilities, cover part of their R&D costs and minimise their organisation, market and financial risks, are essentials part of most national innovation policies (Mayer, 2018; Yigitcanlar, Sabatini, Da Costa, Moreira & Ioppolo, 2019). The link between incentives and its mediating effects on other factors and innovation performance as well as the rationale for government incentives in the literature are very sound (Olcay & Bulu, 2015; Guan & Yam, 2015; Carboni, 2017). The ability of governments to effectively deliver and firms taking advantage of incentive programs, however, remain a challenge leading to concerns over the effectiveness of incentivising innovation in many countries (Sabatini-Marques et al., 2015). The results of quantitative investigations into the role of government incentives in innovation performances of firms is therefore still a mixed one.

A number of scholars argued government incentives particularly financial support, in general, positively moderates the relationships between other factors and firms' innovation performance (Carboni, 2017, Zhang & Guan, 2018). Others claimed government incentives have several drawbacks, and financial incentives for example may just substitute firms own innovation expenditures (Zhang & Wu, 2014; Guan & Yam, 2015). Other scholars portrayed and confirmed inverted U-shaped associations explaining that incentives are positively associated with innovation performance until a certain threshold value (for some time), after which the positive effect will gradually diminish and eventually turn negative (Zhang & Guan, 2018; Zhu, Wang & Wang, 2019). Zhang and Guan (2018) offered a solid empirical support for the effects of government incentives over time and found that subsidies favour firms in the short-term, but hinder them in their long-term, indirect tax credit on the other hand is favourable to firms'short-term and long-term innovation performance.

Some scholars suggested the efficacy depend on factors such as industry conditions, country institutional factors, firm size, and size of the intervention (Huergo et al., 2016). Srhoj and Zilic (2020) recently using the case of Croatia provided some evidence that MSEs and unlimited limited liability firms benefiting from grant schemes, have a more favourable survival profile than big companies and that the effectiveness of grants in easing the initial difficulties of business start-ups have improved over the years.

The literature on government incentives and innovation performance largely focused on the supply sides. Few, for example, Narassimhan and Johnson (2018) using commercialisation of plug-in electric vehicles, examined over 400 supply-side and demand-side incentives and regulations in the US and offered some plausible evidence that within tax incentives, rebates on the demand side are generally more effective than tax credits on the supply side. Other scholars found some evidence in the Scandinavian countries that demand side non-monetary incentives such as toll and parking exemptions are more effective in increasing sales of electric vehicles than subsidy on infrastructure itself (Mersky, Sprei, Samaras & Qian, 2016; Zhang, Qian, Sprei & Li, 2016). Eisenberg and Price (2017) explained that greater involvement of payers and incentives to innovation users is more efficient and effective than incentives to firms or innovation sellers which promote use of expensive technologies and costly new products. From BRI perspective, low cost of products, consumers reduced cost of using the innovation and use of appropriate technology are key for successful commercialisation.

Incentives in Ghana has largely been on the supply side. Amankwah-Amoah and Sarpong (2015) examined the evolution and scaling up of solar photovoltaic technology in Ghana from 1980–2010 and concluded that government policy providing incentives to enhance local firms' capacity building could help develop a competitive solar manufacturing base. Afful Owusu (2017) analysed the drivers of innovation from Ghana Enterprise and Innovation Follow-Up Survey, observed product and process innovation are weak, dependent on R&D and called for government R&D subsidies for firms. Udimal, Jincai, Musah and Hua (2019) analysed the determinants of new products innovation in the Ghanaian MSEs sector. Using sales value of new products as a proxy for new products innovation performance, and innovation funding sources as the determinants, Udimal et al. (2019) provided some evidence that foreign capital combined with government tax credit and subsidies had significantly influence on new products innovation. As reviewed from the Ghanaian innovation system, the identifiable commercialisation incentives elements relating to MSEs include grants, concessionary loan, free/subsidized inputs, regulatory relaxation, government purchases and free training (Oduro-Marfo, 2015; Amankwah-Amoah, 2016; MESTI, 2017b, Udimal, Jincai, & Ibn Musah, 2019). This decade, for example, has seen proliferation and over concentrating on training support as a panacea intervention for MSEs.

5.5.2 Commercialisation strategies

Another factor that can influence firm performance for commercialisation of innovation of firms is the commercialisation strategy. For this study, innovation commercialisation strategy can be analysed from three perspectives. The first is based on the type of agent or commercialising entity undertaking the commercialisation. Second is the use of university hub or other innovation supporting institutions to shape innovation or reduce cost. Third is the pricing strategy of the firm to offer consumers affordable values and/or appropriate more value for the firm.

In respect of commercialising entity, the three main and often discussed methods for commercialisation of innovation are technology transfer and spinoffs from knowledge-based institutions (KBIs); corporate venturing by existing firms (corporate spinoff or licenses from others); and start-ups by entrepreneurs or innovators theMSElves (Dahstrand et al., 2016; Bartelset et al., 2016).

From the literature, infectiveness of KBIs in commercialisation of innovation has been well discussed (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016; Gachie & Govender, 2017: Sitnikova, Halo & Polusmakova, 2018). The long history of KBIs disseminating important information on science, technology and innovation is only seen as tangential. Sitnikova, Halo and Polusmakova (2018) hyped the low effectiveness of the process of innovation commercialisation in research and academic institutions. Employing structural and functional analysis, statistical analysis, and formalisation and the case of Russia, Sitnikova et al. (2018) demonstrated that modern universities only do “innovation for innovation” and the interest of scholars to gain recognition in the scientific society do not correlate with the national interests of increasing indigenous innovation activities. Gachie and Govender (2017) using evidence from south African affirmed the ineffectiveness higher education institutions (HEIs) in commercialisation of research and iterated that HEIs are constrained by lack of commercialisation skills, qualified staff, brain drain, aging of faculty, absence of intellectual property (IP) policy measures, and focus on lecturing rather than research-focused mandates.

The impact of Knowledge based institutions (KBIs) on successful commercialisation in Ghana has not been well analysed. However, few have accused Ghanaian (KBIs) which is supposed to act as gatekeepers and producers of innovation, knowledge, and technology of having a myopic focus on fundamental research (Oduro-Marfo, 2015; Fu, et al., 2018). Some argued that the academia in Ghana care less about eventual transferability of discoveries to users and often fight efforts for commercialisation by over focusing on scientific rigor and generalisability (Chilana et al., 2015; El-Jardali & Fadlallah, 2018). Some other Ghanaian innovation scholars observed that most universities and other actors in the innovation ecosystem in Ghana also lack proper infrastructure and there is lack of coherent policies on tech transfer from KBIs to start-up businesses (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016). Scholars such as Victoria, van Der Sijde, Groenewegen and Baaken (2015) called for a better understanding of university knowledge generation and transfer to firms for innovation given the high desire to pursue innovation-led economic and social development currently.

Further, from the innovation literature, large and existing firms are not the main source of new innovations on the market. Large and existing firms may have the capacity to deploy resources for effective commercialisation of innovation but are more risk averse (Dahstrand et al., 2016; Futterer, Schmidt & Heidenreich, 2018). Entrepreneurial firms are, by far, the most common agents of innovation commercialisation particularly in low-income economies (Dahlstrand, 2016; Asiedu, 2016). Menna and Walsh (2019), for example, highlighted the role MSEs can play in the diffusion of indigenous innovation by comparing commercialising new wines using small-scale, locally based, artisanal methods, and large-scale industrial modes of production, and demonstrated that the subtleties of place, terroir, generations of expertise and empathy made the MSEs outperformed the chemicals and new techniques of corporate venturing.

Although entrepreneurial firms and new MSEs are clearly at the forefront, there are growing evidence from the innovation ecosystem literature that development of collaboration with intermediary organisations such as university incubators and the exploitation of innovation support services can be important for effective commercialisation process (Auerswald, 2015; Bell-Masterson & Stangler, 2015; Mack & Mayer, 2015; Stam, 2015; Clayton, Feldman & Lowe, 2018). The growing interest in innovation ecosystems present an opportunity to analyse and highlight the behind-the-scenes intermediary role of universities in commercialisation of indigenous innovation. It is emerging from nascent innovation ecosystem literature that an important links between universities and innovation commercialisation is the innovation intermediary roles (Mack & Mayer, 2015; Stam, 2015; Mian, Lamine & Fayolle, 2016; Clayton et al., 2018). However, just like a theatre where the focus of audience is the action on the stage, and not the backstage crew working behind the scenes, the rising star for successful innovation commercialisation is the entrepreneur, and the least visible players are intermediary organisations (Clayton et al., 2018). Iyortsuun (2017) highlighted that the role of business incubation is one of the key strategies in supporting and promoting MSE development. He provided substantial evidence that intensity of business assistance and professional management services from hubs are significant predictors of startup and innovation performance.

The interest of Ghanaian universities in tech hubs and incubators have grown in the last decade. The Kwame Nkrumah Univerisity of Science and Technology (KNUST) for example has established technology park and incubator for local innovation and entrepreneurship (KNUST, 2014; Omane Boamah & Atta-Boateng, 2020). A number of the technical universities, including Ho Technical University, in the study area also have innovation and business incubators. Empirically, Abdulai, Murphy and Thomas (2020) study using data from 245 Ghanaian firms and partial least squares structural equation model found a positive relationship between university–industry collaboration and innovation performance, but weak or no moderating effect of informal mechanisms of university knowledge transfer. The weak moderating effects of university informal knowledge transfer mechanisms identified by Abdulai et al. (2020) highlight the views of earlier scholars (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016) of lack of trust and coherent policies on tech transfer from KBIs to firms in Ghana.

The rationale behind the hub concept is that through this intermediary role, universities can create communities to develop, test and implement new technology, and form networks to discuss new ideas around innovation (Schmitt & Muyoya, 2020). Through tech hubs and incubators universities can increase access of innovators to infrastructure in terms of university labs and workshops. Clayton et al. (2018) argued that entrepreneurs trying to commercialise their invention lack resources and can rely on innovation intermediary such as the universities within their local ecosystems. Indeed, university incubators and technology parks have been key in strategic efforts in many countries to promote commercialisation of innovation (Jamil, Ismail & Mahmood, 2015; Olefirenko & Shevliuga, 2017). Jamil et al. (2015) nonetheless noted incubators and academic spinout appear to work best only when there is a complementary innovation system in a country. Hossain (2018) Suggested that despite numerous challenges innovation intermediary platforms give innovators (users) diversified knowledge, learning culture, developing a different way of thinking, gaining insights from other experts, networks, fun and sense of achievement.

Pricing strategies have direct moderating effect on firms' performance. Whether commercialisation is carried out through technology transfer and spinoffs from knowledge-based institutions (KBIs), corporate venturing by existing firms or start-ups by entrepreneurs, pricing strategy can impact on the outcome (Boomerang, 2015; Howell, van Beers & Doorn, 2018; Dean, 2020). BRI models prescribed that low pricing for-market expansion should be explored in the early stages of innovation development and further considered at various stages in a product's life cycle—at birth, in childhood, in adulthood, and in senescence (Tiwari et al., 2014).

De Toni, Milan, Saciloto, and Larentis (2017) studied pricing strategies of 150 Brillian firms in metal-mechanic sector found out that the profitability is positively affected by high price levels and negatively affected by low price levels. Pratono (2018) also with a random survey of 380 Indonesian MSEs provided some evidence that pricing capability can positively moderate other efforts on firm performance.

5.6 SUMMARY OF RESEARCH GAPS

Only a few studies have examined commercialisation of indigenous innovation by MSEs in small-scale industrial sector particularly in the Ghanaian context. Most of the limited studies like (Akinboade, 2015; Oduro & Nyarku, 2018; Quaye and Mensah, 2019; Donbesuur et al., 2020) which have investigated the effect of key drivers on innovation performance, have largely not isolated the commercial dimensions and well examined impacts on sales, profitability, and employment. Meanwhile, MSEs have become policy focus for government as significant strategic sector for promotion of entrepreneurship and innovation precisely because of their potential for growth in terms of GDP and employment generation. There is therefore the need to further examine the impact of the key drivers on various dimension of innovation performance in order to profess appropriate interventions. Available empirical studies on commercialisation of innovation have also given mixed results on the interrelationship between the key drivers of regulation, market factors, technology and government incentives and their influence on innovation performance, hence, further research is deserved in these areas.

Even for the variables with evidence of overwhelming linkages, there are still shortcomings that required further investigations. For drivers such as finance, for example, there is abundance evidence of a strong link between credit availability and firms' positive commercial and innovation performance. Based on this evidence the focus of recent literature has been on how to improve availability and increase MSEs access to credit. However, given the cost and the impatience nature of credit there is the need to further test the usage of credit in commercialisation of indigenous innovation in low-income settings where markets are fragmented, margins are low, and it takes time to increase scale and build volumes.

Moreover, the overwhelming evidence of positive links between human capital and innovation performance and moderating influence of government incentive has led to proliferation of training programmes by government and NGOs as panacea intervention for MSEs. This present opportunity to test the impact of incentives such as free training on MSEs' innovation performance. Most studies on government incentives and innovation performances of firms indeed offered mixed results and required further research. The few studies on government incentives and innovation performance on Ghana, just as the international literature, are largely focused on the supply side and incentives that fortify firms and innovation sellers. The emerging and growing evidence from the US and the Scandinavian countries, therefore, call for efficacy of demand side incentives to be also tested in low-income countries.

In addition, the weak linkage between effective commercialisation of innovation and universities and other KBIs has been well hyped in the literature. However, the growing interest of Ghanaian universities in tech hubs and other commercialisation intermediary roles present an opportunity to examine the behind-the-scenes roles of universities and innovation commercialisation.

5.7 CHAPTER SUMARRY

This chapter has reviewed the variables in the conceptual framework and hypothesised some linkages between the independent and the dependent variables. The research instrument in the next chapter is developed based on the theoretical and empirical linkages identified in the literature and the proposed hypotheses.

CHAPTER 6: METHODOLOGY

6.1 INTRODUCTION

The last chapter discussed the conceptual framework of the study and drew on extant literature regarding the impact of the commercialisation factors on the performance of MSEs. The reviewed literature reflected the stated research problem of limited commercialisation of indigenous innovation and the need to further understand the factors influencing the performance of firms engaged in indigenous innovation activities. How the study was conducted to address the research problem and answer the research questions is discussed in this chapter. The chapter describes the design and methodological issues of the study. Providing comprehensive descriptions of the research design and methodology makes it possible for the research to be replicated by other researchers. It is also important to provide guidance for future research and methodological choices in relation to the study of the influence of commercialisation factors on the performance of MSEs in low-income economies.

This chapter, therefore, explained the adopted research philosophy, the research approach and design, the study population and sampling, data collection, pilot test, as well as validity, reliability, and other data analysis issues.

6.2 RESEARCH PHILOSOPHY/PARADIGM

Philosophically, four schools of thought about knowledge claim (post positivism, constructivism, participatory and pragmatism) are often discussed (Vasilachis de Gialdino, 2017). The adopted research philosophy of this study is post positivism as the study is deterministic and the research problem, examining drivers of successful commercialisation of indigenous innovation, reflects a need to examine causes that influence the outcome. Post positivism involves thinking that challenge the traditional notion of absolute knowledge, and there is a need to collect information on instruments and test hypothesis and theories (Martela, 2015; Farjoun, Ansell & Boin, 2015). The

Central University of Technology, Free State

study involved careful observation and measurement of objective reality in order to make a claim, refine or reject some existing claims.

The ontological, epistemological, axiological, and methodological assumptions of researchers undoubtedly affect the research approach and the paradigm, which influence the answers to the research questions (Vasilachis de Gialdino, 2017). The axiological view of the researcher is that values interfere in society, and through value analysis and the study of their interrelation, societies can reach high degrees of development.

Postpositivists are critical realists as they recognise that observations can be subjected to error and are critical of the reality that they study (Panhwar, Ansari & Shah, 2017). Postpositivism makes distinctions between external and internal relationships among the objects or entities it studies and also supports examination of the contextual variables and their impact on performance (Easton, 2000; Panhwar et al., 2017). This study examines the drivers of successful commercialisation of indigenous innovation from the Ghanaian small firm owners' perspective and aims to provide a contextual and holistic understanding of the commercialisation of indigenous innovation. The purpose is to understand the phenomenon of commercialising innovation in the context of Ghanaian small-scale industry by examining key factors and how they contribute to the expected outcome of sales, profitability, employment generation and firm owners' feelings of success.

6.3 RESEARCH APPROACH

The research strategy relied on deductive reasoning and quantitative answers to the research questions. Among various approaches to research design, deductive, inductive, and abductive are the three most common modes and these can differ in the generalisability of findings (Folger & Stein, 2017; Behfar & Okhuysen, 2018).

Deductive reasoning is concerned with moving from general theory to a specific prediction or drawing inferences from known propositions or hypotheses and is

Central University of Technology, Free State

effectively used in combination of theories and inferring from literature (Folger & Stein, 2017). From practice, innovators always have many ideas and are torn between what to focus on and the best strategy. Similarly, the call for the best strategy to stimulate entrepreneurship and innovation is a thorny issue with many policy suggestions. Theoretically, some have argued that innovation, and in the case of this study, indigenous innovation is different from existing products in many ways. Adopting a deductive approach to test and confirm or reject patterns would therefore make a stronger claim and make the study have a greater impact. Even though in deductive studies, premises and conclusions can sometimes be flawed with subtle errors, greater certainty is given, and knowledge claims are stronger as hypothesis are tested (Schwab & Starbuck, 2017).

In spite of countless empirical studies, the methodological debates in innovation research are strangely detached from the general debate on social science methodology (Ametowobia, Baur & Jungmann, 2015; Baur and Blasius, 2015). Ametowobla et al.(2015) observed that this severe methodological shortcoming of innovation studies has its roots in the conceptual limitations of established perspectives on innovation and in the fact that innovation researchers often confine themselves to studying technical and scientific novelties or marketable products. In order to deepen the empirical base of the field of research, the methodological debate has to discuss specific possibilities and problems of specific types of data, data collection, data analysis, and linking theory and data that arise while researchers try to grasp patterns in innovations as specific processes of social change (Baur & Blasius, 2015; Rossetto, Bernardes, Borini, & Gattaz, 2018).

Extant literature explored in methods of innovation research (Altmann, 2015; Engelhardt, 2015; Gläser & Grit, 2015; Rossetto et al., 2018; Antons, Grünwald, Cichy & Salge, 2020) calls for the expansion of the theoretical as well as the methodological toolkit for innovation research. Following this emerging line of inquiry, innovation studies can employ all the range of social science methods, including qualitative methods (e.g., Weiss, Ludvig, & Ivojinovi, 2020), quantitative approaches (e.g., Goertzen, 2017; Bloomfield & Fisher, 2019), and mixed methods approaches (Ramrez-Montoya & Lugo-Ocando, 2020).

Based on the postpositivist and critical realist philosophy adopted for the study, a quantitative strategy has been used to assess the impact of selected key drivers of successful commercialisation of indigenous innovation on the performance of MSEs . Thus, quantitative strategies underpin this study. A quantitative study employs a positivist research approach (Creswell, 2014). It is based on scientific strategy and assumes that realities can be studied in a systematic and objective manner (Nair & Prem, 2020). In quantitative studies, researchers develop numeric measures of observation, advance the relationship between variables, and pose this in terms of questions and hypotheses (Martela, 2015).

The commercial success of products is usually examined using quantitative data and techniques (Acimovic, Thomas & Van Mieghem, 2017). Innovation input and output measures are indeed easily obtainable (Lhuillery et al., 2016). The study has more quantitative aspects, and quantitative techniques are used to improve the outcome of categorical data and the calculation of variables in order to test theories. According to Goertzen (2017), one advantage of the quantitative strategy is that the findings of the research, which is based on a sample, can be generalised to a larger population. This implies that the knowledge gained from the sample of a study can benefit the larger population. Again, the quantitative strategy allows the research gather and analyse large data sets statistically, limiting biases, thereby making the study more scientific.

Others have also explained that the choice of a quantitative strategy allows the design of a study to be determined in advance so that the research can test a theory and ultimately support or reject it (Bloomfield & Fisher, 2019). This study aims to establish facts about selected drivers of commercialisation, find evidence which supports or does not support a set of hypotheses, and validate constructed theories about the successful commercialisation of innovation. The current study aims to make predictions about appropriate interventions to stimulate innovation in small-scale industries, and quantitative research provides important information for business and policy decisions (Goertzen, 2017; Adjimah et al., 2022a).

6.4 POPULATION AND SAMPLING

6.4.1 The research setting

This study is designed to examine drivers of successful commercialisation of indigenous innovation in Ghana. It was carried out among MSEs (SSIs) in the Volta Region (now Volta and Oti Regions) of Ghana. Two main reasons justify the choice of SSI as a subsector to study commercialisation of indigenous innovation in Ghana. First, MSEs promote indigenous technological know-how and use mainly local resources. As emphasised in earlier chapters, indigenous innovation in the context of the study includes modernisation and use of indigenous resources and practices as well as creation of domestic standards that reduces the burden of paying fees and royalties to foreign countries. Thus, SSIs are the bed rock of commercialisation activities and indigenous innovation is more observable in SSI sector in Ghana.

The second reason is the long-standing call for protection of infant industries in developing counties. Ghana just like many other developing countries is stack between the two realities of globalisation and trade liberalisation benefits or inefficiencies of protectionist policies on one hand. On the other hand, is the need to protect infant industries and support industrialisation. Within the free trade and industrialisation policy dichotomy, preservation and promotion of indigenous knowledge and practices is tolerable. Since SSI is the seabed for commercialisation of indigenous activities, a case for indigenous innovation is essentially a case to support infant industries. Examining the commercialisation of indigenous innovation in the Volta Region of Ghana can provide some empirical evidence and to some extend theoretical basis for trade and industrial policies and strategies.

The third and final justification is the roles of SSIs in low-income economies. Generally, MSEs engaged in small scale industrial activities are recognised as the bed rocks for indigenous entrepreneurship; can mobilise funds which otherwise would have been idle; are labour intensive and employ more; adapt easily to customer requirements and cater for the needs of the poor. The highlighted impacts of SSI on the local economies in low-income countries together with other reasons provided above, makes the choice of the SSI sector in Ghana justifiable and worthy of investigation to study drivers of successful commercialisation of innovation.

In terms of area, the research settled on Volta Region as a study area because a census of all SSIs or complete nationwide survey of the whole Ghana is impossible for doctoral studies given time and resource constraints. Volta Region was one of the 10 administrative regions and since 2019 Volta and Oti are two of the 16 Regions in Ghana. When a nationwide survey is impossible, focusing on a Region such as the Volta Region is sensible because the MSEs in the Region get the same institutional support and operate under similar market conditions. Secondly, SSI activities are largely influenced by geographical regions and Volta Region cut across all geographical zones (costal, coastal savannah, forest, and savannah) in Ghana. There are Aflao-Denu-Agbozome, Keta- Angloga local economies in the costal zones; Sogakope-Akatsi-Abor, Avenor-Agortime-Adaklu local economies in coastal savannah zone, Ho area, Kpando-Hohoe, Jansika-Kejebi local economies in the forest zone; Nkonta-Kpasa, Dambai-Kete Krachi in the savannah zone. The Region consist of sub urban, peri urban and rural areas. The density of SSI particularly rural small scale industrial (RSSI) activities is also high and evenly distributed in the Region. The region is indeed a microcosm of Ghana and therefore a worthy choice for investigating the drivers of successful commercialisation of indigenous innovation in Ghana.

6.4.2 The Research population

A research population is defined as the total number of units, including individuals, artefacts, events, or organisations from which data can be collected (Martela, 2015). According to Gosens et al. (2018) an effective way to understand an innovation system is to focus on the components within the systems, thus the players and the institutions. The population for this study consists of MSEs in the small-scale indigenous innovation industry value chain in the Volta Region, including the owner and managers of the firms. The total population for this study is about 2,000 MSEs who are active players and registered members of the association of the scale industry (ASSI) in the Volta Region at the time of this study. These actors within the population are considered suitable for examining the effects of the selected factors on successful commercialisation measures.

6.4.3 Sample frame

A sample frame is a list of the total population (actual listings or any description) from which sample can be drawn for a study (Kumar, 2014; Watson, Porteous, Bolt & Ryan, 2019). The size and the characteristics of the population, cost and the required level of precision are key in the selection of a sample for a study (Roller & Lavrakas, 2015; Watson et al., 2019). The sample frame for this study is the members of the Association of Small-Scale Industries (ASSI), involved in the development and commercialisation of indigenous knowledge and innovations in Volta Region of Ghana. This data is obtained from the National Board for Small Scale Industry (NBSS), Volta Regional Office in Ho.

The sampling criteria required that the sample to have a defined and narrowed target of the population and that the elements in the population possessed some specific characteristics to be sampled for a study (Denzin & Lincoln, 2013; Fusch, Fusch & Ness, 2018). Therefore, in examining the drivers of commercialisation of indigenous innovation, only MSEs playing active roles in the SSI in the Volta Region: registered members of ASSI, those with innovation on the market, those seeking license or permit from regulators or those attempting to seek support from innovation hubs, other innovation support agencies, are selected.

6.4.4 Sample and sampling techniques

As defined above the sample frame for this study is 2, 000 circa active players in the innovation system in the Volta Region and this consists of MSEs found in the database of the National Board for Small-Scale Industry (NBSS) who are also registered members of the Association of Small-Scale Industry (ASSI) at the time of the study. To ensure that the selected sample is the true representative of the entire population, the stratified sampling technique was used for the selection of respondents in the study. Stratified sampling involves the selection of a sample from a study population by dividing it into homogeneous and non-overlapping subgroups and random sampling from each subgroup or strata (Pradhan, 2013; Adam, 2020). Focussing on the major geographical zones in the Volta Region of Ghana, four (4) stratums were identified: coastal zone, coastal savannah zone, forest zone and savannah zone.

The use of stratified random sampling method to select MSEs in the study area enhanced precision, convenience and ensured a better coverage of the research population (Lapko & Lapko, 2014). As explained earlier the indigenous innovative and the small-scale industrial activities are highly influenced by the geographical zones. The zones consist of suburban, peri-urban, and rural areas and are very homogenous. The innovative small scale industrial activities are also evenly distributed in the Volta Region

Slovin's formula was used to determine the sample size for each of the identified strata as the population for each zone is known (Adam, 2020). Using Slovin's formula: $S = N/[1+N(e^2)]$, where: S = sample size, N= target population, e = marginal error (degree of freedom = 0.05 (5%). The sample size for each zone was determined (table 6.1).

Table 6.1: Sample size for the study

Geographical Zones	District Description	Sample Frame	Sample size determination	Sample Size (%)
costal,	Aflao-Denu-Agbozome, Keta- Angloga	91	$91/ [1+91 (0.05^2)]$ =73	73(80%)
Coastal Savannah,	Sogakope-Akatsi-Abor, Avenor-Adidome, Agortime-Adaklu	90	$90/ [1+90 (0.05^2)]$ =73	73(81%)
Forest	Ho, Kpando-Hohoe, Jansika-Kejebi	1740	$1740/ [1+1740 (0.05^2)]$ =325	325(18%)
Savannah	Nkonta-Kpasa, Dambai-Kete Krachi	79	$79/ [1+79 (0.05^2)]$ =66	66(84%)
Total	Registered ASSI members found in the Data base of NSSI	2000		537(27%)

Based on the determined sample size for each zone, 537 self-administered questionnaires were designed and sent out. The sample consists of 73 MSE owners (80% of the population in the coastal zone); 73 MSE owners (81% of the population in the coastal savannah zone); 325 MSE owners (18% of the population in the forest zone) 66 MSE owners (84% of the population in the savannah zone). Overall, 27% of the registered active MSEs who are active with commercialisation activities were to be covered by the study. For a population of less than 10,000, 10% is a good and usually an effective sample size, and it is an adequate and not excessive sample that is required to observe true relationships in a dataset (Willaby, Costa, Burns, MacCann & Roberts, 2015; Kyriazos, 2018; Morris, 2020).

To select the sample for the survey, 2000 registered MSEs found in the database of NBSS were first sorted according to districts of the business location and each district placed under the respective geographical zones. The obtained list of each zone was then sorted out alphabetically in Microsoft Excel. Random numbers were then generated for each MSEs on the list of each zones using Microsoft Excel RAND Function. For each zone, the randomised MSEs were again sorted in ascending order according to the random numbers and MSEs were selected in the order of appearance. Thus, for the coastal zone, the first 73 out of the 91 MSE owners; for the coastal savannah zone, the first 73 out of the 90 MSE owners; for the forest zone, the first 325 out of the1740 MSE owners; and for the savannah zone, the first 66 out of the 79 MSE owners were selected as respondents. This gave the total sample size of 537 respondents contacted for enumeration. The use of random numbers gave a fair chance for each MSE in all the zones to be selected. Out of the total 537 respondents contacted 453 respondened positively giving a response rate of 85%.

6.5 CONSTRUCT DEVELOPMENT FOR THE STUDY

6.5.1 The proposed research model

Drawing from the reviewed literature and the developed conceptual framework in chapter five, the study proposed that there is a strong relationship between the selected drivers and success of indigenous innovation commercialisation. The conceptual model underpinning the study has five main independent variables namely finance, organisational factors, market factors and technology. Controlling for characteristics such as government incentives and firm commercialisation strategies, it is expected that these five factors would have a substantial impact on successful commercialisation of indigenous innovation in SSI sector in terms of sales, employment, profitability, and MSEs personal feeling of success. The summary of the formulated hypotheses is presented in Table 6.2 below.

Table 6.2: Summary of formulated hypotheses

SN	Hypotheses	
1	H1a	Regulation is positively related to sales growth of indigenous innovation in the SSI sector
2	H1b	Regulation is positively related to the profitability of indigenous innovation for MSEs
3	H1c	Regulation is positively related to the employment level of MSEs in SSI sector.
4	H1d	Regulation is positively related to MSEs feeling of success
5	H2a	Finance is positively related to sales indigenous innovation in the SSI sector
6	H2b	Finance is positively related to the profitability of indigenous innovation for MSEs
7	H2c	Finance positively related to the employment level of MSEs in SSI sector.
8	H2d	Finance is positively related to MSEs feeling of success
9	H3a	Organisational factors are positively related to sales of indigenous innovation in the SSI sector
10	H3b	Organisational factors are positively related to the profitability of indigenous innovation for MSEs
11	H3c	Organisational factors are positively related to the employment growth of MSEs in SSI sector.
12	H3d	Organisational factors are positively related to MSEs feeling of success
13	H4a	Market factors are positively related to sales of MSEs in the SSI sector
14	H4b	Market factors are positively related to the profitability of MSEs in SSI sector
15	H4c	Market factors are positively related to employment level of MSEs in SSI sector
16	H4d	Market factors are positively related to MSEs feeling of success
17	H5a	Technology is positively related to sales of indigenous innovation in the SSI sector
18	H5b	Technology is positively related to the profitability of indigenous innovation for MSEs
19	H5c	Technology is positively related to the employment level of MSEs in SSI sector.
20	H5d	Technology is positively related to MSEs feeling of success

6.5..2 Measuring the dependent variables

The dependent variable in the study is MSEs' commercial performance over the last five years. Four dependent sub-variables: sales, employment, profitability, and MSEs' feeling of success were considered in carrying out the analysis. In these sub-variables, different measures were used including sales (sales revenue, sales growth) employment (number of people engaged, and employment growth); profitability (description of profit margin); and MSEs feeling of success (feeling of recognition of innovation, and innovators level of satisfaction). The feeling of recognition of innovation and its performance were measured using MSEs owners' ranking on a percentage scale based on received complements, associated invitations, customer reviews and, media reviews and media mentions. Similarly, innovators own feeling of satisfaction was measured using level of accomplishment relative to MSEs' goals on percentage scale.

***6.5.*3 Measuring the independent variables**

The independent variables in the study are also measured in the following manner.

6.5.3.1 Regulation

Bearing in mind indigenous innovation by their nature often begin informally and MSEs have to comply with required rules as commercialisation activities expand, reasonability and ease of compliance, cost and time burdens, and market benefits are very important in measuring regulation in the Ghanaian SSI sector. Specifically, seven (7) items indicating reasonability and ease of compliance, affordability of regulatory cost, timeliness of approval, time burden on MSEs, attitudes of regulatory staff, customer/market requirement of regulatory approval, and new demand opportunities (Edler et al., 2016; Fu et al., 2016) are used in the study. The items were measured using a Likert scale of agreement anchored on strongly disagree (1) and strongly agree (5) indicating the respondents' levels of agreement on regulation and compliance issues in innovation commercialisation process in SSI sector.

6.5.3.2 Finance

The key finance elements in the indigenous innovation commercialisation process from the perspective of MSEs are access to sources of capital, cost of capital and patience of capital. Financial variables in the study have been measured using eleven (11) items describing reliance on personal savings, reliance on cooperative contribution, reliance on family and friends, reliance on credit purchase, reliance microcredit, reliance on bank loans, reliance on grant and concessionary loans, cost of capital, and patience of capital (Allison et al., 2015; Soofi, 2017; Klyton & Rutabayiro-Ngoga, 2017; Atiase, 2018; Allen, Qian & Xie, 2018). These items are also measured on a Likert scale of agreement, strongly disagree (1) to strongly agree (5), levels of agreement on the level of access to the sources, cost, and patience of capital.

6.5.3.3 Organisational factors

From the perspective of MSEs in low-income economies, the most important organisational factors in commercialisation process are human capital and ability to gather and use resources. Organisational factors have been measured in the study using five (5) items, namely adequacy of technical skills, adequacy of people skills, ability to gather financial resources, ability to mobilise logistics and material, and ability to leverage on other business infrastructure. Each of these items was also measured using a Likert scale, disagree (1) to strongly agree (5) showing MSE owners' level of agreement on adequacy of their human capital and ability to gather and use resources in the commercialisation process.

6.5.3.4 Market factors

From below the radar innovation theoretical perspectives, the key market factors in low-income economies are the 4As (affordability, acceptability, awareness, and availability) (Anderson & Markides, 2007). Specifically, market factors in the study were measured using seven (7) items and these are: aggressiveness of cost cutting strategies, market awareness of the crown jewel of the innovations, customer affordability of packages, market acceptance and willingness to pay for indigenous brand (patriotic premium), product availability and outreach, promotion cost in terms of level of distributive margin and extras required to accept product on the market,and ease of attainment of volume potentialities in the market. These items are also measured on a Likert scale of agreement, strongly disagree (1) to strongly agree (5). The responses indicate MSE owners perceived level of market affordability, acceptability, awareness, and availability of their innovations.

6.5.3.5 Technology

The main indicators of technology from MSEs perspective are embracement of new technology, competitiveness and survival, and level of digitalisation. Technology was measured using six (6) items (usage of adapted technology to improve indigenous innovation, confidence of not being crowded out, usage of Ecommerce and social media, usage and acceptance of E-money, level of sales via Ecommerce and level of purchases via Ecommerce). Each of these items was measured using a Likert scale anchored by strongly disagree (1) and strongly agree (5).

6.5.4 Measuring the control variables

Some other variables may play intervening or moderating role between independent and dependent variables and, therefore, had crucial roles in the final results were considered and controlled. Based on the evidence in the literature and the conceptual model discussed in chapter 5, government incentives and method of commercialisation are used as control variables for this study. These variables were selected because, it has been observed that government incentives and method of commercialisation could substantially influence how the selected drivers of commercialisation impact innovation performance of MSEs (Stam, 2015; Clayton et al., 2018; Mayer, 2018; Yigitcanlar et al., 2019)

The government incentives were assessed in terms of both incentives to MSEs and incentives to buyers of indigenous innovation. In respect of incentive to MSEs, respondents were asked to indicate whether they have received governments incentives and the type of incentives received ([1] None; [2] Grant [3] Regulatory relaxation; [4] Free or subsidised inputs; [5] Concessionary loans and [6] Free Training. With regards to incentive to buyers, respondents were again asked to indicate if their clients relied on government incentives and which type to buy their innovation ([1] None; [2] Grant; [2] Tax rebate; [3] Government purchase; [4] Subsidised complements; and [5] Concessionary loans.

The study also assessed the method of commercialisation from three perspectives: the type of agent or commercialising entity undertaking the commercialisation; use of university hub or other innovation supporting services to shape innovation or reduce cost of commercialisation; and the pricing strategy of the firm to offer consumers affordable values and/or appropriate more value for the firm. Thus, in measuring method of commercialisation respondents were asked to select the type of commercialisation [1] Licensing by knowledge-based institutions (KBIs); [2] Business spinoffs from knowledge-based institutions (KBIs); [3] Corporate venturing by existing firms; [4] Start-ups by entrepreneurs or innovators theMSElves. Second, whether they use university hub or other supporting services in their commercialisation process ([1] None; [2] University Lab/workshop; [3] Hub/incubator; [4] Mentoring [5] Promotion & Demand legitimisation; and [6] Others, please specify [ ]. Finally, respondents were asked to indicate their adopted pricing strategy in the commercialisation process (packaging and pricing: [1] well below the industry average, [2] around the industry average and [3] at the upper end of the industry price. Table 6.3 summarises the variables, their dimensions how they are measured in the study.

Table 6.3: Summary of Variables and how they are measured

Variables	Indicators (Dimensions)	Source	Number of items
Dependent Variables (Business performance)			
Sales	Sales Revenue	Bayer et al. (2020)	5
	Sales growth		5
Profitability	Profit margin	Lee et al. (2018)	5
Employment	No. of people engaged	Atiase (2018); Anning-Dorson (2018)	5
	Employment growth		5
Feeling of achieved success	Social recognition	(Wach et al., 2016; Dijkhuizen et al., 2018)	5
	Personal level of satisfaction		5
Independent Variables (Drivers of commercialisation)			
Regulation	Ease of compliance	Adopted from Edler et al., 2016; Fu et al., 2016	8
	Time burden		
	Cost burden		
	Market benefits		
Finance	Access: (sources of capital)	Adopted from (Yang & Birge 2017; Lee, Zhou, & Wang, (2018) (Allen, Qian & Xie, 2018)	11
	cost of capital		
	patience of capital		
Organizational Factors	Human capital	Formed	5
	Ability to gather resources		
	Ability to use resources		
Market Factors	Affordability	Adopted from (Anderson & Markides, 2007)	8
	Acceptability		
	Awareness		
	Availability		
Technology	Usage of technology	(Arias-Aranda & Bautista-Carrillo, 2020	6
	Competiveness & survival		
	Level of digitalisation		
Control Variables			
Government incentives	Incentive to innovators	(Eisenberg & Price, 2017)	
	Incentive to buyers		
Methods of commercialisation	Agents	(Dahstrand et al., 2016; Clayton et al, 2018; De Toni et al, 2017; Pratono, 2018)	
	Use of University intermediary services		
	Pricing strategy		

6.6 DATA COLLECTION

6.6.1 Sources and type of data

The data for this study is largely from primary sources and sourced by a sample survey of MSEs engaged in small-scale industrial activities in the Volta Region of Ghana. According to Vaske(2019), survey research facilitates the collection of primary data as a source of information from a sample of people by using questionnaires or interviews. The objectives of survey research are to identify the characteristics of the particular research problem, such as the need to know what is happening, why it is happening how it is happening, and who is involved in what is happening (Vaske, 2019; Story & Tait, 2019).

Within quantitative innovation systems research paradigms, most studies are dependent on the methods and strategies that empirically answer their research questions with hypotheses testing (Goertzen, 2017; Bloomfield & Fisher, 2019; Sun, K. 2019). Consequently, the survey is considered to be the most appropriate research method to enable the researcher to examine the phenomena in their natural setting while covering a large population (Story & Tait, 2019). The significance of survey research within the information systems domain can be observed with the meta-analysis literature. From the review of the previous meta-analysis papers in the context of innovation firm performance literature(Rossetto et al., 2018; Feng, Ma & Jiang, 2020; HizarciPayne, pek, & Kurt, 2021), it is clearly apparent that the survey is the most widely accepted method.

Apart from the past literature, survey research is also an appropriate method of research because it provides a quick, inexpensive, efficient, and accurate means of assessing information about a target population (Vaske, 2019). There are three main objectives for conducting survey research (Story & Tait, 2019). First, when a study requires a quantitative method of inquiry with standardised information (e.g., hypotheses and relationships between variables) about a subject; second, when a study requires the collection of data by asking questions with a pre-defined structured instrument; and third, when a study requires the ability to generalise information about a whole population through a fraction of the sample. In line with the above criteria, the aims and objectives of this study are purely based on the positivist approach with a quantitative method of inquiry.

6.6.2 The Research instrument

Research instruments are tools designed to measure attitudes, knowledge, skill, and used to collect primary data for a study (Fowler, 2014). The study used structured paper based self-administered questionnaires to collect quantitative data from MSEs in SSI to understand commercialisation performance, and the drivers. The structured questionnaires were used to aid the MSEs respond more easily and it also enabled the researcher to efficiently accumulate and summarise the responses. Historical documents such as annual reports, commentaries, journals, and newspapers were used to understand and explain the trends in Ghanaian innovation systems and SSI in terms of MSEs, their market, and government policies.

A sample questionnaire for the survey is attached as Appendix II. It has four main sections. Section A captured demographic data on the respondents. Section B dealt with business profile of the MSEs including types of industrial activity, age of business (innovation), types of indigenous innovation, usage of government incentives and method of commercialisation (innovating entity type or agent, use of KBI hubs and prising strategy). Section C measured the selected commercialisation drivers. Finally, section D, assessed indigenous innovation and performance of the MSEs in terms of sales, profitability, employment, and MSE owners feeling of achieved success.

6.6.3 Data collection procedure

Broadly, the questionnaires were administered to MSE owners and managers in SSI involved with indigenous innovations. The items in all the 4 sections applied to all respondents. The sample frame was obtained from the National Board for Scale Industry (NBSSI), Volta Region Office. Prior to the data collection, the researcher familiarised himself with the NBSSI, Association of Small-Scale Industry (ASSI) and Association of Ghana Industry (AGI), by attending their programmes to understand the environment and build relationships. This made a significant impact on the response rate and most questionnaires were instantly completed.

The researcher contacted the respondents and either went to MSEs innovators individually or their association meetings to administer the questionnaire. In few instances the researcher phoned to administer the questionnaires. Two research assistants who were trained well helped the researcher in the data collection. The exercise was smooth and took about 40 days to complete.

6.6.4 Pilot test, validity, and reliability assurance

The research instrument for the study was tested for reliability and validity to ensure internal consistency for the variables in measuring successful commercialisation. The selected variables are very relevant for the study as they are based on enterprise and innovation follow-up survey of the World Bank, innovation impact surveys of OECD, global innovation index and other previous studies (Cirera & Muzi, 2016; OECD & EUROSTAT. 2018; Connell University et al., 2018). These variables have also been further tested using expert opinion of industry practitioners.

Prior to the main survey, the researcher pretested questionnaires on 50 respondents, 10% of the planned sample. The pretesting was done directly by the researcher himself, and the result are not included in the analysis of the final study. Pilot study is defined as a mini-scale version of a major study to obtain the necessary information in order to improve its feasibility and to test the research instrument for reliability and validity to ensure internal consistency for the selected variables (Robinson, 2018). From the onset the questionnaire items were developed using simple English language so that it was easily understood by respondents and easily interpreted in Ewe and Twi (the main local languages in the study area) to respondents who could not speak English. However, at the piloting stage, the researcher still discovered a few phrases were not clear and amended them accordingly before the main survey.

The pilot study also checked the research instrument for reliability and validity to ensure internal consistency for the selected variables. Therefore, based on the result of the pilot study, reliability test using Cronbach's Alpha Coefficient was carried out on the variables and sub variables in SPSS to ensure the results are reliable. The result of the reliability test for the constructs used are provided in Table 6.4 bellow.

Table 6.4: Reliability statistics for pilot study

Construct and Variables	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	No. of Items
Regulation	.462	.460	7
Finance	.100	.140	9
Organizational Factors	.770	.763	5
Market Factors	.536	.550	7
Technology	.688	.680	6
Sales Revenue	.956	.958	5
Sales growth	.755	.747	5
Profitability	.711	.710	5
Employment	.888	.891	5
Employment growth	.636	.665	5
Feeling of societal recognition	.961	.961	5
Level of personal satisfaction	.934	.935	5

Based on the result of the pilot, changes were effected accordingly before the main quantitative study. Constructs with low reliability were reconstructed using additional items to ensure that all the constructs were above the Cronbach's $\alpha > 0.7$ threshold. For finance construct, for example, the number of items were increased from 9 to 11 in the main study

6.7 DATA ANALYSIS

6.7.1 Unit of analysis

A unit of analysis is the main elements that are chosen for a research study (Kumar, 2014). Thus, the unit of analysis is the focus of the study, the elements from which data is obtained and the entity on which comments are made after the study. Selecting appropriate unit of analysis is very important because if the unit is too precise, the investigation may miss important contextual information and analysis may require more time and cost, and if the unit chosen is at a very high macro-level, important connections in the content may be missed, leading to erroneous interpretation of data (Roller & Lavrakas, 2015). The unit of analysis for this study are therefore carefully selected to ensure appropriate categorisation and sound analysis of drivers of innovation commercialisation and these are MSEs engaged in any form of indegenous innnoation included in the sample. The various aspects of SSIs innovation commercialisation and factors that are measured and analysed included regulation, finance, organisational factors, market factors, technology, government incentives, methods of commercialisation, sales growth, profitability employment growth and MSE owners feeling of success.

6.7.2 Survey questionnaire items

The questionnaire items used in measuring the drivers of commercialisation and firm performance (P) constructs are presented in Table 6.5 and Table 6.6 respectively.

Table 6.5: Questionnaire Items for drivers of commercialisation

Questionnaire items for independent variables
Regulation (Edler et al., 2016; Fu et al., 2016) Rules in the SSI are reasonable and easy for compliance (15a). Attitudes of staff are reasonable and supportive (15b). The cost of regulation compliance is bearable and affordable (15c). Approvals are timely and do not delay commercialisation (15d). The time burden for compliance with rules is reasonable. (15e). Most customers required regulatory compliance before buying (15f). Overall, government regulations and policies create new demand opportunities (15g). Government regulations help create more values and improve standards for customers (15h). **Finance** (Soofi, 2017; Klyton & Rutabayiro-Ngoga, 2017; Allen, Qian & Xie, 2018)) Personal savings form small part of the capital for my activities(16a) I relied heavily on "susu" contribution) to fund my activities (16b). I relied heavily on credit/investment from family and friends (16c). I relied heavily on credit purchases (16d) . I get government grants and concessionary loans (16e) . Bank/micro credit loans form substantial part of my capital (16f) . I hardly go to high interest financial institutions for loans (16g) . Credit is accessible, my business gets it when we need it (16h) . Costs of capital are bearable and do not increase my risks (16i) . Terms are flexible and do not increase my business risks (16j). Repayment terms of credit/capital are long enough (16k). **Organizational factors** (Lindsay & O'Connor, 2014; Fatoki, 2018; Suseno et al., 2020). The technical skills of my team are adequate (17a). Peoples' skills of my team members are adequate (17b). We are highly able to gather financial and other resources (17c). We are highly able to use our capacity to achieve results (17d). We can leverage other existing business infrastructure (17e). **Market factors** (Anderson & Markides, 2007; Liu & Atuahene-Gima, (2018; Chan et al. 2018) We adopt cost cutting strategies and to offer lower cost (18a). We are well able to brand our crown jewel on the market (18b). Our innovations are appropriately packaged and affordable (18c). Customers willing to pay patriotic premium for (made in GH (18d)). Our innovation is available everywhere customers need them (18e). Our product outreach is increasing (18f). Distributors don't require high margin and extras from us (18g). It is easy to attain large volume potentials in our target market(18h) **Technology** (Zaglago, 2019; Arias-Aranda & Bautista-Carrillo, 2020). We can use emerging specific purpose technology to improve indigenous innovation (19a). We are confident our business would not be crowded out by competition from the emerging technologies in the industry (19b). We extensively use digital technology to promote our products (19c). We extensively use E-payment platforms and accept E-money (19d). Our usage of digital technology is effective as substantial part of our sales are via Ecommerce and this is growing strongly (19e). Substantial part of our purchases is via Ecommerce (19f).

Table 6.6: Questionnaire items for firm performance (P)

Performance Indicators					
MSE Performance :(Wach et al., 2016; Dijkhuizen et al., 2018; Atiase, 2018; Lee et al.2018)					
Sales					
Sales revenue (20a)	2016	2017	2018	2019	2020
Sales growth (20b)	2016	2017	2018	2019	2020
Employment					
No. of employees engaged (21a)	2016	2017	2018	2019	2020
Employment growth (21b)	2016	2017	2018	2019	2020
Profitability (22)	2016	2017	2018	2019	2020
Feeling of success					
Feel of recognition (23a)	2016	2017	2018	2019	2020
Level of satisfaction(23b)	2016	2017	2018	2019	2020

6.7.3 Data analysis technique

The sampled data were processed and analysed using Statistical Package for Social Science (SPSS) version 25. In addition, Smart PLS 3.3.3 was employed to generate the reliability, convergent and discriminant validity of the variables, and to assess the models. SPSS is easily able to perform both parametric and non-parametric comparison analysis, validate variable items, test the assumptions, and perfectly conduct frequency analysis (Pallant, 2015). The PLS-SEM tools such as Smart PLS also aided in the efficient and effective estimation of the proposed models with many constructs, indicators, and structural paths without imposing distributional assumptions on the data (Ong & Puteh, 2017; Hair, Risher, Sarstedt & Ringle, 2019).

The overarching aim of researchers when analysing data is to get a feel of the data, to check the goodness of the data and to test the proposed hypothesis of the study (Willaby et al., 2015; Ong & Puteh, 2017). Descriptive statistics, inferential analysis was done and presented using tables. Calculation of the descriptive statistics of the variable in the study provided more understanding of the data. The response rate, frequency distributions, means, and standard deviation for the selected variables, and estimation of the skewedness and kurtosis for the dependent variable gave the researcher a good feel of the data on commercialisation of indigenous innovation in Ghana.

Composite factor analysis was done and used to check the goodness of the data. Variance based structural equation model (VB-SEM) was employed in analysing the data to determine the relationships between the selected drivers as the independent variables and successful commercialisation measures (sales, profitability, employment and feeling of success) as the dependent variables. Controlling for government incentives and firm's commercialisation strategies, partial least squares structural equation modelling (PLS-SEM) PLS-SEM approach was used to determine the relationship between drivers of commercialisation of indigenous innovation of regulation, finance, organisational factors, market factors and technology on one hand, and innovation commercialisation performance measures on the other hand.

6.8 VALIDITY AND RELIABILITY MEASUREMENT OF THE VARIABLES

Validity, the ability of a research design to accurately measure what it is intended to measure, is crucial in choosing a research design in order to produce results that correspond to the real-world situation (Creswell, 2014; Mohajan, 2017). Different type of validity including construct validity, convergent validity, content validity, face validity, criterion validity, internal validity, external validity has been identified in the literature (Middleton, 2019; Thoomes-de Graaf, Fernández-De-Las-Peñas & Cleland, 2020; Mallah, Rodríguez-Cano, & Figueiras, 2020). Of key relevance in studying drivers of successful commercialisation of indigenous innovation are construct validity and content validity.

Construct validity is about ensuring that the questionnaire items match the construct, the study intent to measure. Similarly, content validity is about making sure that the survey covers all relevant parts of the subject it aims to measure and does not include irrelevant aspects (Robison, 2018). To achieve construct and content validity in this study, the researcher ensured that indicators and items are carefully developed based on relevant existing knowledge on commercialisation of innovation from the perspective of MSEs in low-income economies. Only relevant items that measure known indicators of the selected drivers (concepts) and commercialisation performance were included. The questionnaire items were developed in line with the objectives, and the questionnaire was pretested in pilot survey on 50 MSE respondents and suitability assessed before the main survey.

To achieve validity, the research also ensured reliability was first achieved as reliability is prerequisite for validity (Mohajan, 2017; Robison, 2018; Mallah et al., 2020). Reliability involves ensuring the replicability of a research design elsewhere and the consistency of results if the research is repeated over a period (Bazeley, 2013; Mohajan, 2017). The study used multi-item psychometric scales to collect data and measure respondents' views on drivers of commercialisation of indigenous innovation. Meanwhile, invalid scale may not measure the intended variables well, while unreliable scales could prevent consistent measurement of variables (Robison, 2018), which could lead to distorted research findings, poor theoretical development, or even counterproductive policies and practices. Following Ringle et al. (2015), the study run Smart PLS 3.3.3 to generate the reliability, convergent and discriminant validity of the variables.

6.9 EXPLORATORY FACTOR ANALYSIS (EFA)

To explore the construct dimensions, EFA was first conducted to check the possible dimensionality of the constructs. EFA was run using the principal components extraction method with Varimax rotation. All the scales used to measure the drivers for innovation commercialisation in this study were subjected to principal component analysis (PCA) using SPSS version 25. Before carrying out the principal component analysis, data suitability for factor analysis was examined using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Bartlett's Test of Sphericity.

Central University of
Technology, Free State

6.9.1 EFA for regulation

The principal component analysis was done on all items of the regulation construct. This was done to determine whether the construct can be classified as multidimensional. There were eight (8) items measuring the regulation factor. The Bartlett's Test of Sphericity gave a chi-square value of 2704.002 with a p-value of 0.000 indicating sufficient correlations. The KMO measure of sampling adequacy was 0.840, exceeding the recommended value of 0.5. Thus, both indicate that a factor analysis is appropriate. Table 6.7 shows the KMO and Bartlett's test results for regulation scale.

Table 6.7: KMO and Bartlett's test for regulation

KMO and Bartlett's test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.840
Bartlett's Test of Sphericity	Approx. Chi-Square	2704.002
	df	28
	Sig.	.000

From Table 6.8, the principal component analysis revealed a one-factor solution which accounted for 64.4% of the total variance. The scree plot (Figure 6.1) also confirms the number of components which needs to be extracted; only one component is greater than 1.

Table 6.8: Total variance explained for regulation

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	5.150	64.378	64.378	5.150	64.378	64.378
2	.967	12.083	76.461			
3	.540	6.749	83.210			
4	.500	6.244	89.454			
5	.329	4.109	93.563			
6	.208	2.597	96.160			
7	.180	2.252	98.412			
8	.127	1.588	100.000			
Extraction Method: Principal Component Analysis.						

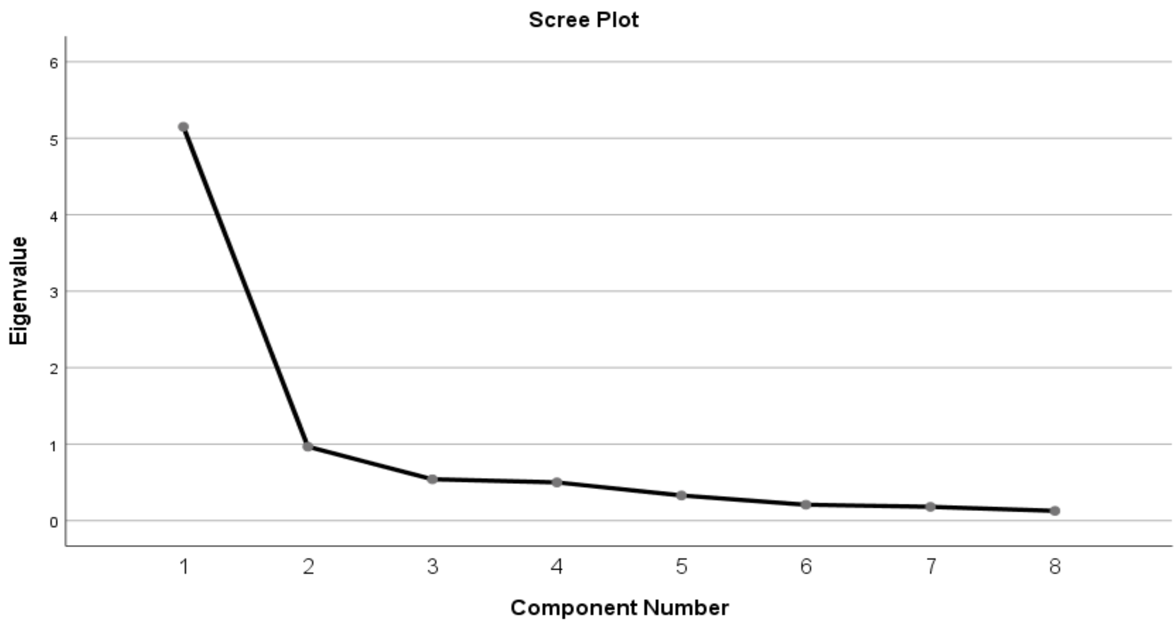

Figure 6. 1: Scree plot for regulation

Central University of Technology, Free State

6.9.2 EFA for finance

The principal component analysis was done on all items of the finance construct. This was done to determine whether the construct can be classified as multidimensional. There were eleven (11) items measuring the finance factor. The Bartlett's Test of Sphericity gave a chi-square value of 7945.353 with a p-value of 0.000 indicating sufficient correlations. The KMO measure of sampling adequacy was 0.785, exceeding the recommended value of 0.5. Thus, both signify that a factor analysis is apposite. Table 6.9 shows the KMO and Bartlett's test results for finance scale.

Table 6.9: KMO and Bartlett's test for finance

KMO and Bartlett's test result		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.785
Bartlett's Test of Sphericity	Approx. Chi-Square	7945.353
	df	55
	Sig.	.000

Table 6.10: Total variance explained for finance

Component	Initial Eigenvalues			Extraction Sums of Squared Loading		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	7.070	64.273	64.273	7.070	64.273	64.273
2	1.673	15.210	79.482	1.673	15.210	79.482
3	.695	6.319	85.801			
4	.668	6.074	91.875			
5	.396	3.602	95.477			
6	.263	2.390	97.867			
7	.130	1.178	99.045			
8	.041	.371	99.416			
9	.032	.287	99.702			
10	.027	.246	99.948			
11	.006	.052	100.000			
Extraction Method: Principal Component Analysis.						

The principal component analysis (table 6.10) revealed a two-factor solution which accounted for 79.5% of the total variance explained. Factor 1 had eigenvalue of 7.07

and it accounted for 64.3% of the total variation while Factor 2 had eigenvalue of 1.67 and accounted for only 15.2% of the total variation.

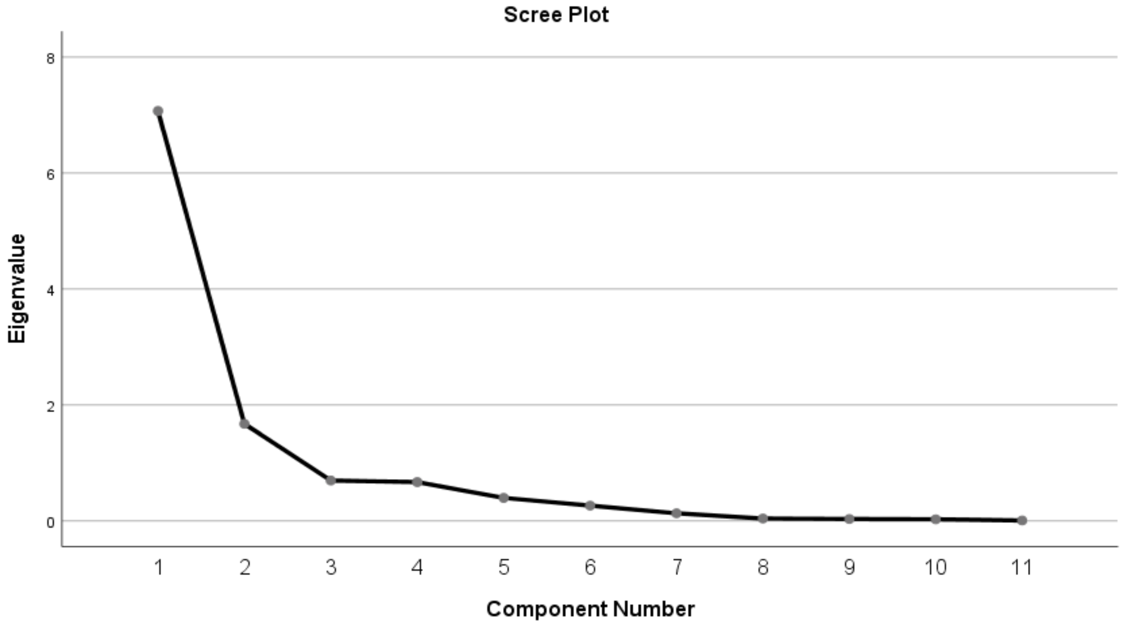

Figure 6.2: Scree plot for finance

The scree plot (figure 6.2) also approves the number of components which needs to be extracted; only two components are greater than 1.

6.9.3 EFA for organisational factors

The principal component analysis for organisational factors was done to determine whether the construct can be classified as multidimensional. There were five (5) items measuring this construct. The Bartlett's Test of Sphericity gave a chi-square value of 1187.400 with a *p*-value of 0.000 demonstrating sufficient correlations. The KMO measure of sampling adequacy was 0.781, surpassing the recommended value of 0.5. Thus, both indicate that a factor analysis is appropriate. Table 6.11 shows the KMO and Bartlett's test results for organisational factors scale.

Table 6.11: KMO and Bartlett's test for organisational factors

KMO and Bartlett's test result		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.781
Bartlett's Test of Sphericity	Approx. Chi-Square	1187.400
	Df	10
	Sig.	.000

Table 6.12: Total variance explained for organisational factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loading		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.309	66.185	66.185	3.309	66.185	66.185
2	.680	13.607	79.792			
3	.475	9.500	89.292			
4	.344	6.880	96.172			
5	.191	3.828	100.000			
Extraction Method: Principal Component Analysis.						

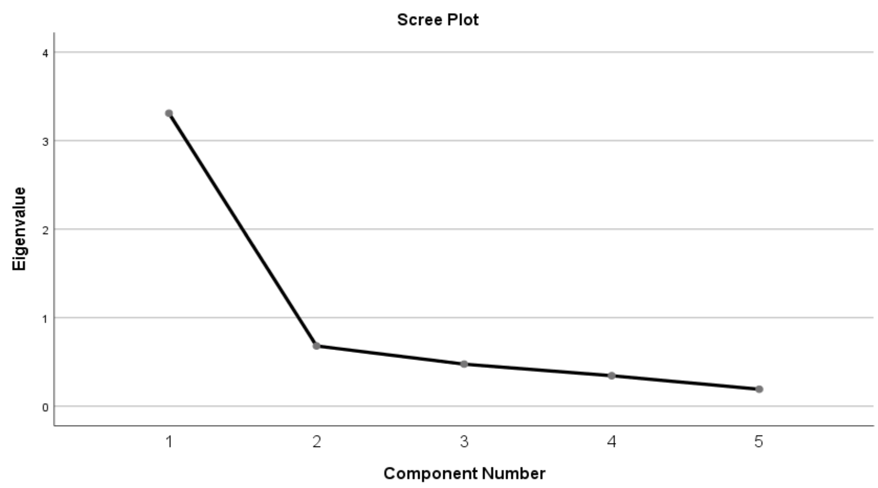

Figure 6.3: Scree plot for organisational factors

As shown in Table 6.12, the principal component analysis revealed a one-factor solution which accounted for 66.2 % of the total variance. The scree plot as depicted by Figure 6.3 likewise confirms the number of components which needs to be extracted; only one component is greater than 1.

6.9.4 EFA for market factors

The principal component analysis was done for the market factors. There were eight (8) items measuring the market factors. The Bartlett's Test of Sphericity gave a chi-square value of 3522.534 with a p-value of 0.000 indicating sufficient correlations. The KMO measure of sampling adequacy was 0.680, exceeding the recommended value of 0.5. This justifies the appropriateness of factor analysis. Table 6.13 shows the KMO and Bartlett's test results for market factors scale.

Table 6.13: KMO and Bartlett's test for market factors

KMO and Bartlett's test result		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.680
Bartlett's Test of Sphericity	Approx. Chi-Square	3522.534
	df	28
	Sig.	.000

Table 6.14: Total variance explained for market factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loading		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	4.011	50.133	50.133	4.011	50.133	50.133
2	2.229	27.867	78.001	2.229	27.867	78.001
3	.706	8.825	86.825			
4	.506	6.328	93.153			
5	.283	3.539	96.693			
6	.166	2.077	98.770			
7	.057	.711	99.481			
8	.042	.519	100.000			
Extraction Method: Principal Component Analysis.						

From Table 6.14, the principal component analysis revealed a two-factor solution which accounted for 78% of the total variance explained. Factor 1 had eigenvalue of 4.011 and it accounted for 50.1% of the total variation while Factor 2 had eigenvalue of 2.23 and accounted for only 27.9% of the total variation. The scree plot as shown by Figure 6.4 also supports the number of components which needs to be extracted; only two components are greater than 1.

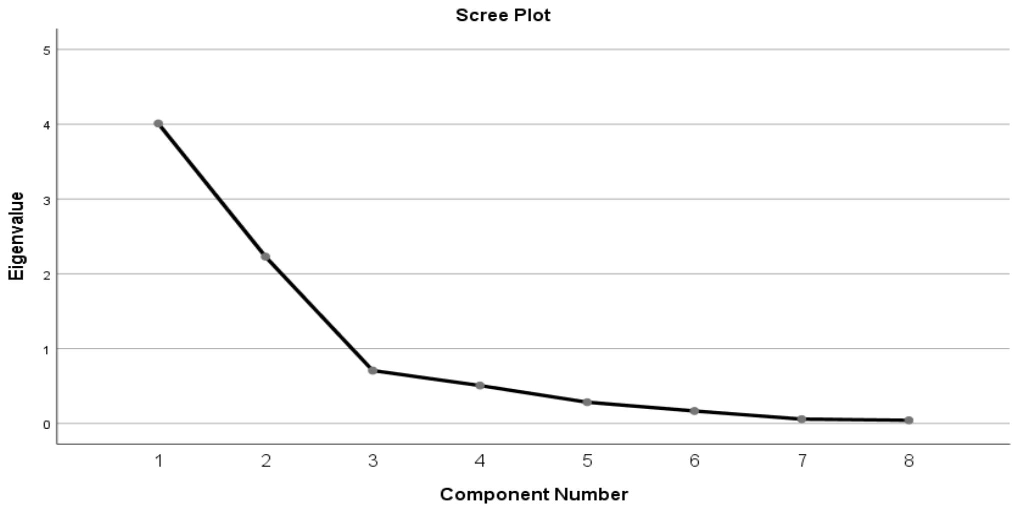

Figure 6.4: Scree plot for market factors

6.9.5 EFA for technology

There were six (6) items measuring this technology construct. The Bartlett's Test of Sphericity provided a chi-square value of 1291.448 with a p-value of 0.000 demonstrating sufficient correlations. The KMO measure of sampling adequacy was 0.723, surpassing the suggested value of 0.5. Thus, both specify that a factor analysis is fitting. Table 6.15 shows the KMO and Bartlett's test results for technology scale.

Table 6.15: KMO and Bartlett's test for technology

KMO and Bartlett's test result		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.723
Bartlett's Test of Sphericity	Approx. Chi-Square	1291.448
	df	15
	Sig.	.000

Table 6.16: Total variance explained for technology

Initial Eigenvalues			Extraction Sums of Squared Loadings		
Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
3.447	57.446	57.446	3.447	57.446	57.446
.990	16.494	73.940			
.593	9.877	83.817			
.458	7.635	91.452			
.332	5.525	96.977			
.181	3.023	100.000			

From Table 6.16, the principal component analysis discovered a one-factor structure which accounted for 57.4% of the total variance. The scree plot as shown by Figure 6.5 also confirms the number of components which needs to be extracted; only one component is greater than 1.

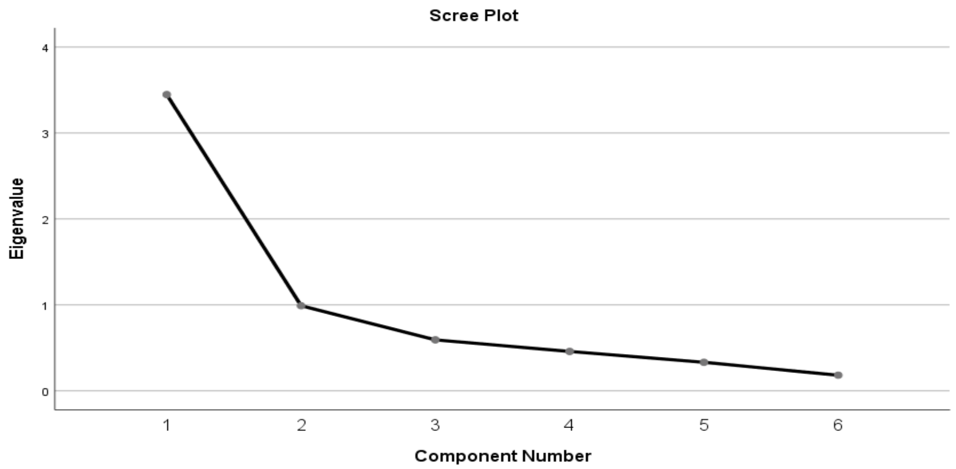

Figure 6.5: Scree plot for technology

Central University of Technology, Free State

6.10 MEASUREMENT MODEL ASSESMSENT

This section of the analyses reports on the reliability and validity for the latent variables generated from the measurement model assesMSEnt (Hair et al., 2019; Shmueli et al., 2019). Thus, the SmartPLS 3.3.3 (Ringle et al., 2015) was run to generate the reliability, convergent and discriminant validity. The results are presented in subsections 6.10.1 and 6.10.2.

6.10.1 Reliability and convergent validity tests

The reliability and convergent validity of the measures assessed in this subsection include the item loadings with their significance, construct reliability and average variance extracted (AVEs). The results are reported in Table 6.17.

Table 6.17: Reliability and convergent validity results

Items	Loadings	*SE*	*t*-statistics	*p*-values	CA	CR	AVE
Reg1	0.854	0.016	54.759	0.000	0.919	0.933	0.635
Reg2	0.859	0.015	58.727	0.000			
Reg3	0.771	0.022	34.697	0.000			
Reg4	0.843	0.017	50.693	0.000			
Reg5	0.685	0.032	21.341	0.000			
Reg6	0.755	0.030	25.447	0.000			
Reg7	0.744	0.026	28.160	0.000			
Reg8	0.847	0.018	46.396	0.000			
Fin1	0.948	0.005	190.012	0.000			
Fin2	0.706	0.038	18.689	0.000			
Fin3	0.638	0.035	18.115	0.000			
Fin4	0.656	0.034	19.174	0.000			

Items	Loadings	*SE*	*t*-statistics	*p*-values	CA	CR	AVE
Fin5	0.872	0.015	56.867	0.000	0.940	0.949	0.635
Fin6	0.916	0.008	119.907	0.000			
Fin7	0.600	0.036	16.495	0.000			
Fin8	0.768	0.018	42.842	0.000			
Fin9	0.967	0.005	176.356	0.000			
Fin10	0.965	0.006	164.086	0.000			
Fin11	0.575	0.041	13.881	0.000			
OrgF1	0.816	0.019	41.944	0.000	0.871	0.904	0.653
OrgF2	0.815	0.022	37.802	0.000			
OrgF3	0.853	0.016	54.938	0.000			
OrgF4	0.703	0.036	19.742	0.000			
OrgF5	0.845	0.011	77.942	0.000			
MktF1	0.924	0.006	158.537	0.000	0.871	0.906	0.620
MktF2	0.833	0.016	52.908	0.000			
MktF3	0.864	0.014	59.857	0.000			
MktF4	0.624	0.028	22.070	0.000			
MktF5	0.638	0.040	15.821	0.000			
MktF6	0.795	0.021	38.188	0.000			
Tech1	0.848	0.012	71.708	0.000	0.850	0.888	0.572
Tech2	0.814	0.019	43.080	0.000			
Tech3	0.696	0.047	14.767	0.000			
Tech4	0.753	0.025	29.566	0.000			
Tech5	0.681	0.031	21.724	0.000			
Tech6	0.729	0.029	25.524	0.000			
SR1	0.662	0.039	16.801	0.000	0.883	0.910	0.671
SR2	0.828	0.024	35.234	0.000			
SR3	0.828	0.023	36.451	0.000			

Items	Loadings	*SE*	*t*-statistics	*p*-values	CA	CR	AVE
SR4	0.896	0.014	66.333	0.000			
SR5	0.861	0.014	60.058	0.000			
Prof1	0.647	0.039	16.510	0.000			
Prof2	0.897	0.012	73.289	0.000			
Prof3	0.824	0.018	46.880	0.000	0.881	0.912	0.677
Prof4	0.896	0.007	124.468	0.000			
Prof5	0.825	0.010	81.734	0.000			
GE3	0.585	0.078	7.493	0.000			
GE4	0.801	0.036	22.219	0.000	0.632	0.794	0.569
GE5	0.850	0.028	30.780	0.000			
NE3	0.670	0.051	13.155	0.000			
NE4	0.953	0.006	156.771	0.000	0.837	0.897	0.748
NE5	0.943	0.010	93.360	0.000			
Rec1	0.788	0.018	44.141	0.000			
Rec2	0.870	0.012	75.074	0.000			
Rec3	0.915	0.008	114.563	0.000	0.909	0.932	0.733
Rec4	0.885	0.008	104.295	0.000			
Rec5	0.817	0.015	53.818	0.000			
Satis1	0.827	0.017	48.979	0.000			
Satis2	0.851	0.015	58.694	0.000	0.931	0.948	0.784
Satis3	0.918	0.007	129.139	0.000			
Satis4	0.909	0.008	116.991	0.000			
Satis5	0.918	0.007	137.792	0.000			

Note: Fin = Finance; GE = Growth of employment; MktF = Market Factors; NE = No. of employees; OrgF = Organisational Factors; Prof = Profitability; Rec = Recognition; SR = Sales revenue; Satis = Satisfaction; Tech = Technology; SE = Standard Error; CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted

As depicted in table 6.17, there is demonstration that all the indicators have significant loadings (Hair et al., 2019). Additionally, the reliability coefficients using the Cronbach Alpha criterion were greater than 0.7 (ranging from 0.632 to 0.940) except for growth of employment; likewise, the composite reliabilities (ranging from 0.794 to 0.949) were higher than 0.7 for all the constructs. Thus, all the emergent constructs have adequate reliabilities despite growth of employment has a slightly lower α of 0.632, but looking at the composite reliability, it is assumed this value is satisfactory (Saari et al., 2021). Assessing construct reliability using composite reliability is superior to the use of Cronbach alpha, hence, adequate reliability is established for all the variables (Hair et al., 2019; Benitez, Henseler, Castillo & Schuberth, 2020).

For the convergent validity of the constructs, the AVE values are all beyond the 0.50 threshold (ranging from 0.569 to 0.784). These suggest that the measures have adequate reliability and convergent validity (Hair et al., 2019; Shmueli et al., 2019)

6.10.2 Discriminant validity tests

Following the establishment of the construct reliability and convergent validity, the final model is checked for discriminant validity. The assesMSEnt was done using the Fornell and Larcker, the cross loadings and the Heterotrait-Monotrait (HTMT) methods (Fornell & Larcker, 1981; Hair et al., 2017; Henseler et al., 2015). The results are illustrated in Tables 6.18, 6.19 and 6.20, correspondingly.

Table 6.18 shows the results for Fornell-Larcker criterion for determining discriminant validity. As exposed, the square root of AVE (shown on the diagonal and in italics) for all latent variables was higher than the inter-construct correlations (Fornell & Larcker, 1981). This denotes the fulfilment of the discriminant validity for the emergent constructs

Table 6.18: Discriminant validity by Fornell-Larcker criterion

Constructs	1	2	3	4	5	6	7	8	9	10	11
Finance	0.797										
Growth of Employment	0.069	0.754									
Market Factors	-0.230	0.281	0.788								
No. of Employees	0.218	0.599	0.120	0.865							
Organisational Factors	0.081	-0.064	0.459	-0.167	0.808						
Profitability	-0.228	0.348	0.589	0.308	0.289	0.823					
Recognition	0.012	0.316	0.556	0.305	0.559	0.616	0.856				
Regulation	0.112	0.326	-0.178	0.271	0.146	-0.423	0.132	0.797			
Sales revenue	0.295	0.159	0.300	0.351	0.455	0.475	0.674	0.041	0.819		
Satisfaction	-0.317	0.090	0.559	0.140	0.461	0.652	0.713	0.087	0.430	0.885	
Technology	-0.063	-0.077	0.507	-0.168	0.525	0.361	0.521	0.077	0.431	0.495	0.756

For the cross-loading criterion of establishing discriminant validity, the indicators are more closely related to their respective construct than with other constructs, as presented in Table 6.19. The rule of thumb is that an indicator's outer loading on the associated construct (e.g., Fin1 to Fin11 onto BP; MktF1 to MktF6 onto MktF) should be greater than its cross-loadings on the other constructs (Bin-Nashwan et al., 2019). Consequently, discriminant validity is attained using the cross-loading criterion, too.

Central University of Technology, Free State

Table 6.19: Discriminant validity by cross-loading criterion

Indicators	Fin	GE	MktF	NE	Org.F	Prof	Rec	Reg	SR	Satis	Tech
Fin1	*0.948*	0.150	-0.222	0.197	0.017	-0.191	0.060	0.086	0.323	-0.312	-0.035
Fin2	*0.706*	-0.113	-0.154	0.220	0.118	-0.217	-0.086	0.032	0.078	-0.174	-0.109
Fin3	*0.638*	-0.001	0.024	-0.026	0.267	-0.112	0.148	0.042	0.122	-0.157	0.078
Fin4	*0.656*	0.027	0.058	0.026	0.301	-0.079	0.196	0.026	0.171	-0.128	0.071
Fin5	*0.872*	0.007	-0.268	0.215	-0.054	-0.250	-0.065	0.127	0.232	-0.257	-0.098
Fin6	*0.916*	0.146	-0.176	0.321	0.064	-0.065	0.023	-0.011	0.383	-0.313	-0.073
Fin7	*0.600*	0.010	-0.114	-0.018	0.080	-0.267	-0.029	0.020	-0.015	-0.281	0.179
Fin8	*0.768*	0.095	-0.394	0.202	0.054	-0.270	-0.080	0.263	0.270	-0.342	-0.224
Fin9	*0.967*	0.066	-0.230	0.218	0.033	-0.251	0.024	0.091	0.251	-0.276	-0.066
Fin10	*0.965*	0.060	-0.212	0.201	0.082	-0.194	0.023	0.074	0.276	-0.268	-0.074
Fin11	*0.575*	-0.020	0.018	0.062	0.041	-0.083	0.042	0.169	0.280	-0.138	0.084
GE3	0.037	*0.585*	0.102	0.362	-0.031	0.228	0.135	-0.199	0.149	-0.004	0.004
GE4	0.072	*0.801*	0.230	0.491	0.052	0.327	0.288	-0.268	0.214	0.104	-0.032
GE5	0.046	*0.850*	0.262	0.494	0.085	0.244	0.262	-0.268	0.037	0.074	-0.113
MktF1	-0.199	0.316	*0.924*	0.203	0.355	0.551	0.480	-0.188	0.216	0.451	0.345
MktF2	-0.203	0.222	*0.833*	0.193	0.420	0.517	0.454	-0.296	0.286	0.473	0.431
MktF3	-0.323	0.225	*0.864*	0.047	0.366	0.509	0.419	-0.119	0.108	0.424	0.355
MktF4	-0.056	0.179	*0.624*	0.122	0.188	0.386	0.463	-0.225	0.313	0.426	0.459
MktF5	-0.021	0.041	*0.638*	-0.101	0.533	0.268	0.405	0.142	0.347	0.493	0.532
MktF6	-0.262	0.305	*0.795*	0.045	0.322	0.506	0.392	-0.086	0.155	0.375	0.291
NE3	0.158	0.164	-0.083	*0.670*	0.042	0.083	0.142	-0.127	0.280	0.063	-0.090
NE4	0.199	0.550	0.110	*0.953*	0.123	0.339	0.294	-0.267	0.357	0.128	-0.204
NE5	0.208	0.676	0.181	*0.943*	0.220	0.297	0.309	-0.270	0.291	0.150	-0.125
OrgF1	-0.058	-0.083	0.431	-0.007	*0.816*	0.121	0.345	0.242	0.180	0.315	0.425
OrgF2	0.087	-0.101	0.205	-0.012	*0.815*	0.057	0.352	0.346	0.297	0.310	0.408
OrgF3	0.140	0.095	0.292	0.336	*0.853*	0.239	0.481	0.214	0.504	0.372	0.386
OrgF4	-0.010	-0.004	0.281	-0.097	*0.703*	0.206	0.318	0.069	0.314	0.285	0.483
OrgF5	0.093	0.191	0.555	0.235	*0.845*	0.397	0.616	-0.112	0.420	0.491	0.448

Indicators	Fin	GE	MktF	NE	Org.F	Prof	Rec	Reg	SR	Satis	Tech
Prof1	-0.110	0.223	0.216	0.224	0.144	*0.647*	0.347	-0.236	0.482	0.381	0.150
Prof2	-0.175	0.287	0.491	0.217	0.251	*0.897*	0.533	-0.386	0.442	0.565	0.366
Prof3	-0.164	0.326	0.355	0.336	0.084	*0.824*	0.473	-0.420	0.333	0.426	0.102
Prof4	-0.215	0.334	0.592	0.379	0.264	*0.896*	0.566	-0.351	0.371	0.627	0.271
Prof5	-0.236	0.264	0.622	0.147	0.363	*0.825*	0.560	-0.336	0.392	0.610	0.478
Rec1	0.051	0.258	0.372	0.177	0.420	0.358	*0.788*	-0.022	0.541	0.460	0.408
Rec2	-0.010	0.381	0.456	0.292	0.413	0.539	*0.870*	-0.215	0.549	0.545	0.409
Rec3	-0.052	0.232	0.507	0.198	0.553	0.557	*0.915*	-0.061	0.569	0.713	0.472
Rec4	0.004	0.197	0.543	0.329	0.511	0.584	*0.885*	-0.183	0.556	0.676	0.445
Rec5	0.069	0.301	0.481	0.298	0.481	0.572	*0.817*	*-0.073*	0.673	0.624	0.489
Reg1	0.135	-0.093	-0.257	-0.273	-0.021	-0.484	-0.259	*0.854*	-0.074	-0.250	0.003
Reg2	0.093	-0.296	-0.287	-0.182	0.018	-0.500	-0.169	*0.859*	-0.058	-0.184	0.040
Reg3	0.070	-0.136	-0.167	-0.027	0.201	-0.223	-0.072	*0.771*	0.133	0.050	0.033
Reg4	0.223	-0.244	-0.146	-0.137	0.088	-0.293	-0.053	*0.843*	0.153	-0.033	-0.073
Reg5	0.131	-0.232	-0.166	0.004	0.202	-0.187	-0.054	*0.685*	0.211	-0.001	0.030
Reg6	0.081	-0.251	0.062	-0.165	0.277	-0.204	0.121	*0.755*	0.122	0.035	0.137
Reg7	0.041	-0.369	0.045	-0.311	0.234	-0.241	-0.028	*0.744*	0.098	0.164	0.178
Reg8	-0.003	-0.392	-0.125	-0.388	0.129	-0.350	-0.152	*0.847*	-0.064	-0.124	0.126
SR1	0.116	0.109	0.079	0.205	0.154	0.233	0.416	-0.088	*0.662*	0.102	0.195
SR2	0.165	0.067	0.214	0.189	0.339	0.336	0.559	-0.054	*0.828*	0.269	0.418
SR3	0.335	0.182	0.028	0.437	0.221	0.277	0.449	0.021	*0.828*	0.204	0.177
SR4	0.301	0.214	0.284	0.475	0.423	0.469	0.606	0.089	*0.896*	0.440	0.270
SR5	0.261	0.099	0.425	0.183	0.538	0.505	0.647	0.101	*0.861*	0.530	0.540
Satis1	-0.291	0.200	0.403	0.186	0.345	0.593	0.611	-0.084	0.401	*0.827*	0.434
Satis2	-0.183	0.119	0.384	0.189	0.297	0.607	0.607	-0.101	0.441	*0.851*	0.425
Satis3	-0.309	-0.047	0.500	0.000	0.426	0.536	0.624	-0.036	0.332	*0.918*	0.434
Satis4	-0.260	0.038	0.532	0.178	0.461	0.585	0.637	-0.080	0.395	*0.909*	0.395
Satis5	-0.336	0.108	0.611	0.097	0.474	0.583	0.674	-0.090	0.361	*0.918*	0.497
Tech1	-0.186	-0.039	0.607	-0.132	0.518	0.396	0.531	0.070	0.264	0.568	*0.848*
Tech2	0.043	-0.032	0.462	-0.128	0.416	0.224	0.386	0.231	0.414	0.425	*0.814*
Tech3	-0.061	0.116	0.429	-0.076	0.221	0.307	0.358	-0.262	0.163	0.242	*0.696*
Tech4	-0.155	-0.204	0.378	-0.248	0.326	0.339	0.299	-0.091	0.257	0.372	*0.753*
Tech5	0.143	-0.088	0.163	-0.040	0.483	0.163	0.448	0.215	0.513	0.323	*0.681*
Tech6	-0.060	-0.076	0.163	-0.141	0.328	0.175	0.267	0.094	0.314	0.186	*0.729*

Table 6.20 reports the HTMT values for determining the discriminant validity of the constructs. As discovered in Table 6.18, all the values were below the recommended maximum threshold of 0.85. This signifies the establishment of the discriminant validity of all the concepts (Bin-Nashwan et al., 2019; Henseler et al., 2015). Thus, again, discriminant validity has been established in the model, since all HTMT values are meaningfully less than the cut-off value of 0.85 (HTMT0.85) (Hair et al., 2019; Henseler et al., 2015; Saari et al., 2021).

Table 6.20: Discriminant validity by Heterotrait-Monotrait Ratio (HTMT) criterion

Constructs	1	2	3	4	5	6	7	8	9
Finance									
Growth of Employment	0.165								
Market Factors	0.289	0.349							
No. of Employees	0.228	0.737	0.194						
Organisational Factors	0.178	0.190	0.520	0.225					
Profitability	0.250	0.473	0.627	0.340	0.290				
Recognition	0.148	0.401	0.622	0.325	0.580	0.666			
Regulation	0.177	0.410	0.269	0.295	0.307	0.430	0.174		
Sales revenue	0.304	0.239	0.312	0.437	0.434	0.526	0.726	0.178	
Satisfaction	0.319	0.171	0.615	0.166	0.476	0.707	0.766	0.155	0.422
Technology	0.222	0.196	0.575	0.195	0.595	0.393	0.574	0.290	0.446

6.11 ETHICAL CONSIDERATIONS

The pressing ethical issues to be addressed in social science research range from sound research practices, non-discrimination, objectivity, competency, respect for intellectual property, respect for human and animal rights to conflicts of interest (Navalta, Stone & Lyons, 2019). The aim of the research is to conduct the study using the highest form of ethical standards. Therefore, research modalities of the Central University of Technology (CUT), assurance of no harm, freedom of subject to participate, confidentiality, anonymity, team competency and academic credibility were highly adhered to in observing and ensuring ethical issues.

First and foremost, to ensure sound research practices, the research topic was only selected after thorough consultations with a team of experts and supervisors. This ensured originality of work and enhanced fresh thinking as well as the potentials of the research output. The university ethics clearance form was completed, approval was sought and was given by the Departmental and Faculty Research Committees before the commencement of the study. The process made the researcher very conversant with all relevant ethical issues at Central University of Technology.

According to Giele (2021), care must be taken to protect the rights and dignity of research participants. Maximum efforts were accordingly made to ensure that neither respondents nor research assistants engaged suffer any physical or psychological harm during the study. Participants were administered at their own place of convenience and safety. No one was compelled to participate. Respondents freely consented to participate.

Confidentiality was also highly ensured and assured. The questionnaire clearly explained the research is for academic purposes only, the required information will not be used for any other purpose, and the respondents' names were not required. Confidentiality of information and anonymity of respondents are assured. However, investigating and publishing cases of small businesses on indigenous innovation in low-income economies, where protection strategies tend to be information restriction, still raises ethical issues. To limit this risk, participants were guided to feel free not to disclose information that border on their trade secret during the survey.

Researchers are required to protect subjects, gather valid data, and properly analyse and interpret data (Navalta et al., 2019). Accordingly, enumerators and technicians who assisted were well trained to understand the issues before their engagement. Appropriate statistical tools were used to analyse and present data, and maximum care was taken to avoid misinterpretation and misrepresentation of data. Intellectual property was highly recognised and academic credibility was maintained throughout. Appropriate acknowledgements were given, and references were cited where other ideas and knowledge are used.

6.12 CHAPTER SUMMARY

Chapter 6 provided an in-depth explanation of the research design and the methodology of the study. Direct observation of all the actors and the entire commercialisation phenomena is not technically feasible and even if the direct observation was possible, it could only offer a partial truth. To build the understanding of the local truth about successful commercialisation of indigenous innovation and its key drivers, data on the perception of MSE innovators and innovation sellers in SSI in the Volta Region of Ghana was collected. Based on the analysis of the collected data, the findings from the research are presented and discussed in the next chapter.

CHAPTER 7: RESULTS, FINDINGS AND DISCUSSION

7.1 INTRODUCTION

This chapter 7 presents the structural model results, analyse and discuss the effects of the selected drivers on indigenous innovation and MSE performance. Based on the research objectives, the chapter aims at providing an in-depth understanding of the commercialisation of indigenous innovation (CII) by discussing the links between the selected commercialisation drivers (regulation, finance, organisational factors, market factors and technology) and MSE performance in the Ghanaian SSI sector. It assesses the impact of the drivers on the performance of MSEs engaged in indigenous innovation activities in terms of sales, profitability, employment and feeling of success metrics.

7.2 DEMOGRAPHIC INFORMATION

This section presents the demographic information of the respondents in the study. The demographic characteristics include gender, age, marital status, and types of training as well as the educational levels of the respondents.

7.2.1 Respondents' gender

Table 7.1 below presents the gender distribution of the MSE respondents. It indicates that men constitute 40.8% and women constitute 59.2%.

Table 7.1: Gender Distribution

		Frequency	Valid Percent
Valid	Male	185	40.8
	Female	268	59.2
	Total	453	100.0

This suggests that the commercialisation of indigenous innovation in the Ghanaian SSI sector is female dominated. Female dominance of indigenous small scale industrial activities is not surprising as most MSEs are set out because of owners' route out of unemployment and women have significantly fewer employment opportunities in Ghana.

This evidence is in contrast with the global trend which seems to suggest women are less likely to innovate and commercialise than men (Sexton & Ligler, 2018; Fechner & Shapanka, 2018). Other authors such as Neumeyer and Chen (2021), nonetheless, recognised many aspects of commercialisation is largely neglected in the innovation literature and rather called for further research on gender participation in innovation.

7.2.2 Age distribution of respondents

Table 7.2 below shows the age distribution of the respondents. Most MSE respondents, nearly 70% are under 36 years and only 1.3% are 55+. This is consistent with innovation studies such as Ndirangu (2017) that corroborated with earlier studies that suggest 25-35 years as the optimum age for entrepreneurs.

Table 7.2: Age DistributionSource

	Age bracket	Frequency	Valid Percent	Cumulative Percent
Valid	25 and under	88	19.4	19.4
	26-35 years	228	50.3	69.7
	36-45 years	99	21.9	91.6
	46-55 years	32	7.1	98.7
	55+	6	1.3	100
	Total	453	100.0	100

The inference to be drawn from the age distribution is mixed. On one hand, the dominance of the youth in the sector infer that the young people are flexible in doing their business and are willing to adapt and commercial indigenous innovation. Secondly, policy efforts of promoting youth entrepreneurship might be yielding some results. Again, the low representation of the aged in the sector supports the worrying observation of extinction of indigenous knowledge (Quaye & Mensah, 2019) as the aged are archives of most indigenous knowledge and practices.

7.2.3 Marital status of respondents

The data on marital status (table 7.3) below is mainly characterised by 41.3% married and 53.0% single status. The evidence is not clear cut and relates to studies such as Alene (2020) that portrayed insignificant impacts of marital status on commercial success. Nonetheless, marital status is an important aspect in commercialisation due to gender-related issues in entrepreneurship.

Table 7.3: Marital status

	Status	Frequency	Valid Percent
Valid	Married	187	41.3
	Single	240	53.0
	Divorced	21	4.6
	Widowed	5	1.1
	Total	453	100.0
	Married	187	41.3

Singles have more time for business and can commit more personal resources to innovation development and commercialisation activities as they have lower living expenses. It is easier for single ladies, for example, to travel from one market to another, move outside their localities, meet, and network with new people. Yet, there is also abundance of evidence of spousal supports for entrepreneurs. There is anecdotal evidence of men funding and continuously bankrolling start-ups of their spouses. Ndirangu (2017), for example, provided some evidence that in terms of retail trade, married businesMSEn tend to open for longer hours as their spouses pitch in for them to keep business open.

7.2.4 Educational level of respondents

As indicated from educational level data in Table 7.4, nearly almost all respondents have been to school, over 95% have at least secondary education of which even over 42% attained undergraduate degree.

Table 7.4: Educational level MSE owners/managers

	Educational Level	Frequency	Valid Percent	Cumulative Percent
Valid	Postgraduate degree	3	0.7%	0.7%
	Undergraduate degree	190	41.9%	42.6%
	Secondary school	240	53.0%	95.6
	Primary school	17	3.8%	99.3
	No formal education	3	0.7%	100%
	Total	453	100%	100%

According to Rambe and Makhalemele (2015), the educational level of managers plays an important role in the success or failure of MSEs. This revealed result should therefore ordinarily mean most of the MSE owners/managers are able to read and write for commercial transactions, business communication and operation. The reported high educational attainment is because education up to secondary school is free and compulsory in Ghana. Skill proficiency levels are, however, not necessarily high. Danquah and Ouattara (2014) indeed observed tertiary education attainment has insignificant to no effect on innovation performance in African countries.

7.2.5 Type of training received by respondents

Some scholars (Danquah & Ouattara, 2014; Alhassan & Habib, 2016) opined types of schooling, training and experience correlate differently with firm performance. As indicated in Table 7.5, most MSE owners, 47.0%, acquired their business skills through on-the-job training. Only 25.8% of the respondents had their training through apprenticeship, while 27.2% had it through technical and vocational training.

Table 7.5: Type of training received by MSE owner/managers

	Status	Frequency	Valid Percent
Valid	Apprenticeship	117	25.8%
	Technical/Vocational	123	27.2%
	On-the-job training	213	47.0%
	Total	453	100.0%

From this result, less than a third reported having received their technical, innovation, and commercial skills through technical and vocational training, which is supposed to be the bedrock of small businesses. This is notwithstanding the government campaign to promote TVET. This evidence supports the views of (Alhassan & Habib, 2016; Afful & Owusu, 2017), blaming inappropriate academic programmes for low innovation in Ghana. Also evident from the result is the reduced relevance of apprenticeship training which is an effective way of passing and transferring indigenous knowledge and skills to the youth.

7.3 FIRMS' PROFILES AND COMMERCIALISATION CHARACTERISTICS

This section presents the background information and commercialisation strategies of MSEs involved in the commercialisation of indigenous innovation in the Ghanaian SSI sector who have been engaged in the study. The background information analysed are business/industry category, the role of the respondent with business, age of business and types of indigenous innovation. The section also analysed government incentives and other commercialisation strategies as control variables. Government incentive was analysed in terms of incentives to MSE sellers and incentives to buyers of indigenous innovation. Other commercialisation strategies analysed include the method of commercialisation, usage of university (or other) innovation intermediary services and pricing strategies of MSEs.

7.3.1 Business/industry category

The various categories of industrial activities engaged in by MSE in the sector is presented in table 7.6. From the table, the small industrial activities applying ingenious innovation predominantly consist of agro (food and cash crop) processing 24%, textile & garment (including Kente weaving), 20%, followed by others including building and other trades, 19%. 12.6% of MSEs of the sampled respondents were engaged in pottery and ceramics, while just under 12% are engaged in metal works.

Table 7.6: Business /industry categories

	Categories	Frequency	Valid Percent
Valid	Food processing	87	19.2%
	Cash crop processing	67	14.8%
	Kente weaving	44	9.7%
	Other textile & garment	46	10.2%
	Wood works	11	2.4%
	Metal works	53	11.7%
	Poetry & ceramics	57	12.6%
	Others	87	19.2%
	Total	452	100.0%

The dominance of food and agro-processing indicate improving access to technology and the adoption of new technology to indigenous input. Secondly, the relevance of textile and garment particularly Kente weaving, an indigenous craft in the Volta Region, per the sampled data also infer some dividends of non-traditional export promotion programme of the Government. It is however surprising, woodwork consists of only 2.4%, given the fact that the Ewes are more associated with carpentry and woodworks. The Ewes, the main indigenes in the Volta Region, dominates the Ghanaian woodwork craft to the extent that, the biggest carpentry hub in Ghana in Kumasi, is called Angloga, the name of one of the traditional capitals in the Volta Region. There are other evidence that blacksmithing and other traditional metal trades have also diminished. The data on metalwork is presumably augmented by the expanding welding and fabrication subsector. This evidence of diminished relevance of these indigenous trades buttresses the concerns over the risks of indigenous knowledge fading out (Quaye & Mensah, 2019).

7.3.2 Respondents role with MSE

The survey captured the views of MSE owners and key members of the innovation team as much as possible. The roles played by the respondents with the innovation or business (table 7.7) shown below indicate that nearly 77% were owner/developer.

Table 7.7: Role with MSE/Innovation

	Role	Frequency	Valid Percent
Valid	Owner/Developer	347	76.8%
	Manager	77	17.0%
	Team member	28	6.2%
	Total	453	100.0%

The deduction here is that MSE owners manage their businesses and personally play key roles in commercialisation decisions. This is consistent with other studies (Dzansi & Atiase, 2014; Fatoki, 2018) which suggest that MSEs in low-income economies are primarily self-employment by nature and owners double as managers.

7.3.3 Age of innovation/business

The background data also analysed the age of innovation/business and the indication from Table 7.8 is that majority (73.2%) of the MSEs aged between 3 to 5 years. About 15% aged over 5 years and just under 12% aged between 0 to 2 years.

The revealed result has multiple implications. Majority, over 70% of MSEs attempting to commercialise indigenous innovation surviving over 2 years suggest resilience and commitment of the MSEs to succeed and is consistent with other studies such as Ofunoye (2017) that highlight the resilience of MSEs in low-income countries. On the other hand, few of them aging over 6 years supports the concerns over long term profitability, survival, and sustainability of MSEs (Addo, 2017; Tsatsenko, 2020).

Table 7.8: Age of innovation/business

	Years	Frequency	Valid Percent
Valid	0-2	53	11.7%
	3-5	331	73.2%
	6-10	65	14.4%
	Over 10	3	0.7%
	Total	452	100.0%

7.3.4 Types of indigenous innovation

Another important factor considered as part of the background analysis is the types of indigenous innovation applied by the MSEs. Indigenous innovation applied by the MSEs in the SSI sector as shown in Table 7.9 below indicate that the SSI activities are characterised by either the use of indigenous inputs, further application of indigenous knowledge or both and these constitute over 80% per the data. Those adopting new technology to indigenous knowledge constitute just about 18%.

Table 7.9: Types of indigenous innovation applied

	Application indigenous innovation	Frequency	Valid Percent
Valid	Further application of indigenous knowledge	150	33.2%
	Use of indigenous inputs	35	7.7%
	Adaptation of indigenous knowledge to technology	12	2.7%
	Both use of indigenous inputs and further application of knowledge	169	37.4%
	Both adaptation of technology and further application of indigenous knowledge	71	15.7%
	Both use of indigenous inputs and adaptation of technology	15	3.3%
	Total	452	100.0%

The dominance of the use of indigenous inputs, further application of indigenous knowledge or both rather reflect the high desire of the Ghanaian society, at least MSEs, to achieve, use local resources and provide local solutions. This observation is consistent with the views that at least there is something happening in Ghana, albeit below-the-radar (Fu et al., 2018). This evidence juxtaposed with Ghana's reported poor innovation performance (Dutta et al., 2016; Cornell University et al., 2020) also support views suggesting that the problem in low-income economies is not low innovative activities but rather their commercialisation (Shpak et al., 2014). The low level of the commercialisation of indigenous innovation activities and low adaptation of new technology to indigenous knowledge seem to be the reflections of the weak actor linkages in the Ghanaian National System of Innovation (GNSI) highlighted in the literature (Quarmine et al., 2014; Asare, 2016; Osei-Amponsah et al., 2016 Amankwah-Amoah, 2016; Quaye, et al., 2019).

7.3.5 Government incentives received by the innovators

As indicated in Table 7.10 below, out of the 453 MSEs commercialising indigenous innovation engaged in this study, 225 representing 49.7% reported that they have never received any form of government incentives for their activities.

Table 7.10: Types of Government incentives received by the innovators

	Incentives received by innovators	Frequency	Valid Percent
Valid	None	225	49.7
	Grant	2	.4
	Regulatory relaxation	1	.2
	Free or subsidized inputs	6	1.3
	Concessionary loans	1	.2
	Free training	217	47.9
	Free or subsidized inputs and free training	1	.2
	Total	453	100.0

In terms of the remaining 50% that indicated they have received some incentives, 217(47.9%) received only free training. Thus, only about 2% of the respondents benefited from real incentives in the form of grants, concessionary loans, regulatory relaxation and free or subsidised inputs. This evidence is inconsistent with a number of government reports and speeches that tout having instituted a number of incentives and innovation support programmes for MSEs (MOTI, 2015; MESTI, 2017b; NEIP, 2017; Adu et al., 2020). The reality on the ground is that government support programmes for small businesses are always plagued with political cronyism and "who you know", and most MSEs think it is a waste of time to apply. Interaction with government officials and other reports also revealed that budgetary allocations for most of these business incentives programmes are inadequate. Meanwhile, so many people need help and therefore only a few can get it (Quaye et al., 2020).

7.3.6 Government incentives enjoyed by the customers

Table 7.11 below also present the types of government incentives enjoyed by buyers/users of indigenous innovation. In respect of incentives enjoyed by customers, out of the 453 MSEs, only 98, about 21% reported their customers rely on government incentives, out of which 53, nearly 12%, is government purchase. Only 8 percent of the respondents reported that their customers rely on other types of Government incentives to purchase.

Table 7.11: Types of Government incentives enjoyed by the customers

	Incentives	Frequency	Valid Percent
Valid	None	355	78.4
	Grant	5	1.1
	Tax rebate	24	5.3
	Government purchase	53	11.7
	Subsidized complements	1	.2
	Concessionary loans	14	3.1
	Government purchase and subsidized complements	1	.2
	Total	453	100.0

This result is also back by other observation on the ground, for example, most government institutions that used to be furnished with made in Ghana furniture, are now furnished with imported furniture, while a lot of indigenuous furniture are showcase on the roadside and sellers complain of slow sales. The government officials' response is that the procurement law, inability of the indigenous MSEs to produce on large scale and deliver on time, and poor finishing of indigenous products make them favour imports. This evidence clearly imply that government policy has not focused on demand-side incentives to promote indigenous innovation. In the same vein, there is not much evidence of MSEs theMSElves strategising to target and attract customers with government incentives. The findings also support earlier studies and reports that observed weak GNSI Actor linkages and poor ability of Ghanaian MSEs to scrutinise regulatory regimes and influence policy instruments for promoting and accelerating indigenuous innovation (Oduro-Marfo, 2015; Donkor et al., 2018; Cornell University et al., 2018; UNCTAD, 2019). The findings are dissimilar to "zizhu chuangxin", the Chinese indigenous innovation programme that aggressively uses government procurement and incentives to promote made in China and buy made in China (Baark, 2016; Bazavan, 2019).

7.3.7 Method of commercialisation

Method of commercialisation was assessed in terms of the type of commercialising entity. As shown in Table 7. 12 below, the result of the study confirmed that commercialisation of indigenous innovation is mainly carried out by small scale entrepreneurs.

Over 87% of the observed indigenous innovation activities in the SSI sector were by Start-ups MSEs. Although the focus of the study is MSEs, attempts were made in the study to observe corporate venturing in terms of existing MSEs trying to embrace and commercialise indigenous innovation and KBIs improving and commercialising indigenous innovation. The result revealed that apart from startup small scale entrepreneurs, other methods of commercialisation of indigenous innovation is minimal. These findings support other studies that confirmed that MSE start-ups are at the forefront of diffusion and commercialisation of innovation (Dahlstrand, 2016; Asiedu, 2016; Menna & Walsh, 2019).

Table 7.12: Method of commercialisation

	Methods	Frequency	Valid Percent
	Business spinoffs from knowledge-based institutions (KBIs)	2	.4
	Corporate venturing (from licensing by to others)	28	6.2
	Corporate venturing (spinout from existing firms).	27	6.0
	Start-ups by MSEs entrepreneurs or innovators	396	87.4
	Total	453	100.0

7.3.8 Usage of university and related innovation intermediary services

As emerging from nascent innovation ecosystem literature, MSE start-ups can make use of university and other innovation intermediaries to shape or cut down the cost of innovation in the commercialisation process. The study, therefore, assessed how the 453 sampled MSEs are making use of university and other innovation intermediary services in their commercialisation process. As indicated in Table 13 below only about 25% reported having used university or other intermediary services, of which 15% reported having used university incubators.

The evidence of use of innovation university intermediary services, albeit low, adds to the growing evidence of university–industry collaboration (Mack & Mayer, 2015; Stam, 2015; Mian, Lamine & Fayolle, 2016; Clayton et al., 2018; Abdulai et al., 2020) and this is in respect of MSEs. This evidence is good news and is important because as evident from the method of commendation data above, MSE start-ups are clearly at the forefront of the commercialisation of indigenous innovation. Unlike large firms, MSEs are unable to generate the frenzy and interest for new products from a large promotion budget. Thus, MSEs cannot on their own create the big bubbles required for successful commercialisation and universities can act as the big fish. Successful commercialisation can be likened to the splash effects of fish in a pond. Thousands of small fishes in a pond cannot create effective bubbles. However, a big fish can create big bubbles and the smaller ones can also enjoy it.

Table 7.13: Usage of university or other innovation intermediary services

	Years	Frequency	Valid Percent
Valid	None	339	74.8
	University lab/workshop	3	.7
	Hub/incubator	68	15.0
	Mentoring	5	1.1
	Promotion & new demand legitimization	1	.2
	Hub/incubator and mentoring	1	.2
	Mentoring and promotion & demand legitimization	27	6.0
	Others	9	2.0
	Total	453	100.0

7.3.9 Pricing strategy

Pricing strategy is an important factor in the innovation commercialisation process, as it affects value for money to customers, address affordability issues of customers, and it is the channel through which a firm can appropriate the created value on the market to itself. Pricing is very important as it can directly impact innovation performance as well as influence other factors (Boomerang, 2015; Howell et al., 2018; Dean, 2020).

The result of the study (table 7.14) below indicates that most MSEs in the SSI sector (55%) package and price their indigenous innovation around the industry average. Less than a third (27.6%) package and price well below the industry average while less than a fifth (17.4%) reported packaging and pricing around the upper end of the industry price.

Table 7.14: Pricing strategies of MSEs in commercialisation process

	Innovation is packaged and priced	Frequency	Valid Percent
Valid	Well below the industry average.	125	27.6
	Around the industry average.	249	55.0
	Around the upper end of the industry price.	79	17.4
	Total	453	100

The dominance of pricing around the industry average implies MSEs pricing strategy is largely constrained by competition more than anything else. The low number of MSEs attempting to price around the upper end also confirmed that the Ghanaian SSIs serve the masses than the upper class. These findings are consistent with the BRI views that MSE innovators in low-income economies do not have a lot of pricing discretion as their buyers cannot pay substantial premiums and they have to devise low-cost strategies to deliver to affordability constrained customers with little purchasing power (Hang et al., 2014; Harilal, 2017; Krämer & Kalka, 2017).

7.4 CONSTRUCT DESCRIPTIVE ANALYSIS

This section reports on the construct descriptive statistics of the measuring scales of the drivers of indigenous innovation commercialisation and business performance indicators. The drivers were scored on a 5-point scale where 1 denotes strongly disagree and 5 signifies strongly agree. Thus, according to Robison (2018), a mean of 3.2 is a good guideline to distinguish between positive and potential negative perceptions. Tables 7.15 and 7.16 show the descriptive statistics.

The statistics in Table 7.15 indicates that the drivers of indigenous commercialisation had mean scores ranging from 2.57 to 3.49. Specifically, regulation ($M = 2.87$; $SD = 0.705$), finance ($M = 2.57$; $SD = 0.578$) and market factors ($M = 3.05$; $SD = 0.509$) had mean values less than 3.2. These suggest that most of the respondents had negative perceptions about the regulation, finance, and market factors. Nevertheless, organisational factors ($M = 3.49$; $SD = 0.620$) and technology ($M = 3.29$; $SD = 0.615$) had mean values less than 3.2. These imply that most of the respondents had positive perceptions about the organisational factors and technology driving indigenous commercialisation.

Table 7.15: Construct descriptive statistics for commercialisation drivers

Variables	Min.	Max.	Mean	Std. Deviation	Skewness		Kurtosis	
					Statistic	Std. Error	Statistic	Std. Error
Regulation	2	5	2.87	0.705	0.116	0.115	-0.422	0.229
Finance	2	4	2.57	0.578	1.228	0.115	1.683	0.229
Organisational factors	2	5	3.49	0.620	-1.035	0.115	1.312	0.229
Market factors	2	4	3.05	0.509	-0.339	0.115	-0.746	0.229
Technology	2	5	3.29	0.615	-0.565	0.115	-0.258	0.229

Table 7.16 depicts the performance metrics of the firms in terms of sales revenue, employment, profitability, recognition, and personal level of satisfaction which were assessed over a five-year period (2016 to 2020). As revealed in Table 7.4, the mean scores for sales revenue and number of employees ranged from 1.39 to 3.41 and 1.15 to 2.12, respectively. Thus, both sales revenue and number of employees of the firms consistently increased over the five years. However, the mean values for growth of employment and profitability recognition constantly increased from 2016 to 2019 but began to dwindle in 2020. Similarly, the mean values for personal level of satisfaction consistently increased from 2016 to 2018 but started to decline in 2019. These results present a worrying situation about the indigenous innovations.

Table 7.16: Construct descriptive statistics for business performance

Variables			Mean	Std. Deviation	Skewness		Kurtosis	
	Min.	Max.			Statistic	Std. Error	Statistic	Std. Error
Sales revenue								
2016	1	6	1.39	0.897	2.976	0.140	9.516	0.278
2017	1	6	2.02	1.004	1.475	0.135	2.778	0.270
2018	1	6	2.61	1.217	1.078	0.122	0.573	0.243
2019	1	6	3.30	1.518	0.646	0.115	-0.637	0.229
2020	1	6	3.41	1.916	0.307	0.115	-1.423	0.229
Overall	1	6	2.64	1.190	0.706	0.115	-0.437	0.229
Number of employees								
2016	1	4	1.15	0.392	2.962	0.140	11.189	0.279
2017	1	5	1.59	0.552	0.755	0.136	3.618	0.271
2018	1	5	1.80	0.489	0.222	0.122	4.967	0.243
2019	1	5	2.02	0.651	0.276	0.115	0.550	0.229
2020	1	5	2.12	0.703	0.250	0.115	0.174	0.229
Overall	1	5	1.74	0.476	0.645	0.115	2.814	0.229
Growth of employment								
2016	1	5	1.13	0.395	4.623	0.140	32.499	0.279
2017	1	4	1.47	0.744	1.935	0.135	3.942	0.270
2018	1	5	1.50	0.784	2.121	0.122	5.968	0.243
2019	1	5	1.54	0.816	1.805	0.115	3.970	0.229
2020	1	5	1.48	0.786	1.776	0.115	3.411	0.229
Overall	1	3	1.42	0.486	1.142	0.115	0.792	0.229
Profitability								
2016	1	4	1.53	0.712	1.020	0.140	-0.108	0.278
2017	1	4	1.95	0.966	0.713	0.135	-0.510	0.270
2018	1	4	2.11	0.935	0.632	0.122	-0.388	0.243
2019	1	4	2.51	0.868	0.102	0.115	-0.668	0.229
2020	1	5	2.37	1.025	0.020	0.115	-1.123	0.229
Overall	1	4	2.11	0.786	0.543	0.115	-0.692	0.229
Recognition								
2016	1	6	3.30	1.067	-0.642	0.140	-0.364	0.278
2017	1	6	3.40	1.142	-0.480	0.135	-0.560	0.270
2018	2	6	3.65	1.027	-0.129	0.122	-1.027	0.243
2019	1	6	3.70	1.123	-0.010	0.115	-1.189	0.230
2020	1	6	3.42	1.134	0.304	0.115	-0.743	0.229

Variables			Mean	Std. Deviation	Skewness		Kurtosis	
	Min.	Max.			Statistic	Std. Error	Statistic	Std. Error
Overall	1	6	3.47	1.038	-0.013	0.115	-1.111	0.229
Personal satisfaction								
2016	1	6	3.44	1.213	-0.362	0.140	-0.460	0.278
2017	1	6	3.56	1.193	0.165	0.135	-0.412	0.270
2018	1	6	3.96	1.277	-0.036	0.122	-0.945	0.243
2019	1	6	3.94	1.298	-0.101	0.115	-0.883	0.230
2020	1	6	3.72	1.411	0.019	0.115	-0.953	0.230
Overall	1	6	3.73	1.290	0.116	0.115	-0.846	0.229

7.5 JUSTIFICATION FOR EMPLOYING PLS-SEM APPROACH

In view of the research objectives and the conceptual model underpinning this study, partial least squares structural equation modelling (PLS-SEM) is the most suitable measurement method. The research objective is of most paramount importance in choosing the statistical approach for performing the data analysis (Ong & Puteh, 2017). The main objective of the study is to examine the impact of factors of indigenous innovation commercialisation (CII) on four dimensions of MSE performance (sales, profitability, employment and feeling of success) in Ghana. Thus, the study involves an examination of causal and effect relationship between a number of independent and dependent variables, hence, PLS-SEM analysis is the most preferred statistical tool (Hair, Risher, Sarstedt & Ringle, 2019).

SEM combines various techniques available in the first generation of multivariate analysis and enables the significance of relationship among constructs, based on gathered data, to be easily determined (Ong & Puteh, 2017). SEM has the statistical ability to test the causal relationships between constructs with multiple measurement items and it is a useful statistical tool for testing theories and conceptual models of empirical studies (Ong & Puteh, 2017; Hair et al., 2019). For studies such as the current one, SEM is the best method because it reduces the impact of Type 1 error (Hair et al., 2014; Elsenhauer et al., 2015; Fan et al., 2016).

The two most common theories under SEM statistical analysis are Covariance Based SEM (CB-SEM) and Variance Based SEM (VB-SEM). However, VB-SEM such as PLS-SEM is more robust towards the assumption of normality distribution and the sample size and found to be most suitable for exploring the relationship among variables (Dijkstra & Henseler, 2015; Richter et al., 2016; Sarstedt et al., 2016; Hair et al., 2019). The study employed SmartPLS to perform the data analysis (Ringle et al., 2015), although, it also used SPSSS to perform the descriptive analysis and exploratory factor analysis (EFA). According to Hair et al. (2019), if the proposed model is a nascent theoretical development derived from several theories, or the research intend to test a framework from a prediction perspective, then, the prediction between the constructs in the model requires usage of PLS-SEM. The use of five indigenous innovation commercialisation drivers with multiple items, as well as the control variables (CV), justifies the use of SEM-PLS to test this relationship.

PLS-SEM is trending among quantitative researchers and is chosen for the analysis of the current data also because it is very powerful for testing theories and it can normalise the data for further analysis (Hair, Hult, Ringle, Sarstedt & Thiele, 2017). It can handle complex research models more effectively and efficiently, it requires no GOF (goodness of fit) and offers flexibility because of the ability to process different types of nominal, ordinal, interval, and ratio data (Ong & Puteh, 2017).

7.6 CRITERIA FOR ASSESSING THE STRUCTURAL MODEL

Following the prescriptions of Ringle et al. (2015) and Hair et al. (2019), the measurement (or outer) model was first examined using CFA to assess the reliability and validity of the model to ensure all the required criteria are met before the assesMSEnt of the structural model. The reliability was measured using Cronbach's α and composite reliability, while validity was measured using convergent and discriminant. The result of the reliability and validity tests as (tables 6.16 to 6.19 in chapter 6) demonstrate that all the indicators have significant loadings. From Table 6.16, the AVE values also ranged from 0.569 to 0.784 (all beyond the 0.50 threshold)

Central University of Technology, Free State

for the convergent validity of the constructs. Figure 7.1 below summarises the measurement model loadings and their respective p-values (<0.001).

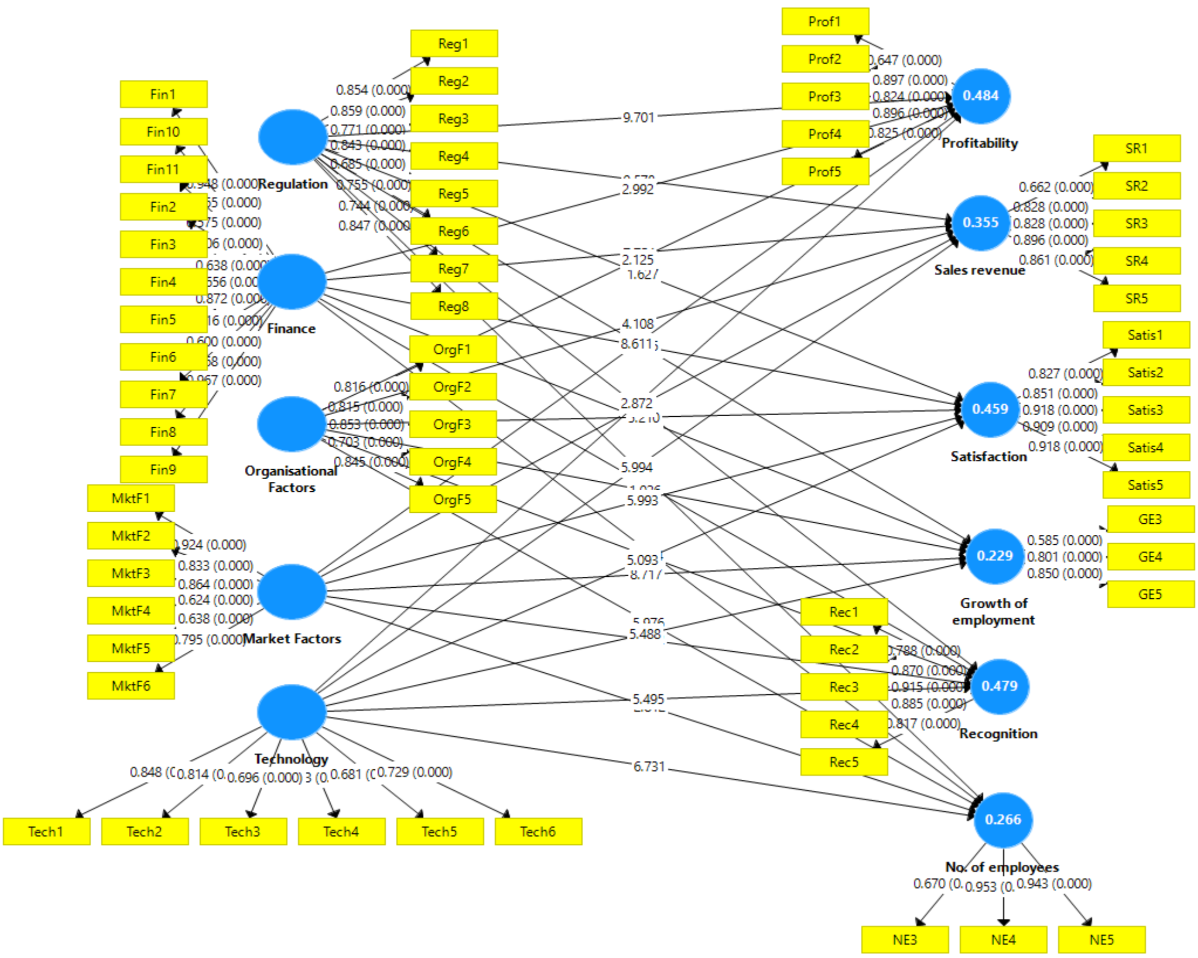

Figure 7.1: Measurement model: loadings and p-values (<0.001)

The results of the reliability and validity tests suggest that the measures have adequate reliability and convergent validity (Hair et al., 2019; Shmueli et al., 2019). Again, all the HTMT values for determining the discriminant validity of the constructs, as reported in Table 6.19, were below the recommended maximum threshold of 0.85, signifying establishment of the discriminant validity of all the concepts (Bin-Nashwan et al., 2019; Henseler et al., 2015).

Having assured the constructs met all the required criteria in the measurement model (Hair et al., 2019), the structural models of the study are evaluated. The main criteria used to assess the structural models in the study are the coefficient of determination (R^2) for the dependent variables, the blindfolding-based cross validated redundancy measure of prediction relevance (Q^2), and the statistical significance and relevance of the path coefficients estimation of path coefficient (β). The description and the threshold values for these criteria are summarised in table 7.17 followed by the examination of the structural models.

Table 7.17: Criteria of assesMSEnt of the Structural model

Criterion	Description	Acceptable fit
R^2 Coefficient of determination	A measure of the model's explanatory power. It measures how much variability in outcome is accounted by the observed independent variables. Values range from 0 to 1	
Q^2 Prediction relevance	Is an assesMSEnt of the model's capability to predict **R^2** through sample reuse/cross-validation. Values should be larger than zero	Values > 0, 0.25 and 0.50 indicate small, medium, and large predictive relevance
β coefficient	A measure of multiple correlation coefficients between independent and dependent variables. Values range from -1 to +1 are evaluated in terms of sign, magnitude and significance	Value t=2.58 p<0.01, t=1.96 p<0.05, and t=1.64 p<0.10
VIF values	A measure of variable inflation factor of the model using the latent variable scores of the predictor constructs. Values should be close to 3 and lower	Values > 5 are indicative of probable collinearity issues .
SRMR	Standardized Root Mean Square Residual (SRMR) assesses the average magnitude of the discrepancies between observed and expected correlations as an absolute measure of (model) fit criterion.	0 indicates perfect fit and the acceptable range is 0 to 0.08

Source: Summarised from (Becker et al., 2015; Shmueli et al., 2016; Hair et al., 2019)

7.7 STRUCTURAL MODEL ASSESMSENT

7.7.1 Testing the effects of control variables on MSE performance

One of the assumptions of this study is that the impact of selected drivers of regulation, finance, organisational factors, market factors and technology on indigenous innovation and MSEs' performance largely depends on commercialisation characteristics (government incentives and commercialisation strategies). Although the study considers the selected drivers as important factors in ensuring a significant impact on commercial performance, government incentives (Olcay & Bulu, 2015; Guan & Yam, 2015; Carboni, 2017), and commercialisation strategies (Auerswald, 2015; Bell-Masterson & Stangler, 2015; Mack & Mayer, 2015; Stam, 2015; Clayton, Feldman & Lowe, 2018) can also play direct or moderating roles in the impact. It is for this reason that the study controlled for these firm commercialisation characteristics in using selected drivers on the indigenous innovation and MSEs' performance.

In examining the relationship between the selected drivers of CII and MSE performance, a separate structural model was assessed to estimate the effects of the control variables on MSE performance. The results include the VIF (i.e., collinearity check), path coefficients, standard errors, t-statistics, p-values, $\mathbf{R^2}$ (i.e., predictive power), $\mathbf{Q^2}$ (i.e., predictive relevance) values and SRMR (i.e., the model fit). The path results are presented in table 7.18, table 7.19 and figure 7.8 below.

Table 7.18: Model 1: Model predictive power, predictive relevance and fit

Construct	R^2	Adjusted R^2	Q^2	SRMR
Sales	0.125	0.115	0.116	0.054
Profitability	0.142	0.133	0.134	
Employment	0.087	0.076	0.049	
Feeling of Success	0.287	0.279	0.236	

As demonstrated in Table 7.18, the **R^2** statistics indicate that the model explains 12.5%, 14.2%, 8.7% and 28.7% of variations in sales, profitability, employment level and feeling of success, respectively. This implies that the government incentives and firm's commercialisation strategies significantly contribute to the variations in the performance of MSEs engaged in CII sales. Correspondingly, the **Q^2** values of the model span from 0.049 to 0.236 which are > 0.0, establishing the fact that the PLS structural model has some predictive relevance. The results also show that the model has a good fit as the SRMR was 0.054 which is less than the 0.08 threshold (Hu & Bentler, 1998; Hair et al., 2019). From **R^2** and **Q^2** statistics, the model has satisfactory predictive power, and variations from the control variables have some small effects on sales, profitability and employment, and moderate effects on the feeling of success.

Following the pattern identified in the literature, government incentives to MSE indigenous innovation sellers (GINMSE) was isolated from incentives to buyers of indigenous innovation (GINBU) and assessed separately. Similarly, commercialisation strategy was assessed in respect of the method of commercialisation (COMAGENT) use of university or related intermediary services **(**USUNIS) and pricing strategies **(**PRITRA). The results of these effects are presented (Table 7.19).

As depicted in Table 7.19, all the VIF values are beneath the more conservative threshold of 3.3, signifying that collinearity is not at critical levels (Hair et al., 2019) , hence the path relations can be examined. According to Hair et al. (2019), VIF values above 5 are indicative of probable collinearity issues among the predictor constructs, but ideally, the VIF values should be close to 3 and lower.

Table 7.19: Result of the effects of firms 'commercialisation characteristic

	Path	VIF	*β*	*SE*	*t*-values	*p*-values
Sales	GINMSE => Sales	1.196	-0.105	0.048	2.178	0.029
	GINBU => Sales	1.045	0.322	0.045	7.115	0.000
	COMAGENT => Sales	1.126	-0.034	0.039	0.858	0.391
	USUNIS => Sales	1.260	-0.103	0.035	2.972	0.003
	PRITRA => Sales	1.208	-0.084	0.048	1.762	0.078
Profitability	GINMSE => Profitability	1.196	-0.024	0.051	0.467	0.640
	GINBU => Profitability	1.045	0.045	8.151	0.000	0.045
	COMAGENT => Profitability	1.126	0.061	0.049	1.253	0.210
	USUNIS => Profitability	1.260	0.136	0.034	3.972	0.000
	PRITRA => Profitability	1.208	0.077	0.051	1.504	0.133
Employment	GINMSE => Employment	1.196	0.139	0.053	2.601	0.009
	GINBU => Employment	1.045	0.110	0.046	2.393	0.017
	COMAGENT => Employment	1.126	-0.024	0.046	0.518	0.605
	USUNIS => Employment	1.260	0.316	0.052	6.073	0.000
	PRITRA => Employment	1.208	0.024	0.053	0.466	0.641
Feeling of success	GINMSE => Feeling of success	1.196	-0.130	0.047	2.768	0.006
	GINBU => Feeling of success	1.045	0.463	0.042	10.927	0.000
	COMAGENT => Feeling of suc.	1.126	0.222	0.057	3.869	0.000
	USUNIS => Feeling of Success	1.260	0.217	0.032	6.765	0.000
	PRITRA => Feeling of Success	1.208	0.031	0.049	0.638	0.523

Note: GINMSE = Government incentives to indigenous innovators/sellers; GINBU = Government incentives to buyers; COMAGENT = Method of commercialisation; USUNIS = Use of university innovation intermediary services; PRISTRA = Pricing strategies; β = Multiple correlation coefficients VIF = Variable inflation factor; SE = Standard Error.

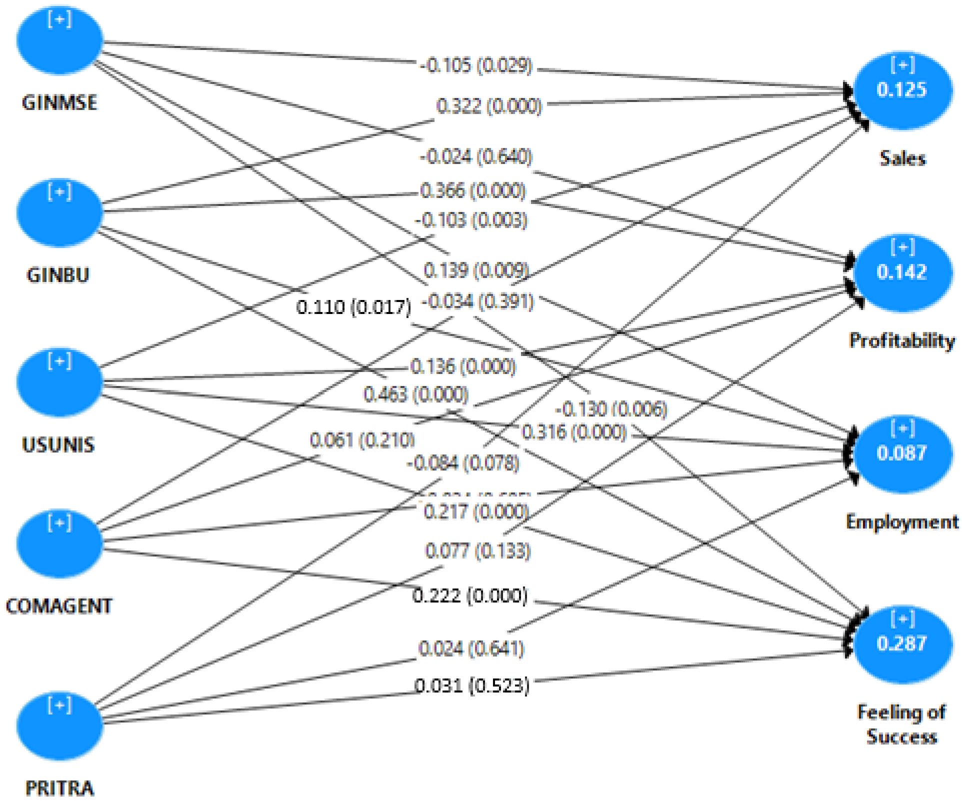

Figure 7.2: Structural model: the effects of control variables on the successful CII

7.7.1.1 The impact of control variables on sales growth of MSEs

The path assesMSEnt of model 1 (table 7.19) indicate that government incentives to MSE indigenous innovation sellers (GINMSE), indigenous innovation (GINBU), use of university or related intermediary services (USUNIS) have significant effect on sales at 5% level. The effects of method of commercialisation (COMAGENT) indicating (β = -0.034; SE = 0.039; t = 0.858; p = 0.391), pricing strategies (PRITRA) indicating (β = -0.084; SE = 0.048; t = 1.762; p = 0.078), on sales are, however statistically insignificant at 5% level. Further evaluation of the correlation coefficients indicates that only GINBU government reveals significant positive effects on sales: (β = 0.322; SE = 0.045; t = 7.115; p = 0.000). This implies that one standardised unit increase in government incentives for buyers of innovations will lead to an increase in predictable value of sales by 32.2%, holding other variables constant. GINMSE:(β = -0.105; SE =

0.048; t = 2.178; p = 0.029), and USUNIS: (β = -0.209; SE = 0.058; t = 3.597; p = 0.000) exhibited significant negative effect on sales, implying a unit increase in GINMSE and USUNIS could rather lead to a decrease in predictable value of sales respectively by 10.5 and 20.9%, ceteris paribus.

The positive significant effect of government incentives to buyers of indigenous innovation on sales suggested by the study is consistent with earlier studies on government incentives and innovation performance particularly on Ghana (Amankwah-Amoah & Sarpong, 2015; Srhoj & Zilic, 2020), while the indicated significant negative effect of incentives to MSEs rather supports the mixed feelings and empirical evidence on government incentives (Carboni, 2017; Zhang & Guan, 2018). Similarly, the negative correlation of sales with the use of university intermediary services is consistent with other studies (Iyortsuun, 2017; Abdulai et al., 2020) that also signalled mixed effects of innovation and intermediary services on innovation and firm performance.

7.7.1.2 The impact of control variables on profitability of MSEs

From the path assesMSEnt (Table 7.19), government incentives to buyers of indigenous innovation (GINBU), use of university or related intermediary services (USUNIS) have significant effect on profitability at 5% level. The effects of government incentives to MSE indigenous innovation sellers (GINMSE), method of commercialisation (COMAGENT) and pricing strategies (PRITRA) indicating [(β = -0.024; SE = 0.051; t = 0.467; p = 0.640), (β = 0.061; SE = 0.049; t = 1.253; p = 0.210), and (β = 0.077; SE = 0.051; t = 1.504; p = 0.133)] respectively, on sales, are statistically insignificant at 5% level.

The correlation coefficients indicate that both GINBU (β = 0.366; SE = 0.045; t = 8.151; p = 0.000) and USUNIS (β = 0.103; SE = 0.050; t = 2.047; p = 0.041), have significant positive effects on profitability. The implications are that that a standardised unit increase in GINBU and USUNIS will lead to an increase profitability of MSE by 36.6% and 10.3% respectively. The positive significant effect of GINBU on profitability revelation by the study supports the emerging views in the literature (Mersky et al., 2016; Zhang et al., 2016; Eisenberg & Price, 2017). Similarly, the positive significant effect of USUNIS on profitability is consistent with earlier studies (Auerswald, 2015; Bell-Masterson & Stangler, 2015; Feldman & Lowe, 2018).

7.7.1.3 The impact of control variables on employment growth of MSEs

From the path assesMSEnt (Table 7.19), the effects of government incentives to MSE indigenous innovation sellers (GINMSE), incentives to indigenous innovation buyers (GINBU), use of university or related intermediary services (USUNIS) are significant on employment level at 5% level. The COMAGENT => Employment path, (β = -0.024; SE = 0.046; t = 0.518; p = 0.605), and the PRITRA => Employment path (β = 0.024; SE = 0.053; t = 0.466; p = 0.641) cannot be statistically explained as they are insignificant at 5% level.

Further evaluation of the correlation coefficients shows positive significant effects (β = 0.139; SE = 0.053; t = 2.601; p = 0.009) for GINMSE, (β = 0.110; SE = 0.046; t = 2.393; p = 0.017) for GINBU and (β = 0.316; SE = 0.052; t =6.073; p = 0.000) for (USUNIS) on employment level. Thus, a standardised unit increase in GINMSE, GINBU and USUNIS could respectively lead to 13.9%, 11% and 31.6% increment in employment level, everything held net. The positive significant effect of government incentives (in term of both GINMSE, GINBU) on employment level inferences are consistent with earlier studies on government incentives and innovation performance particularly on Ghana (Amankwah-Amoah & Sarpong 2015; Srhoj & Zilic, 2020). Similarly, the positive significant effect of USUNIS is consistent with earlier studies (Jamil et al., 2015; Feldman & Lowe, 2018; Schmitt & Muyoya, 2020).

7.7.1.4 The impact of control variables on feeling of success of MSE Owners

The path assesMSEnt of model 1 (Table 7.19) shows government incentives to MSE indigenous innovation sellers (GINMSE), incentives to buyers of indigenous innovation

(GINBU), use of university intermediary services (USUNIS), and method of commercialisation (COMAGENT) have significant effect on feeling of success at 5% level. On the other hand, the effects of pricing strategies (PRITRA) indicating (β = 0.031; SE = 0.049; t = 0.638; p = 0.523) is statistically insignificant, at 5% level, in explaining variations in feeling of success.

The correlation coefficients show GINBU, COMAGENT and USUNIS, respectively indicating [(β = 0.463; SE = 0.042; t = 10.927; p = 0.000), (β = 0.222; SE = 0.057; t = 3.869; p = 0.000) and (β = 0.103; SE = 0.050; t = 2.047; p = 0.041)], have significant positive effects on feeling of success. The inference is that one standardised unit increase in GINBU, COMGENT, and USUNIS will lead to an increase in predictable value of success feeling by 46%, 4.2% and 10.9% respectively, if everything is held net. Conversely, GINMSE => Feeling of success path [(β = -0.130; SE = 0.047; t = 2.768; p = 0.006) exhibited negative correlation implying that a standardised unit increase in it could result in a decrease in predictable value of feeling of success by 13%, ceteris paribus.

The positive significant effect of GINBU on feeling of success inference from the result is consistent with earlier studies on government incentives and innovation performance in general on Ghana (Amankwah-Amoah & Sarpong, 2015; Srhoj & Zilic, 2020), while the indicated significant negative effect of GINMSEs rather supports the mixed feelings on government incentives (Carboni, 2017; Zhang & Guan, 2018). The positive significant effect of COMAGENT on feeling of success revelations rather seem dissimilar to views of earlier scholars (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016) that suggested lack of trust and coherent policies on tech transfer from knowledge-based institutions (KBIs) to firms in Ghana. Also, the positive correlation of feeling of success with the UNISUS support the findings of Hossain (2018) that revealed innovation intermediary platforms give users a different way of thinking, networks, fun and sense of achievement.

Central University of Technology, Free State

7.7.2 Testing the effects of selected drivers on and MSEs' performance

This section examines the effects of the selected commercialisation drivers on indigenous innovation and performance of MSEs in the small-scale industry in the Volta Region of Ghana. In line with the conceptual framework, the study proposed that the selected drivers (regulation, finance, organisational factors, market factors and technology) have a positive relationship with MSE performance. It therefore tested the proposed hypotheses and assessed the impact of the drivers on MSE performance. Having established the adequacy of the measurement model, assesMSEnt of the structural model was done to estimate the effects of the drivers on MSE performance. Each structural path was assessed if they were significant in the hypothesised direction (Hair et al., 2019; Ringle et al., 2020). These results are presented in Tables 7.20 and 7.31, and Figure 7.7 below.

Table 7.20: Model 2: Model predictive power, predictive relevance and fit

Construct	R^2	Adjusted R^2	Q^2	SRMR
Sales	0.355	0.348	0.420	0.061
Profitability	0.484	0.478	0.471	
Employment	0.286	0.278	0.223	
Feeling of Success	0.511	0.506	0.418	

As revealed in Table 7.20, the statistics indicate that the structural model has an acceptable level of predictive relevance (Q^2>0.0) and predictive power (R^2>0.20) (Hair et al., 2019; Usakli & Kucukergin, 2018). Precisely, the R^2 values show that the model explains 35.5%, 48.4%, 28.6% and 51.1% of the variations in sales, profitability, employment level and feeling of success. Also, Q^2 values of the model which range from 0.223 to 0.471, are > 0.0, established the fact that the PLS structural model has predictive relevance. The results also show that the model has a good fit as the SRMR was 0.061 which is less than the 0.08 threshold (Hu & Bentler, 1998), hence, the path relations can be examined. From $\mathbf{R^2}$ and $\mathbf{Q^2}$ statistics the model has satisfactory explanatory power and relevance, and the selected drivers have moderate effects on all the dimensions of MSE performance.

When the Adjusted R^2 values of the full model (model 2) are compared to that of the control model (model 1 involving the control variables), it is obvious there has been a significant change in the Adjusted R^2 values. The Adjusted R^2 values for the control model are Sales (0.115), Profitability (0.133), Employment (0.076), and feeling of success (0.279). It can be seen that variation in Sales has changed by 23.3% from 11.5% to 34.8%. Similarly, variations in Profitability changed from 13.3% to 47.8% by 34.5%. For Employment, too, it has changed from 7.6% to 27.8%, thus, 20.2%. Finally, the feeling of success has changed from 27.9% to 50.6% by 22.7%. These observed changes clearly suggest that the independent variables significantly explain the variances in the dependent variables. Thus, the indigenous innovation commercialisation (CII) factors significantly contribute to the variations in all the four dimensions of MSE performances.

As shown in Table 7.21, all the VIF values are beneath the more conservative threshold of 3.3, demonstrating that collinearity is not at critical levels (Hair et al., 2019). As presented earlier (table 7.21 and Figure 7.3), all the standardised path coefficients and their p-values and t-values showed significant effects of innovation commercialisation factors on the successful commercialisation, except for the effect of regulation on sales.

Table 7.21: Path results of effect of selected CII drivers on CII MSE performance

Hypotheses	Path	VIF	*β*	*SE*	*t*-values	*p*-values
H1a	Regulation=> Sales	1.121	-0.028	0.043	0.641	0.522
H1b	Regulation => Profitability	1.121	-0.369	0.039	9.371	0.000
H1c	Regulation => Employment	1.121	0.306	0.044	7.017	0.000
H1d	Regulation => Feeling of Success	1.121	0.121	0.035	3.443	0.001
H2a	Finance => Sales	1.109	0.326	0.041	7.988	0.000
H2b	Finance => Profitability	1.109	-0.098	0.031	3.180	0.001
H2c	Finance => Employment	1.109	0.229	0.044	5.249	0.000
H2d	Finance => Feeling of Success	1.109	-0.092	0.034	2.720	0.007
H3a	Org. Factors => Sales	1.611	0.235	0.060	3.950	0.000
H3b	Org. Factors => Profitability	1.611	0.103	0.050	2.047	0.041
H3c	Org. Factors => Employment	1.611	-0.209	0.058	3.597	0.000
H3d	Org. Factors => F'ling of Success	1.611	0.317	0.046	6.827	0.000
H4a	Mkt Factors => Sales	1.701	0.128	0.049	2.585	0.010
H4b	Mkt Factors => Profitability	1.701	0.386	0.044	8.687	0.000
H4c	Mkt Factors => Employment	1.701	0.308	0.051	6.023	0.000
H4d	Mkt Factors => Feeling of Success	1.701	0.294	0.040	7.388	0.000
H5a	Technology => Sales	1.594	0.265	0.043	6.209	0.000
H5b	Technology => Profitability	1.594	0.134	0.047	2.840	0.005
H5c	Technology => Employment	1.594	-0.367	0.053	6.929	0.000
H5d	Technology => Feeling of Success	1.594	0.237	0.039	6.026	0.000

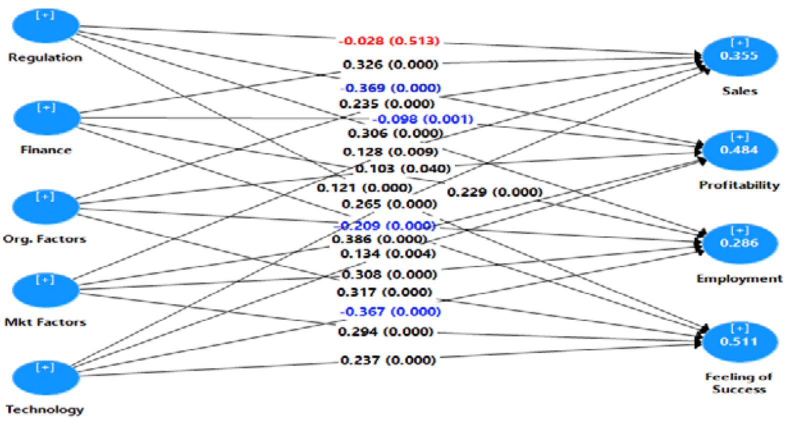

Figure 7.3: Structural model depicting the effects of selected factors for successful CII

Note: Font colour red = Insignificant effect; Font colour blue = Significant negative effect; Font colour black = Significant positive effect.

7.7.2.1 The impact of commercialisation drivers on sales of MSEs

The sales model paths estimated the effect of the drivers on sales and involve hypotheses H1a, H2a, H3a H4a and H5a. Sales is one of the primary measures of successful commercialisation of innovation (Lhuillery et al., 2016; Cirera et al., 2016; Cirera & Muzi, 2016; Smith, 2018; Cornell University et al., 2018). Sales and its growth are an important key performance indicator for MSEs in low-income economies (Yazdanfar & Öhman, 2015; Cirera & Muzi, 2016). Sales metric is a strategic indicator that is used in the decision making of businesses, it acts as a rallying call for the innovation team, investors, and other external stakeholders, and has cascading effects on the firm, the industry, and the economy (Shpak, Kniaz, Myroshchenko & Kolomiyets, 2014; Osoro et al., 2015; Olefirenko & Shevliuga, 2017). Indeed, it is evident from the commercialisation literature that it is the progress of sales that supplies the expected economic effect of innovation to the industry and the economy (Shpak, Kniaz, Myroshchenko & Kolomiyets, 2014). From $\mathbf{R^2}$ (0.355) and $\mathbf{Q^2}$ (0.420) statistics (0.355), the PLS structural model has medium explanatory power and relevance, and the selected drivers have moderate effects on all sales performance (Hair et al. 2019).

7.7.2.1.1 Effect of regulation on sales

As shown by the result (table 7.21) for regulation indicate (β = -0.028; SE = 0.043; t = 0.641; p = 0.522), implying regulation has insignificant negative effect on sales at 5% confidence level. Thus, regulation is statistically insignificant in explaining the sales performance of MSEs in the commercialisation of indigenous innovation (CII) in Ghana. *H1a is therefore rejected*. The evidence from the literature is a mixed one, with some authors suggesting regulations could have different effects on different sectors and firms, and it is not clear if the overall impact is positive or negative (Edler et al., 2016; Fu et al., 2016). Although insignificant, the negative effect of regulation on sales seems to be consistent with (Tang et al., 2020) which portrayed that most regulations negatively influence innovation efficiency and generates detrimental effects, at least, on small enterprises and in the short-term through reducing cash flows. A number of earlier empirical investigations on regulation, innovation, and firm growth in Ghana (Nyarku & Oduro, 2017; Johnson, 2018) also portrayed negative association. Few studies, on the contrary, for example, Donbesuur et al. (2020), shown regulatory enforceability has complementary positive effects on the international performance of MSEs.

7.7.2.1.2 Effect of finance on sales

From the assesMSEnt (table 7.21) of the effects for MSEs commercialising indigenous innovation in the Ghanaian SSI sector, financial variables have significant positive effects on sales (β = 0.326; SE = 0.041; t = 7.988; p = 0.000). From the results, *H2a is therefore accepted*. Thus, the link between finance and sales in the Ghanaian SSI sector is statistically significant at a 95% confidence level. A unit improvement in the financial environment can lead to 33% increases in the sales level of MSEs, all things being equal. Although the current study is specific to MSEs commercialisation of indigenous innovation in SSI, this result collaborates with earlier studies in the literature that provided empirical evidence of a strong link between finance and firms' innovation and commercial and performance (Fowowe, 2017; Nwosu & Orji, 2017. Babajide, 2017; Ullah & Wei, 2017; Mann, 2018; Nkegbe, 2018; Ullah, 2019; Sekyi et al., 2020).

7.7.2.1.3 Effect of organisational factors on sales

The results of the set of organisational variables on indigenous innovations sales performance indicate (β = 0.235; SE = 0.060; t = 3.950; p = 0.000) which is significant at 5%. *Hypothesis, 3a, is therefore accepted*. From the results, the link between organisational factors and sales of MSEs in the Ghanaian SSI sector is statistically significant and a unit improvement in organisational factors can lead to 24% increases in sales. This observation highlights the importance MSEs knowledge management in terms of stock of technical and people skills and application of knowledge to innovation development, operations, and marketing, which is consistent with earlier research on human capital and firm performance (McGuirk, Lenihan & Hart, 2015; Gao & Hafsi, 2015; Akinboade, 2015; Asiedu, 2016; 2014; Atiase, 2018). It also emphasises the relevance of MSEs' ability to gather resources and efficiently use resources as well as networks and cooperation that can enhance their innovation performance. This is also consistent with earlier research relating to firms' inputs management and innovation (De Zubielqui et al., 2014; Ansariet al., 2014, 2018).

7.7.2.1. 4 Effect of market factors on sales

As shown in table 7.21, market factors correlate positively with sales performance. The model assesMSEnt results indicate (β = 0.128; SE = 0.049; t = 2.585; p = 0.000). This is statistically significant, *therefore Hypothesis 4a is accepted*. From the result, market factors are statistically significant at 5% in predicting sales. A unit improvement in market factors for indigenous innovation can increase sales performance of MSEs in the SSI sector by 13 %, *ceteris paribus*. The result implies that market factors in dimensions of the 4As are very helpful in speeding up market acceptance and improving sales of indigenous innovation. The positive association of unfavourable market factors for indigenous innovation and their poor sales performance revelation by the study is supported by other earlier studies to a varying degree (Tiwari et al., 2014; Krämer & Kalka, 2017; Atuahene-Gima, 2018; Dean, 2020). This observation is also consistent with the BRI models and builds upon the BOP proposition that exploiting the fortune at the BOP by finding ways to serve low-income consumers can achieve commercial success (Anderson & Markides, 2007).

7.7.2.1. 5 Effect of technology on sales

As shown in table 7. 21, technology correlates positively with sales significantly at a 5% level. The result indicates (β = 0.265; SE = 0.043; t = 6.209; p = 0.000). Thus, a unit improvement of technology can lead to about 27% increases in sales performance, all other things held constant. *Hypothesis 5a is therefore accepted*. Technology undoubtedly has positive impacts on sales performance of indigenous innovation. This result confirmed previous studies that provided evidence of positive links between technology and innovation performance (Audrey, 2016; Zaglago, 2019; Coffie et al., 2020; Kwaku & Fan, 2020). Kwaku and Fan (2020) related with evidence the development of the plastic packaging industry in Ghana to product improvement and market expansion of MSEs in the food industry. The revelation from the analysis is also consistent with findings of Ndirangu (2016) and Coffie et al. (2020) that highlighted the role of digital technology in business promotion, improvement of customer loyalty and market expansion of small businesses.

7.7.2.2 The impact of commercialisation drivers on profitability of MSEs

Another important measure of commercial success of indigenous innovation is its impact on profitability. The profitability of MSEs in SSI is essential to measure efficiency and effectiveness of indigenous innovation. From the BRI perspective, frugal innovation can aid MSEs with less asset, if SSI sector dramatically cut cost and improve profitability (Radjou & Prabhu, 2014: Zeschky, Winterhalter & Gassmann, 2014). The emphasis on profitability of innovation is further accentuated by the fact that it goes beyond internal financial performance as the interest extend to external stakeholders such as investors, creditors, and the Government. Moreover, and sociologically, the potential of innovation to change societal structure is dependent on profitability as it is the stream of profits that make the lead innovators and entrepreneurs prosperous and move up the social ladder together with their families.

The profitability model paths estimated the effect of the drivers on profitability and these paths have been assessed using hypothesis H1b, H2b, H3b, H4b and H5b. The study measured profitability by reported profit margins of the sampled MSEs from 2016 to 2020. From $\mathbf{R^2}$ (0.484) and $\mathbf{Q^2}$ (0.471) statistics the PLS structural model has medium explanatory power and relevance, and the selected drivers have moderate effects on profitability (Hair et al. 2019). The specific effect of each driver is presented below.

7.7.2.2.1 Effect of regulation on profitability

Regulation–profitability path (table 7.21) indicate (β = -0.369; SE = 0.039; t = 9.371; p = 0.000). The negative link between regulation and profitability is statistically significant at 5% level. Thus, a unit decrease in regulatory level can lead to about 37% increases in profitability of MSEs commercialising indigenous innovation. This implies regulation, overall, has negative effect on profitability. *Consequently, H2a is rejected*. The revelation by the current study seems to correspond to recent emerging views (OECD, 2018; Khan et al., 2020) that the complication of rules and regulations, high compliance costs, and inefficient rules are hindering business activities of MSEs. The reviewed literature, however, largely suggest unclear overall effect of regulation on innovation and profitability of firms, urging the need for different studies on specific sectors, firms, and economies.

7.7.2.2.2 Effect of finance on profitability

Finance–profitability path from the model assesMSEnt also revealed negative associations. The result as presented in table 7.21 is (β = -0.098; SE = 0.031; t = 3.180; p = 0.001). The implication is that everything held net, improving the financial variables by a unit would rather result in a decrease in profitability by 3.1% and this is statistically significant at 5%. Thus, overall, the financial environment correlates negatively with profitability of indigenous innovation. *H2b can therefore not be accepted and is rejected*. This result is contrarily to earlier studies that showed a strong positive link between credit availability and firms' commercial and innovation performance (Nwosu & Orji, 2017; Babajide, 2017; Ullah & Wei, 2017; Mann, 2018; Ullah, 2019). It is however consistent with other emerging studies (Donou-Adonsoua & Sylwester 2016; Atiase et al., 2019). Donou-Adonsoua and Sylwester (2016) observed that most MSEs struggle with repaying their loans because of the short-term nature of loans made to them.

7.7.2.2.3 Effect of organisational factors on profitability

The results of the organisational variables on profitability of CII indicate ($\beta = 0.103$; SE = 0.050; t = 2.047; p = 0.041) significant at 5%. From the results, the link between organisational factors for CII and sales is statistically significant and a unit improvement in organisational factors can lead to over 10% increase in profit. *Hypothesis 3a, is therefore accepted*. This result supports the importance of a firm's human capital and ability to deploy resources and capabilities to achieve business results and is consistent with other studies (Popa & Ciobanu, 2014; Suseno et al., 2020; Martínez-Azúa et al., 2020) that suggest a strong link between organisational factors and firms' productivity and profitability. The finding is also consistent with earlier research (Akinboade, 2015; Rahman & Zaman, 2016; Asongu & Roux, 2017) that provided abundance empirical evidence of strong link between human capital and innovation performance.

7.7.2.2.4 Effect of market factors on profitability

As shown in table 7.21, market factors correlate positively with profitability and the full model results indicate ($\beta = 0.386$; SE = 0.044; t = 8.687; p = 0.000). The result is statistically significant at 5% level. From the result, market factors are statistically significant and can predict profitability. A unit improvement in market factors for CII can improve profitability by 39%. *Hypothesis 4b is hence accepted*. Market factors positively correlating with profitability observation by the study is supported by earlier research, for example, Chan et al. (2018) emphasised high costs and market constraints as parts of the most critical barriers to commercialisation of green building technology in the Ghanaian building industry. The observation is also consistent with strategic management views that through cost leadership and competitive strategies, MMSEs creates efficient-scale facilities, reduction in overheads and expenditures, and gain higher returns on assets (Sangwa & Sangwan, 2018; Kharub et al., 2019; Kharub et al., 2019). This finding also supports BRI views that indigenous innovation must focused on creative cost cutting and low price in order not to be displaced by substitutes (Krämer & Kalka, 2017).

7.7.2.2.5 Effect of technology on profitability

Hypothesis 5b is accepted as the model assesMSEnt (β = 0.134; SE = 0.047; t = 2.840; p = 0.005) in table 7.21 indicated a positive relationship for technology and profitability. The result shows a 13.4% corresponding improvement in profitability with a unit change in technology at a 5% significant level. The findings conform to some existing and emerging studies on innovation and commercialisation. Onufrey (2014) observed structural couplings and firms' increased access to system-level assets and innovation performance. Coffie et al. (2020) provided some empirical evidence of how digital technology is encouraging prompt payment and improved cash flow, and making MSEs efficient in Ghana. There are also, however, some dissimilar views in the literature that shown negative impacts of new technologies and increased operational and financial risks on the performance of MSEs (Chan et al., 2018).

7.7.2.3 The impact of commercialisation drivers on Employment Growth

The employment model paths estimated the effect of the selected drivers on the employment level of MSEs engaged with CII. These paths has been assessed with the guidance of hypothesis H1c, H2c, H3c H4c and H5c. At messo level, an appropriate measure of commercial success of indigenous innovation is employment levels. According to Mahmutaj and Krasniqi (2020), within the context of MSEs and MSEs, employment is a good indicator of economic performance because of its visibility and simplicity to obtain. Indeed, the increasing attention of academics and government policy focus on innovation and MSEs and MSEs as strategic sectors is because of their potential for employment generation. Employment was measured in the study by the reported generated employment and its growth of the sampled MSEs from 2016 to 2020 where applicable. From $\mathbf{R^2}$ (0.286) and $\mathbf{Q^2}$ (0.223) statistics, the PLS structural model has satisfactory explanatory power and relevance, and the selected drivers have some effects on employment level (Hair et al., 2019). The specific effects of each driver on employment level are presented below.

7.7.2.3.1 Impact of regulation on employment

The PLS structural model results (table 7.21) of regulation-employment path indicate ($\beta = 0.306$; SE = 0.044; t = 7.017; p = 0.000), implying, ceteris *paribus*, a unit improvement in the regulatory employment for indigenous innovation can lead to 30.6% increases in employment level. Thus, the link between overall regulation and employment levels of MSEs in the Ghanaian SSI sector is statistically significant. *H1c is therefore accepted.* The current revelation seems to contradict most empirical investigations on regulation and general innovation performance which overwhelmingly infer negative associations (Dahlstrand et al., 2016; Oduro & Nyarku, 2017; Johnson, 2018; Tang et al., 2020). The current finding is, however, consistent with emerging views that isolating different dimensions of innovation performance can yield different results (Chege & Wang, 2020; Adomako, 2020). Indeed, Adomako (2020) also recently provided some evidence that sustainable innovation regulation has a significant positive association with MSE employment growth.

7.7.2.3.2 Effect of finance on employment

Finance–employment path results ($\beta = 0.229$; SE = 0.044; t = 5.249; p = 0.000), from the PLS structural model results in table 7.21, show there exists a positive correlation between the financial variables and employment. Thus, overall, finance correlates positively with employment. A unit improvement in the financial environment could increase the employment level of MSEs by 22.9%, everything held net. The link is significant at 5%. *$H2_C$ is therefore accordingly accepted*. This result is supported by other research (Boame et al., 2014; Owusu et al., 2015; Eton et al., 2017; Atiase et al., 2019) that provided earlier evidence that suggested accessibility, adequacy, and flexibility of repayment terms of credit have positive impacts on employment generation of small businesses.

7.7.2.3.3 Effect of organisational factors on employment

The analysis of organisational variables and employment path presented in table 7.21 indicate (β = -0.209; SE = 0.058; t = 3.597; p = 0.000). Thus, a unit improvement in organisational factors can lead to a 20.9% decrease in the employment level of MSEs engaged in CII. The organisational factors negatively correlate with employment level and the result is statistically significant at 5%. The negative associations, however, do not support the Hypothesis. *H3c is therefore rejected*. There is rather a dearth of literature on organisational factors for innovation commercialisation. Employment and innovation linkages are also complicated (Cramer & Krueger, 2016; Tassinari & Maccarrone, 2017). The current observation with MSEs engaged in CII in the Ghanaian SSI sector seems to relate to Roy et al. (2018) which suggests that innovation, in general, is only labour-friendly in high-tech firms, but not in low-tech manufacturing and service sectors.

7.7.2.3.4 Effect of market factors on employment

As shown in PLS structural model result in table 7.21, market factors correlate positively with the employment level of MSEs. The results indicate (β = 0.308; SE = 0.051; t = 6.023; p = 0.000), inferring that a standardised unit improvement in market factors for indigenous innovation can increase employment level by 30.8%, *ceteris paribus.* The result is statistically significant at 5% and supports the set-out hypothesis, *therefore, H4c is accepted*. This finding is also supported by earlier research such as Sheng et al. (2013) and Sangwa and Sangwan (2018) that observed that firms in underdeveloped environments can achieve result from their marketing and competitive capabilities. It also generally conform to a number of earlier research (Radjou & Prabhu, 2014; Hang et al., 2014; Tiwari et al., 2014; Knorringa et al., 2016; Krämer & Kalka, 2017; Dean, 2020) that highlight a strong link between competitive strategies and innovation performance. Specific to employment, it is consistent with Bin et al. (2019) who provided novel evidence of the role of market and regional factors on innovation and firm employment growth.

7.7.2.3. 5 Effect of technology on employment

From the model result in table 7.21, (β = -0.367; SE = 0.053; t = 6.929; p = 0.000), technology followed similar pattern as organisational factors have negative bearing on employment level of MSEs. The implication is that a standardised unit increase in the application of technology in the commercialisation of indigenous innovation could rather decrease the employment level of MSEs by 36. 7% all other things being equal. The result is statistically supported and significant at 5%. Therefore, the exhibited negative technology-employment path means Hypothesis H4c is rejected. The literature largely portrayed non constant effects of technological innovation on employment (Calvino & Virgillito, 2018). The negative link observation is consistent with other recent research (Quaye & Mensah, 2019) that pointed the role of technology in the speedy fading out of indigenous knowledge in the Ghanaian small-scale industry. The current observation also supports the evidence provided by Roy et al. (2018) relating to insignificant links between technological innovation and job creation in low-tech manufacturing and service sectors.

7.7.2.4 The impact of commercialisation drivers on feeling of success

The feeling of success model paths estimated the effect of the selected drivers on MSE owners' feeling of achieved success. The assesMSEnt of feeling of success paths is guided by hypotheses H1d, H2d, H3d H4d and H5d. Following some recent realisation that subjective measures can even be more predictive of entrepreneurs' decision-making behaviours and performance than objective measures, some scholars urged the use of non-financial indicators and stakeholder satisfaction alongside financial performance indicators (Wach et al., 2016; Mohamad & Radzi et al., 2017; Isaga, 2018; Dijkhuizen et al., 2018). In spite of some measurement and inferential challenges, subjectively, feeling of achieved personal success in terms of personal satisfaction of achievement and community recognition is a good measure of MSE performance. Indeed, innovators and MSEs in expressing feelings of success would invariably reflect on their achieved financial success. With $\mathbf{R^2}$ and $\mathbf{Q^2}$ statistics of (0.511) and (0.418) respectively, the structural model has large explanatory power and relevance, and the selected drivers have substantial effects on MSE owners' feeling of success (Hair et al., 2019). The specific effects of each driver on the feeling of success are presented below.

7.7.2.4.1 Effect of regulation on feeling of success

From table 7.21, the result for regulation-feeling of success path is ($\beta = 0.121$; SE = 0.035; t = 3.443; p = 0.001), and this relationship is statistically significant. Thus, from the perspectives of MSEs commercialising indigenous innovation in the Ghanaian SSI sector, regulation overall has positive bearings on business owners feeling of achieved success. A unit increase in regulatory level can lead to 12.1 % increases in MSE owner's feeling of success. *H1d is therefore accepted*. Literature on regulation and MSE owners' feeling of success is scarce, not only in the context of indigenous innovation in Ghana but also internationally despite the rising interest in subjective measures of firm performance. This positive evidence from the study supports a study of the antecedents of innovation intentions in Germany's renewable energies sector that identified that reliability and continuity of regulation was particularly relevant to entrepreneurs' considerations of bringing new products and services to the market (Grünhagen & Berg, 2011; Mallett, Wapshott & Vorley, 2018).

7.7.2.4.2 Effect of finance on feeling of success

The results of this study exhibit a negative correlation between finance and feeling of success. From table 7.21, the result ($\beta = -0.092$; SE = 0.034; t = 2.720; p = 0.007), is statistically significant at predicting MSE owners' feeling of success. It implies that a unit improvement in the financial environment could rather reduce owners feeling of success by 9.2%. This evidence does not, however, support the set-out hypothesis, hence, *H4b is rejected*. This evidence somehow seem strange and dissimilar to emerging studies that highlight access to finance and availability of financial resources as a key driver in the creation of innovative new ventures, entrepreneurial survival, and success (Cabrera & Mauricio, 2017; European Central Bank, 2018). It is also inconsistent with Gupta and Mirchandani (2018) that provided some evidence of positive correlation between availability of financial resources, and self-achievement and success feelings of women from the Arab World.

7.7.2.4.3 Effect of organisational factors on feeling of success

The PLS structural model result (table 7.21) of the study (β = 0.317; SE = 0.046; t = 6.827; p = 0.000) suggest a positive correlation of organisational variables and feeling of success with indigenous innovations. The result, which is significant at a 5% confidence level, implies a unit improvement in the organisational factors can correspondingly improve the feeling of success by 31.7%. *H4c is therefore accordingly accepted*. The result emphasises the importance of the ability to plan, organise and use resources in difficult environments in personal and business achievement. The findings are consistent with those reported in Ofunoye (2017) and Fatoki (2018) in which entrepreneurial resilience (MSEs' organisational capabilities in a difficult environment) has a significant positive relationship with individual success.

7.7.2.4.4 Effect of market factors on feeling of success

The PLS structural model assesMSEnt (table 7.21) shows (β = 0.294; SE = 0.040; t = 7.388; p = 0.000) for market factors-feeling of success path. The result is statistically significant in predicting MSE owners feeling of success at 5% and it implies a unit improvement in market factors could improve the level of feeling of success by 29.4%. Based on this result, *H4d is accepted*. This finding is consistent with earlier studies, for example, the systematic review of Cabrera and Mauricio (2017) that highlight the entrepreneur's motivation, recognition, and personal development as a success for women entrepreneurship and suggest a strong positive relationship between access to market and resource opportunities and women entrepreneurial success.

7.7.2.4.5 Effect of technology on feeling of success

The PLS structural model results show significant positive bearings of technology on the feeling of success. The technology-feeling of success path (table 7.21) indicate (β = 0.237; SE = 0.039; t = 6.026; p = 0.000). Thus, the link is statistically significant and a unit improvement in the application of technology can lead to 23.7 % increases in MSE owners feeling of success. *H5d is consequently accepted*. This result highlights the importance of subjective factors in technology and innovation adoption and acceptance, and the role technology can play in business performance. It is consistent with earlier studies, for example, the theoretical review of Tirgu-Mures (2017) suggesting that technology adopters are strongly motivated by self-efficacy achievement, emotions, and social image. The strong positive technology-personal feeling of success links is also supported by earlier research (Khan et al., 2018) that provided some evidence of a strong relationship between technology usage behaviours and the perceived reputation of individuals.

7.8 CII DRIVERS AND BUSINESS PERFORMANCE LINKS IN GHANA

Following Hair et al. (2019), the last section largely focused on the prediction aspects of the commercialisation of indigenous innovation model (the CII model). Discussions of the identified linkages between the drivers, and the indigenous innovation and MSE performance is now provided in this section.

7.8.1 Regulation-business performance links

With an understanding from the BRI theories that MSEs in the commercialisation process face the challenge of dealing with institutional voids and lacks (Prahalad, 2005; Kaplinsky, 2011; Bhatti, 2012), the study measured the effect of regulation on indigenous innovation in terms of perception of its ease, cost and time burdens, and creation of demand opportunities. To examine the influence of regulation on MSE performance in the commercialisation of indigenous innovation (CII), four hypothesised paths were assessed (table 7.22). Per the model results at a 5%

significance level, regulation has insignificant effects on sales, significant negative effects on profitability and significant positive effects on employment and feeling of achieved success.

Table 7.22: Influence of regulation on MSEs' Performance in CII

Hypothesis/ Path		*B*	Effect	Ranking
H1a	Regulation=> Sales	-0.028	Insignificant negative	Non predictor of sales
H1b	Regulation => Profitability	-0.369	Significant negative	High negative predictor of profitability
H1c	Regulation => Employment	0.306	Significant positive	2nd highest predictor of employment
H1d	Regulation => Feeling of Success	0.121	Significant positive	Weak negative predictor of feeling of success

Thus, from the model, a hundred per cent improvement in the regulatory environment could result in about a 31% increase in the employment level of MSEs, 12% increase in the feeling of achieved success by MSE owners but could also reduce the profitability of indigenous small scale industrial activities by 37%.

Although regulation has very high negative effects on profitability and quite weak effects on the feeling of success, it has the second-highest positive effects on employment (30.6%) almost the same as market factors (30.8%). The mixed effects of regulation on the firm performance dimensions are supported by other evidence in the literature (Edler et al., 2016; Fu et al., 2016; Tang et al., 2020). Although regulation compliance is a necessary ingredient for the successful commercialisation of indigenous innovations and firms' performance, MSEs in SSIs in Ghana often begin informally and have to comply with regulations as they expand. Some regulations as explained by Elder et al. (2016) can indeed create new demand and force innovators to improve standards and add additional value for consumers. Indeed, there are a few demand-side policy prescriptions emerging in the current Ghanaian innovation policy environment (UNIDO, 2015; Quaye et al., 2019).

The evidence of insignificant effects of regulation on sales as well as significant negative effects on profitability provided by the study is not surprising. In the SSI sector in Ghana, the market is fragmented, volumes are low and regulation, in general, creates constraints and cost burden on supply-side for the MSEs and higher price on demand-side for consumers. Other studies (Oduro & Nyarku, 2017; Johnson, 2018) also confirmed and raised the regulatory regime in Ghana as a constraint to commercialisation and new venture creation. Regulation that project innovation and firms are also largely not applicable in the MSE sector. It is rather apparent that MSEs in the SSI sector face the same regulatory rules and costs as MSEs and large enterprises. For example, an agro-processing MSE with a turnover under GH₵10, 000 (Ten Thousand Cedis) has to pay the same licensing fee as MSE with a turnover of over GH₵200,000 (Two Hundred Thousand Cedis).

From the BRI perspective too, low cost and price are key for successful commercialisation in resource-constrained environments. It is evident in the Ghanaian SSI sector that there are a lot of institutional voids, compliance creates a lot of unnecessary burdens, but MSEs do not feel the incentives for compliance. It is apparent that MSEs do not have the resources and capability to fully comply with the regulation and enjoyed the associated advantages. These observations confirmed earlier observations that the effect of regulatory incentives are not yet obvious to Ghanaian MSEs commercialising innovation (Quaye et al., 2019). Clearly, a lack of supportive and market-augmenting governmental regulations are barriers to the commercialisation of indigenous innovation in Ghana. Some MSEs complained during the survey that the tough enforcement of regulation and attitudes of some regulatory staff have caused losses and bankruptcies in their commercialisation process. It is obvious on the ground and from the literature that governmental rules, taxation, environmental regulations, lending requirements and licensing are barriers to commercialisation activities of MSEs in SSI sector.

On the other hand, the revealed positive link between regulation and employment collaborates with other studies (Adomako, 2020) is not surprising. Generally, MSEs/MSEs in SSI serve as the bedrock for indigenous entrepreneurship, are labour intensive, employ more and adapt easily to constraints (Cozzens & Sutz, 2014). Of course, there are skepticism that most of the jobs in SSI sector are informal, not associated with increases in productivity, pay low income, can exacerbate exploitation and inequality and the statistics can be flawed as it does not take into consideration offsetting effects (Edusah & Antoa, 2014; Essel, Adams & Amankwah, 2019). Nonetheless, the strong and positive link between regulation and employment links has good implications for policy in Ghana. It implies that as regulation improves standards, more formal and regulated jobs can be created through indigenous innovation in SSI sector. Regulatory compliance means going formal and making informal sector jobs counted as proper jobs. Many rules and regulations (e.g health and safety, security rules, the labour law) can help MSEs in the SSI create a better working environment and enhance employee's productivity.

The observed positive link between regulation and feeling of achieved success of MSE owners is unexpected and interesting. Nonetheless, the overall effect of regulation on firm performance is complex. Indeed, there is evidence on the ground that some aspects of innovation regulation create burdens in terms of cost, time, and sometimes personal harasMSEnt for MSE owners in the SSI sector. This finding is also amid the evidence that firms in low-income and emerging economies exhibit dangerously low rates of regulatory compliance (Malesky & Taussig, 2017). It is also clear that Ghanaian MSE owners and managers dislike regulation generally. However, there is also evidence that meeting regulatory requirements improve MSE owner's reputation in the eyes of the public, regulators, the media, and other stakeholders. MSEs in the Ghanaian SSI sector who managed to secure licenses and permits tout it as an achievement. Local radio stations, for example, insist herbalists and food processors comply with the Food and Drug Authority (FDA) before their innovations are promoted on the radio. Regulation compliance shows that a firm is running a trustworthy operation, has a sense of responsibility and positive culture that can attract and retain talented employees, all of which can contribute to a higher feeling of achieved success. Regulation and its compliance legalise innovative activities, reduces legal problems and give MSE owners peace of mind. In essence, regulation is a double edge sword in the Ghanaian National System of innovation (GNSI), particularly for MSEs engaged in the commercialisation of indigenous innovation in the SSI.

7.8.2 Finance- business performance links

The study recognised from BRI theoretical explanation that firms in the Ghanaian SSI are resource-constrained and have to use resources in a different way (Baker & Nelson, 2005; Bhatti, 2012), and therefore examined finance in terms of access, cost, and patience of capital. The influence of finance on MSE performance in the commercialisation of indigenous innovation was assessed with the guidance of hypotheses (H2a, H2b, H2c, and H2d) at a 5% significance level (table 7.23). Per the model results, overall finance has significant positive effects on sales and employment, and on the other hand significant negative effects on profitability and feeling of achieved success.

Table 7.23: Impact of finance on MSEs' performance in CII

Hypothesis/ Path		*B*	Effect	Ranking
H2a	Finance => Sales	0.326	Significant positive	Highest predictor of sales
H2b	Finance => Profitability	-0.098	Significant negative	Weak negative predictor of profitability
H2c	Finance => Employment	0.229	Significant positive	3rd highest predictor of employment
H2d	Finance => Feeling of Success	-0.092	Significant negative	Weak negative predictor of feeling of success

Thus, from the model, a hundred per cent improvement in the financial environment, *ceteris paribus*, could increase sales of indigenous innovation by about 33%, increase the employment level by 23% but could reduce profitability of indigenous innovation by about 10%, and reduce the feeling of success by 9% in the sector.

Although finance has negative effects on profitability and feeling of success, it relatively has strong positive effects on employment, and it is the highest predictor of sales (32.6%). The positive links between finance and sales as well as finance and employment level of MSEs engaged in CII are theoretically sound and expected. The microeconomic reasoning for the positive finance and innovation commercialisation success link is that credit can be used to expand the scale of operation that can invariably increase sales (Savona & Pellegrino, 2017; Ullah & Wei, 2019). Secondly, in respect of sales with favourable financial factors, credit sales can be used as incentives to users of new innovation to make purchases (Altaf & Ahmad, 2019). The reality on the ground is that MSEs commercialising indigenous innovation in the Ghanaian SSI face double whammy problem. To get their products on the market they mostly have supply on credit to distributors. However, to procure indigenous inputs from farmers, they often have to make advancement payments. This double whammy problem exacerbates their fincial needs.

Another reason that can be attributed to the observed positive link of finance with sales and employment is that access to finance is extremely low and most of the MSEs relied on personal sources and face low access. However, a number of policy efforts are also being made to improve access and improve rates of credit and MSEs are getting attracted to use loans in Ghana. As suggested by Eton et al. (2017), the seemingly improving access to cheaper credit, albeit slow and still at high rates, might definitely be enabling some MSEs to get more access to essential resources to expand and improve their indigenous innovation commercialisation activities.

In contrast, the negative finance-profitability link evidence from the current study is puzzling and contradictory to other studies (Nwosu & Orji, 2017; Babajide, 2017; Ullah & Wei, 2017; Mann, 2018; Ullah, 2019). Nevertheless, it is explainable given the evidence on the ground. Credit can indeed be used to expand the scale of operation; however, the reality is that cost of finance is still extremely high in Ghana (GSS, 2014; Boame et al., 2014; Boties & Atiase, 2018; Nkegbe, 2018; Sekyi et al., 2020). The high prevailing interest rates and strict repayment schedules in Ghana contribute to increasing the risks of failure of MSEs that use credit in the Ghanaian SSI sector

(Donou-Adonsoua & Sylwester, 2016). It is common to see even government-sponsored loans with interest above 10% APR and tenure under 12 months. The available capital to MSEs in Ghana is largely inflexible and inappropriate for commercialisation of innovations that have uncertain and long gestation periods. One respondent of very innovative product in a comment put it that *"even if available, using loan for commercialisation of innovation, is like going to the graveyard"*. Meanwhile, in the Ghanaian SSI sector, MSEs face fragmented markets, margins are low, and it takes time to build volumes and profit, even if credit is available.

Finally, the observed negative link between finance and feeling of achieved success of innovators/MSE owners is counterintuitive and inconsistent with evidence from elsewhere (Cabrera & Mauricio, 2017; Gupta & Mirchandani, 2018; European Central Bank; Gupta & Mirchandani, 2018). Nonetheless, the negative effect might be extending from the increased risk of using expensive and impatient capital for undertaking commercialisation activities. Donou-Adonsoua and Sylwester (2016) for example, observed that most Ghanaian MSEs that use credit experience problems with repayment. There is anecdotal evidence that Ghanaian banks prefer granting personal loans to households than business loan to MSEs due to associated high default risk with MSEs. Securing funding may initially come with some joy, however, the tough financial environment, inability to keep up with repayment and defaults may reduce reputation, and the associated financial distress of debts can as well reduce personal satisfaction.

The implication of the above analysis of finance and business performance links is that the current financial environment does not favour the commercialisation of indigenous innovation. Without cheap and patient capital, MSEs cannot commercialise indigenous innovation. They cannot operate on an efficient scale, increase employment, sales and make a profit. The findings of the study, therefore, support the call for increased access to cheaper and flexible credit for MSEs. The finding also signals that other issues need to be addressed to moderate the negative effect of the financial environment in order to enhance profitability and the feeling of success of MSEs. Increasing access and cheaper finance to expand the SSI sector and propel employment may be unsustainable unless there are improvements in profitability and feeling of success.

7.8.3 Organisational factors - business performance links

The frugal innovation notion that firms commercialising innovation in low-income economies are resource-constrained, have to reconfigure value chains and use resources differently (Bhatti, 2012; Radjou & Prabhu, 2014), underpinned the study. Organisational factors were therefore measured in terms of MSEs' skill availability, ability to gather resources, ability to efficiently use resources and ability to leverage others infrastructure to achieve results. Hypnotised paths H3a, H3b, H3c and H3d evaluated the effects of the organisational factors on MSE performance (table 7.24) at a 5% significance level. The result of the analysis provided substantial evidence of a strong positive link between organisational factors and commercial performance of MSEs, in the exception of employment where the evidence is rather a strong negative correlation.

Table 7.24: Impact of organisational factors on MSEs' performance in CII

Hypothesis/ Path		*β*	Effects	Ranking
H3a	Org. Factors => Sales	0.235	Significant positive	3rd highest predictor
H3b	Org. Factors => Profitability	0.103	Significant positive	3rd Highest predictor
H3c	Org. Factors => Employment	-0.209	Significant Negative	Negative predictor
H3d	Org. Factors => F'ling of Success	0.317	Significant positive	Highest predictor

The implication from the model result is that everything held net, if MSEs double their organisational capabilities, they could increase their turnover by about 24%, profitability by 10% and feeling of success by 32 %. Such efforts could however lead to a reduction in their employment level by about 21%. In the exception of employment, organisational factors have moderate effects on MSE performance, and it is the highest predictor of sales among the factors.

Conceptually, organisational factors and innovation commercialisation performance links can be explained through knowledge and inputs management. In addition, MSE owners /managers' ability to use their networks to identify, access and use resources through alliances and cooperation can improve their innovation performance (Mass et al., 2016; Do et al., 2018). It is evident from the survey that MSEs' who reported having adequate technical and people's skills reported higher sales and profit and tend to feel better with their performance. Similarly, those who agreed to being able to gather, efficiently utilise their capacity and leverage other infrastructure reported higher sales and profit as well as a higher level of satisfaction and recognition with the performance of their innovation. As shown in the literature (Al-Ansariet al., 2014), commercialisation of innovation requires technical, vocational and ICT skills for rendering services, people skills for mediating and handling complaints. MSEs can also substantially enhance their innovation performance if they can access and leverage other existing infrastructure and resources at the industry level.

There is abundant evidence on the ground and from the literature (Asiedu, 2016; Atiase, 2018; Mahmutaj & Krasniqi, 2020) that suggest small business owner/manager's training and experience can enhance efficiency in organising and managing processes, managing information, creating relationships with various stakeholders, spot better growth-related opportunities and avoid pitfalls. It is however evident on the ground that MSE owners in the Ghanaian SSI sector are largely deficient in types of education and training, thus the quality of human capital (Bartelset al., 2016; Alhassan & Habib, 2016; Afful & Owusu, 2017).

The negative links between organisational variables and employment rather revealed by the study can also be conceptually explained that when MSEs gain efficiency through better organisation and deployment of resources, they may require less labour unless there are increments in the scale of operations. The evidence on the ground is that the Ghanaian small scale industry is plagued with inefficiencies, low productivity of labour and low growth (Edusah & Antoa, 2014; Essel et al., 2019; Atta-Ankomah & Appiah-Kubi, 2020). Secondly, with improved organisational capabilities, MSEs can expand by leveraging other infrastructure at the industry and national level without necessarily engaging additional labour at the firm level. This firm-level observation of negative organisational factors and employment level links do not, however, negate a possible positive relationship between better organisational factors and employment lingages at the industry level. As highlighted in the literature (Tassinari & Maccarrone, 2017), employment as innovation performance metrics is better measured at a higher aggregation level than at the firm level.

The findings of this study together with other studies highlight the fact that in spite of the low quality of human capital and other organisational capabilities and negative firm level employment correlation observed, the overall organisational factors have significant a positive relationship with MSE performance. These findings imply that MSEs commercialising indigenous innovation can benefit from further specific training which is being provided by the Government and NGOs. However, improved firm performance would also largely depend on, one, MSE owners/managers' internal abilities and two, the existence of other infrastructure at the industry level for leveraging. MSEs' ability to deploy resources and capabilities to achieve business result depends on owner/managers entrepreneurial resilience and on the job experience which can only be improved by MSEs themselves. Firms can indeed substantially enhance their indigenous innovation performance by leveraging on existing infrastructure, however, this is largely possible when the Government provide the infrastructure or when the industry is well developed.

7.8.4 Market factors - business performance links

Following the BOP propositions (Anderson & Markides, 2007), the study examined market factors in terms of the 4As (affordability, awareness, availability, and acceptability). AssesMSEnt of hypothesised paths H4a, H4b, H4c, and H4d at a 5% significance level in the study provided significant substantial evidence of a strong link between market factors and the four metrics of firm performance. It can be inferred from the structural model result that if MSEs double their competitive strategy, promotion, and distribution efforts in commercialising indigenous innovation, they could increase their sales by about 13%, profitability by 39%, employment by 31% and feeling of success by 29%, ceteris paribus. Market factors (table 7.25) relatively have moderate to strong positive effects on MSE performance, and it is the highest predictor of profitability as well as employment, and the second highest for the feeling of success.

Table 7.25: Impact of market factors on MSEs' Performance in CII

Hypothesis/ Path		β	Effect	Ranking
H4a	Mkt Factors => Sales	0.128	Significant positive	4th highest predictor
H4b	Mkt Factors => Profitability	0.386	Significant positive	Highest predictor
H4c	Mkt Factors => Employment	0.308	Significant positive	Highest predictor
H4d	Mkt Factors => Feeling of Success	0.294	Significant positive	2nd highest predictor

The positive links between market factors and MSEs' financial performance (sales and profitability) in indigenous innovation commercialisation are clear and consistent with economics, marketing and strategic management literature (Hang et al., 2014; Dayanet al., 2017; Olhager & Feldmann, 2018; Sangwa & Sangwan, 2018; Lim & Fujimoto, 2019). Theoretically, market factors and innovation commercialisation performance links have been analysed from cost leadership, affordability, market awareness, acceptability, and availability dimensions. The reasoning behind competitive strategies and successful commercialisation of innovation in undeveloped economies, for example, range from the fact that most innovations have high price-elasticity of demand; the need to serve low-income consumers and fit into their expenditure pattern; there are substantial cost savings with larger production volume and creating a strong threat for potential competition (Hang et al., 2014).

The evidence from the result of the study is a strong association of unfavourable market factors and poor commercial performance of indigenous innovation. The reality on the ground is that the sales and profit levels of MSEs engaged in CII are low. Likewise, prices of indigenous innovation are very high relative to imported innovations. Most indigenous Ghanaian products have poor finishing, and most MSEs are unable to brand and promote their innovations leading to speedy fading out of most indigenous innovation in favour of imports (Quaye & Mensah, 2019). It is common to observe well sought-after products only limited to a locality, and not made available in a convenient form to customers elsewhere on the Ghanaian market. A survey that tracked the progress of the Government's local content push in 2019 discovered that leading Ghanaian supermarkets only stock 18% of shelve spaces with made in Ghana goods (Kofidants, 2019). The same survey discovered in 2020 that although stocking is improving the situation is still appalling as it found out that only 25% of brands on the Ghanaian retail market are indigenous and 75% are foreign brands (Kofidants, 2021). Another study have also observed that the Made in Ghana stocks in supermarkets are largely water and unprocessed foods (Ragasa et al., 2020).

It is clear from the result that the Ghanaian SSI sector is plagued with slow growth and low profitability. It is also evident from the literature and on the ground that the cost of doing business is generally very high in Ghana and MSEs in the sector face high input costs (Nyarku & Oduro, 2017; Guy, Agyapong & Mmieh, 2018; Chan et al., 2018). Indigenous processes are also relatively inefficient and uncompetitive not only in terms of production but also in terms of marketing and distribution. In the local sachet water subsector, for example, every MSE have to own and maintain a truck, at quite a high cost for delivery of water, in order to remain in business and for only GH₵3.00 (50-dollar cent) a bag of water. The MSEs in the SSI sector in most cases cannot just pass all costs onto the market as they largely cater for customers with affordability constraints and face weak demand. MSEs and SSI sector in Ghana largely serve customers with income and affordability constraints and therefore have to adopt creative cost cutting and competitive marketing strategies in order to sell and survive.

Secondly, the positive correlation of market factors and employment level of MSEs is also not unexpected and is consistent with the literature. BRI models highlight both exploiting and creating a fortune at the BOP (Radjou & Prabhu, 2014; Knorringa et al., 2016). Creating fortune at the base is explained as, engaging, and forming alliances with local agents and factors of production. From the survey, also, most MSE respondents who agreed, having offered more affordable packages, making their products more available and having increasing product outreach, also reported higher employment. Most jobs in the SSI sector are, however generally low paid jobs and informal. Indigenous innovation processes are labour intensive and required intensive use of local inputs (Cozzens & Sutz, 2014). MSEs and SSI sector in Ghana employs more than 60% of the country's labour force (GSS, 2010; GSS, 2015). This can explain the model result which indicates that market factors positively correlate with the employment of MSEs in the SSI sector in the Volta Region of Ghana.

The clear indication from the result that market factors have a strong positive relationship with MSEs owners' feeling of success is supported with the evidence on the ground and affirmed other evidence (Cabrera & Mauricio, 2017). For instance, the survey revealed that MSEs who confirmed strongly adopting low cost and cost-cutting strategies and offering more affordable packages reported a higher level of personal satisfaction and recognition. In the same vein, respondents, who strongly affirmed being able to market the crown jewel of their innovations, who made their product more available, and who got higher product outreach, also reported they felt more satisfied and recognised with their innovation.

The implication of the strong positive effects of market factors on all the dimensions of firm performance is that there is the need to pay crucial attention to demand-side of things. It substantiates the importance of the 4As (affordability, acceptability, availability, and awareness) as postulated by (Anderson & Markides, 2007). It emphasises the role of cost leadership, supply chain, distribution networks, and the pre and post-sales extras in enabling firms to achieve and sustain growth. It also highlights the fact that successful commercialisation, for that matter development of the industrial sector in low-income economies is more dependent on market opportunities and firms' ability to deal with competitive threats (Sheng et al., 2013; Sangwa & Sangwan, 2018) The strong link between market factors and employment is particularly relevant as it is employment generation impact of indigenous innovation that made the SSI sector a national development policy focus. The findings imply that improving market conditions and promoting demand of indigenous innovation would directly improve sales, profitability as well as employment, and the feel-good factor in developing economies.

7.8.5 Technology-commercial performance links

Guided by frugal innovation theory the study acknowledged that successful commercialisation of innovation in low economies required the use of low cost, efficient, and appropriate technologies and products that may have to be redesigned (Bhatti, 2012; Radjou & Prabhu, 2014). The study as such evaluated the effect of technology on MSE performance using their technology absorption capacities and use of digital technology as indicators. AssesMSEnt of hypothesised paths H5a, H5b, H5c, and H5d at a 5% significance level revealed evidence of a strong link between technology and commercial performance of indigenous innovation, in the exception of the employment level dimension (table 7.26). In fact, technology paths mimicked organisational factors paths and the inference is that all other variables held constant, by doubling their technology absorption capacities, MSEs could increase their sales by about 27%, profitability by 13% and feeling of success by 24 %. Such efforts could however result in 37% reductions in employment by MSEs. Thus, in the exception of employment, technology has moderate to strong effects on MSE performance and it is the second-highest predictor of sales and profitability among other factors.

Table 7.26: Impact of Technology on MSEs Performance in CII

Hypothesis/ Path		β	Effect	Ranking of Technology
H1a	Technology => Sales	0.265	Significant positive	2nd highest predictor
H1b	Technology => Profitability	0.134	Significant positive	2nd highest predictor
H1c	Technology => Employment	-0.367	Significant negative	Negative predictor
H1d	Technology => Feeling of Success	0.237	Significant positive	3rd highest

The strong positive links observed in the study between innovation and performance in terms of sales, profitability and feeling of achieved success is largely supported by literature (Marx et al., 2014; Osoro et al., 2015; Dahlstrand et al., 2016; Azarmi, 2016). Conceptually, the technology-firm performance link is complicated. It is a function of internal and external scope which are linked to the creation, offering and appropriation of values in the marketplace (Bergek et al., 2015). Secondly, entirely different technologies compete and complement each other in various ways, which means that their coevolution can influence the dynamics in the marketplace (Onufrey, 2014; Binz et al., 2014).

It is evident from the result, on the ground and from the literature that Ghanaian MSEs are to some extend embracing digital technology, at least, in terms of using social media and mobile money to promote their businesses, receive payment, improve cash flow; and increase efficiency. This finding also collaborates with other evidence of a few MSEs leveraging emerging technologies. It is also evident that digital interventions, although painstakingly slow, are beginning to show dividends by making MSEs a bit more efficient and accounting for productivity and improvement in the working environment (Karakara & Osabuohien, 2019; Omane Boamah & Atta-Boateng, 2020).

The evidence, however, is not a vibrant industry with MSEs and MSEs actively commercialisation indigenous innovation in the Ghanaian innovation system. The SSI is still plagued with very low levels of innovativeness, stale development of innovation, limited commercialisation, stagnation and low productivity, low return, low growth and fading out of some indigenous activities (Addo, 2017; Tsatsenko, 2020).

The negative links between technology and employment revealed by the study are complicated to explain. Ideally, the somewhat evidence on the ground that MSEs are embracing digital technology and leveraging on emerging technologies to improve indigenous products, introduce new ones and improving efficiency (Karakara & Osabuohien, 2019; World Bank Group, 2019; Bawumia, 2020) should be resulting in a higher level of employment. However, digital technology with associated better deployment and organisation of resources, and possibility of “do it yourself” (DIY), may also be leading to MSEs requiring less labour. Moreover, the indicator measured in the study is the firm-level employment, and as explained by Roy et al. (2018), it is better to measure employment at a higher aggregation level. As a matter of fact, in the MSE sector new entrepreneurs leveraging on technology to create their own and new jobs, business stealing, market expansion, competition, and the relocation of activities may result in completely different patterns at industry and higher aggregation level (Schmidlechner & Peruffo, 2017; Calvino & Virgillito, 2018).

In spite of some positive evidence in respect of the embracement of digital technology and some emerging technologies, there are ample evidence that suggests the role of STI in the country’s development has been limited (Oduro & Nyarku, 2018; Okoe & Boateng, 2016). Ghanaian private sector in general and MSEs in particular, have limited and low capacity to undertake and absorb science and technology for innovation. It is evident from the literature and on the ground that most interventions suffer from inadequate funding, coordination among related agencies, corruption, and politicisation of policy. Clearly, attempts to help indigenous firms in SSI in the technology catching-up process are inadequate.

Nevertheless, the implication of the findings of the study is that pursuing more vigorous and strategic STI policies would improve indigenous MSE performance, at least in respect of business volumes, profitability, and feel-good factor, as revealed by the result, and even employment at the industry level as suggested by the literature. Indeed, just as revealed by the current study, the Government of Ghana herself recognised the importance of technology in driving industrialisation (UNIDO, 2015; MESTI, 2017a; MESTI, 2017b). Yet, despite nice policy crafts, the application of technology in GNIS has been generally problematic. There is, therefore, a need to recalibrate and properly reconfigured available policy instruments in order to overcome constraints to indigenous innovations. It is also important to focus on frugal and below-the-radar technologies as these may be more efficient and applicable in SSI to enhance indigenous innovation.

Central University of
Technology, Free State

7.9 INFLUENCE OF FIRM & COMMERCIALISTATION CHARACTERISTICS

7.9.1 Influence of government incentives

The study examined the influence of government incentives to MSE sellers (GINMSE), and buyers (GINBU) of indigenous innovation, thus from both supply and demand sides separately. For GINMSE, at a 5% significance level, the standardised path coefficients and their p-values and t-values exhibited significant negative effects on sales and feelings of success, significant positive bearings on employment level and rather insignificant negative effects on profitability. Evaluation of the effects of GINBU at a 5% significance level, however, revealed significant positive effects on all the MSE performance metrics.

For the effect of GINMSE, the results in the exception of the effects on employment, seem surprising and inconsistent with earlier study on Ghana (Amankwah-Amoah & Sarpong 2015). The current finding is however supported by the fact on the ground and detail analysis of sample data for the study which shows that out of the 50% MSEs respondent who reported having received some incentives, 47.9% received only free training, implying just 2% benefited from incentives in the form of a grant, concessionary loans or free/subsidised inputs. The reality on the ground is that the Government mostly spins about having instituted incentive schemes for small businesses. However, evidence suggests that the budgetary allocations for these incentives' programmes are woefully inadequate, and the programmes are often plagued with corruption and political cronyism (Quaye et al., 2020). Most MSEs feel they have rather wasted their time on rather a very meagre or irrelevant support, had bitter experience of unsuccessful application or they do not want to waste time putting in applications. These revelations with other supporting evidence on the ground mimicked the mixed feelings and mixed empirical evidence on government incentives and firm performance provided in the literature (Carboni, 2017; Zhang & Guan, 2018). The evidence also aligned towards the incentives sceptics views (Guan & Yam, 2015; Zhang & Guan, 2018; Zhu et al., 2019).

The overwhelming significant positive influence of GINBU on the performance of indigenous innovation observed in the study back the emerging research (Mersky et al, 2016; Zhang, 2016; Narassimhan & Johnson, 2018) that advocate for more demand-side incentives. This finding also confirms the BRI view that emphasised consumers reduced cost of using innovation as key for successful commercialisation. From the BRI lens, Eisenberg and Price (2017) emphasised that incentives to innovators and sellers promote the use of expensive technologies and costly new products and focusing on reduced cost for consumers promotes the use of appropriate technology and is more efficient and effective.

The inference from the above findings is that firstly, the impact of government incentives on the demand side is more effective than incentives on the supply side even though incentive to buyers is less common on the ground. Secondly, it can be concluded that, in spite of the constraints, overall government incentives can have a substantial influence on the performance of indigenous innovation among MSEs in Ghana. Thus, based on the findings of the current study and other facts on the ground, government incentives are required for most indigenous innovations to be successfully commercialised. There is however a need for further research on appropriate incentives and effective strategies in implementing incentives schemes.

7.9.2 Influence of commercialisation strategies

The commercialisation strategies controlled and examined in the study included methods of commercialisation in terms of commercialising entity (COMAGENT), use of university or related innovation supporting intermediary services (USUNIS), and pricing strategies (PRITRA).

The analysis revealed that methods of commercialisation (COMAGENT) exhibited positive significant bearings only on the feeling of success and rather has insignificant impacts on other dimensions of MSE performance (sales, profitability, and employment) at a 5% significance level. This result is supported by evidence on the ground and from the sampled data that indigenous innovation commercialisation activities in Ghana are predominantly by start-ups entrepreneurs, over 87% per the study data. The current findings are also consistent with earlier studies (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016) that suggested a lack of coherent policies on tech transfer from knowledge-based institutions (KBIs) in Ghana.

The model assesMSEnt revealed the use of university intermediary services (USUNIS), has significant positive bearings on profitability, employment and feeling of success, but negative influence on sales at a 5% significance level. The significant positive influence of UNISUS on MSE performance (profitability, employment level, and feeling of success) results affirmed the capability of university incubators and other related institutions or platforms in helping MSEs and start-ups in cutting down cost and reducing risk, attracting people into businesses, and in giving users insights from experts, networks, fun and sense of achievement (Hossain, 2018).

The negative influence on sales is also not suppressing. Per the sampled data, majority of the respondent for USUNIS (21% out of 25%) reported using incubators and mentorship. This suggests there might be a lot of time-wasting and focus on things that do lead to business results. The mixed result is also consistent with other studies (Iyortsuun, 2017; Abdulai et al., 2020) that pointed out incubator selection and associated resource munificence are insignificant in predicting start-up performance but at the same time also provided some evidence that intensity of business assistance and professional management services from hubs are significant predictors of start-up and innovation performance.

Strangely, pricing strategy emerged to have insignificant direct effects on all the performance dimensions: sales, profitability, employment level and feeling of success. The interpretation is that pricing strategy cannot statistically or significantly account for variations in MSEs' performance. Thus, for this study, pricing strategy did not significantly predict the successful commercialisation of indigenous. The insignificant influence of pricing strategies on the innovation commercialisation performance of MSEs is rather surprising and inconsistent with emerging views (Boomerang, 2015; De Toni et al., 2017; Pratono, 2018; Howell et al., 2018; Dean, 2020) in the literature.

One suspicious reason is that indigenous innovations face fierce competition with imports in Ghana, and MSEs do not have discretion for pricing and have to price mostly around the industry average or adopt mixed strategies. Theoretically, pricing strategies should have both direct and moderating effects on firms' innovation performance, as it is the channel by which firms offer better value to customers and attract market as well appropriate the created values to theMSElves.

By and large, the insignificance of COMAGENT on firm performance confirmed the widespread view of infectiveness of KBIs in the commercialisation of innovation in the (Oduro-Marfo, 2015; Bartel, 2016; Amankwah-Amoah, 2016; Gachie & Govender, 2017; Sitnikova, Halo & Polusmakova, 2018). It is also clear from the analysed data, evidence on the ground, and the literature that MSEs are at the forefront of the commercialisation of indigenous innovation in Ghana. Incidentally, the identified positive influence of USUNIS also affirmed the growing evidence from the innovation ecosystem literature that exploitation of innovation support services such as from university incubators can be important for effective commercialisation process (Clayton et al., 2018). The implication of these findings is that innovation intermediary services from universities and other innovation supporting institutions have potentials but the models, have to be improved.

From the BRI perspectives, entrepreneurs in low-income economies are resource-constrained and would benefit from university collaborations such as the use of university incubators, co-working spaces, and mentoring. The observed dominance of small start-up entrepreneurs in tandem with low business performance of indigenous innovation substantiates the fact that MSEs on their own cannot do the trick. The positive influence of the use of university intermediaries implies that innovation incubation, use of university facilities, promotion and demand legitimisation programmes should be promoted as a tool for entrepreneurial promotion to complement the broader strategic entrepreneurial framework.

7.10 SUMMARY OF RESULTS

In sum, the aim of examining the drivers of successful commercialisation of indigenous innovation was achieved through seven subsidiary objectives using twenty hypotheses while controlling for government incentives and commercialisation strategies. PLS-SEM was employed to evaluate the effects of the selected drivers on MSE performance, the dependent variables. The indicators of MSE performance are sales, profitability, employment and feeling of achieved success. All the hypotheses were tested at a 5% significance level and the overall result are summarised in table 7.27 below.

Table 7.27: Summary of objectives, hypotheses testing and analysis

Objectives	Hypotheses/control variables	Evidence/ Significance at 5% level	Result	Remarks
The impact of regulation on the successful commercialisation of indigenous innovations in Ghana	H1a: Regulation is positively related to sales of indigenous innovation in the SSI sector	Insignificant effect	Rejected	Mixed evidence from literature. Not supported by the data.
	H1b: Regulation is positively related to the profitability of indigenous innovation	Significant negative effects	Rejected	Not supported by literature and evidence from the data.
	H1c: Regulation is positively related to the employment level of MSEs	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the evidence
	H1d: Regulation is positively related to MSEs feeling of success	Significant positive effects	Accepted	Mixed evidence from literature. Supported by the data
The impact of finance on the successful commercialisation of indigenous innovations in Ghana.	H2a: Finance is positively related to sales growth of indigenous innovation	Significant positive effects	Accepted	Supported by literature and the evidence
	H2b: Finance is positively related to the profitability of indigenous innovation for MSEs	Significant negative effects	rejected	Mixed evidence from literature. Not supported by the data.
	H2c: Finance positively related to the employment growth of MSEs	Significant positive effects	accepted	Supported by literature and the evidence
	H2d: Finance is positively related to MSEs feeling of success	Significant negative effects	Rejected	Supported by literature. Not supported by evidence from the data

The impact of organisational factors on the successful commercialisation of indigenous innovations in Ghana	H3a: Organisational factors are positively related to sales growth of indigenous innovation in the SSI sector	Significant positive effects	Accepted	Supported by literature and evidence
	H3b: Organisational factors are positively related to the profitability of indigenous innovation for MSEs	Significant positive effects	Accepted	Supported by literature and the evidence
	H3c: Organizational factors are positively related to the employment growth of MSEs in SSI sector.	Significant negative effects	Rejected	Not supported by literature and the evidence from the data
	H3d: Organisational factors are positively related to MSEs feeling of success	Significant positive effects	Accepted	Supported by literature and the evidence
The impact of market factors on the successful commercialisation of indigenous innovations in Ghana	H4a Market factors are positively related to sales growth of MSEs	Significant positive effects	Accepted	Supported by literature and evidence
	H4b: Market factors are positively related to the profitability of MSEs	Significant positive effects	Accepted	Supported by literature and evidence
	H4c: Market factors are positively related to employment growth of MSEs	Significant positive effects	Accepted	Supported by literature and evidence
	H4d: Market factors are positively related to MSEs feeling of success	Significant positive effects	Accepted	Supported by literature and evidence
The impact of technology on the successful commercialisation of indigenous innovations in Ghana	H5a: Technology is positively related to sales of indigenous innovation in SSI	Significant positive effects	Accepted	Supported by literature and the evidence
	H5b Technology is positively related to the profitability of indigenous innovation	Significant positive effects	Accepted	Supported by literature and evidence from the data
	H5c: Technology is positively related to the employment level of MSEs in SSI	Significant negative effects	Rejected	Not supported by literature and the evidence
	H5d: Technology is positively related to MSEs feeling of success	Significant positive effects	Accepted	Supported by literature and the evidence
The influence of government incentives on successful commercialisation in Ghana	Incentives to MSE innovators/sellers	Insignificant on profitability. Significant negative effect on sales, and feeling of success; and positive effect employment		Mixed evidence from literature.
	Incentives to buyers of indigenous innovation	Significant positive effect on sales profitability, employment and feeling of success		Consistent with emerging views from literature.

The influence of commercialisation strategies on successful commercialisation in Ghana	Methods of commercialisation	Insignificant on sales, profitability and feeling of success. Significant positive effect employment	Mixed evidence from literature
	Use of university innovation support or related intermediary services	Significant negative on sales, and positive effects on profitability, employment and feeling of success	Consistent with emerging views from literature
	Pricing strategies	Insignificant effect on sales profitability, employment and feeling of success	Inconsistent with available evidence from literature

7.11 CHAPTER SUMMARY

Focusing on the effect of regulation, finance, organisational factors, market factors and technology on MSE performance in the commercialisation of indigenous innovation, chapter 7 discussed the findings of the study. The chapter began with a demographic analysis of the MSE respondents. This provided some understanding of the nature and characteristics of MSEs in the Ghanaian small-scale industry. The discussion revealed that gender issues in the commercialisation of innovation, though very important has not been well researched in the innovation literature.The chapter also presented a descriptive analysis of the firm and commercialisation characteristics of the MSEs. The result of the descriptive analysis of the firm characteristics is insightful, particularly, in respect of business categories and the trend of indigenous knowledge, the age distribution of MSE indigenous innovators, as well as the type of indigenous innovative activities. The patterns and trends of these characteristics draw attention to some implications for the future of indigenous knowledge and firm performance in Ghana. The analysis, for example, confirmed the view that some indigenous knowledge is indeed fading out (Quaye & Mensah, 2019).

Next, the firm commercialisation characteristics of government incentives and commercialisation strategies were subjected to inferential analysis employing PLS-SEM. The evidence from the model results shows that not all the characteristics have a significant influence on all the metrics of firm performance. For example, pricing strategies surprisingly do not seem to have a significant influence on any measure of firm performance. The chapter mainly discussed the effect of selected drivers on the performance of MSEs in areas of sales, profitability, employment and feeling of success. The discussion provided evidence that in the exception of regulation on sales, regulation and all the other variables have a significant impact on the MSE performance dimensions. However, some of the commercialisation factors rather relate negatively to some performance indicators. For example, regulation has negative effects on profit, finance has negative effects on profitability and feeling of success and both organisational factors and technology have negative effects on employment level.

In conclusion, the analysis of the structural model results in this chapter supports the proposed conceptual framework in chapter 5 for the effects of the selected drivers on MSEs' performance in the commercialisation of indigenous innovation in the Ghanaian SSI sector. Based on the results, **H1c, H1d, H2a, H2a, H2c, H3a, H3b, H3d, H4a, H4b, H4c, H4d, H5a, H5b** and **H5d**, are accepted while H**1a, H1b, H2b, H2d, H3c** and **H5c** are rejected. The next chapter presents the conclusions and recommendations for this study.

CHAPTER 8: SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 INTRODUCTION

The study sought to establish the determinants of successful commercialisation of indigenous innovations in Ghana. This was done based on how regulation, finance, organisational factors, market factors and technology determine MSE performance while controlling for government incentives and commercialisation strategies. The determinants of successful commercialisation of indigenous innovation from small scale entrepreneurs' perspective were established by critically examining the seven objectives in this study. This involves examining the impact of regulation, finance, organisational factors, market factors and technology, as well as government incentives and commercialisation strategies as control variables, on MSE performance in the Ghanaian SSI sector. Theoretically, the study adopts below-the-radar-innovation theories. Specifically, the bottom of the pyramid (BOP) and frugal innovation theories underpinned the study.

Methodologically, quantitative, and deductive reasoning approaches were used. Descriptive statistics and PLS-SEM were used to analyse the seven objectives. A sample survey of 537 MSEs with a response rate of 85 per cent was carried out in the small-scale industries in the Volta Region of Ghana so as to address the objectives. Multi-item psychometric scales were used to collect and measure respondents' views on the selected drivers of commercialisation of indigenous innovation. SPSS version 25 was used to validate the variable items and conduct the frequency analysis together with Smart PLS 3.3.3 to estimate the proposed model.

The control model explains 12.5%, 14.2%, 8.7%, and 28.7% of variations in sales, profitability, employment level and feeling of success, respectively. Comparatively, the complete model explains 35.5%, 48.4%, 28.6%, and 51.1% respectively, variations in sales, profitability, employment level and feeling of success, clearly suggesting that the commercialisation drivers significantly explain the variances in MSE performance. The findings and their major implications are summarised in this chapter. These include conclusions on the findings of the objectives, their policy and practical implications, contribution to knowledge, limitations of the study and direction for future research.

8.2 SUMMARY OF RESEARCH FINDINGS

In pursuance of the stated research objectives, the study has been able to analyse the extent to which commercialisation factors impact the success of indigenous innovation and MSE performance in the areas of sale, profitability, employment and feeling of success in the Volta Region of Ghana. It has established regulation, finance, organisational factors, market factors and technology as main drivers of commercial activities and proposed a conceptual framework for commercialisation of indigenous in the Volta Region of Ghana.The results and findings for each objective are again summarised below.

8.2.1 Objective 1

The first objective of assessing the impact of regulation on innovation performance was achieved. As indicated by the results, regulation has insignificant effects on sales, relatively high negative effects (36.9%) on profitability, moderate negative effects (12.1%) on the feeling of success, and strong positive effects on employment (30.6%). It is therefore concluded that through regulation of indigenous innovation and businesses, the country can increase employment and somehow improve the feeling of success of Ghanaian local business owners. The need to improve the regulatory regime in Ghana is reflected in the results as the current environment clearly makes indigenous businesses unprofitable.

8.2.2 Objective 2

The second objective of assessing the impact of finance on successful commercialisation of indigenous innovation is also achieved. The results indicate, finance has relatively weak negative effects on both profitability and the feeling of success, strong positive effects on employment, and it is the highest predictor of sales. Based on this evidence it can be concluded that improving the financial environment for MSEs can expand businesses in the domestic industrial sector and increase employment. Parenthetically, the main reason for the policy focus on MSEs is because of their potential for growth in terms of output and employment generation (Musah, 2017; Chege & Wang, 2020). The findings are also reflective of the harsh effects of the current financial environment on Ghanaian businesses as finance bears negatively on profitability and the feeling of success.

8.2.3 Objective 3

The third objective is to examine the effect of organisational factors, and this is also achieved. Regarding organisational factors, the result revealed that among other factors, it is the best predictor of the feeling of success. Relatively, it has strong positive effects on sales and moderate positive effects on profitability. The organisational factors however exhibited negative bearing on MSEs' level of employment. Nonetheless, the study concluded that MSEs engaged in the commercialisation of indigenous innovation can substantially improve their performance by improving their organisational capabilities in terms of skills, gathering of resources, and efficient use and leveraging other resources.

8.2.4 Objective 4

The fourth objective of evaluating the impact of market factors is also achieved. The results indicate that relatively market factors have moderate to strong positive effects on indigenous innovation and MSE performance. Market factors are the highest predictor of profitability and employment, and the second-highest predictor of the feeling of success. Based on this evidence, it can be concluded that improving the market environment for indigenous innovation is key for the expansion of the Ghanaian small-scale industry and growth in terms of employment and income as well as making business proprietorship attractive. This conclusion also implies that indigenous firms commercialising innovation can improve their performance if they increase their competitive, promotion and distribution strategies.

8.2.5 Objective 5

Finally, on the drivers, the objective of examining the effect of technology on MSEs and indigenous innovation performance was achieved. The result revealed that relatively, technology has moderate to strong positive effects on sales, profitability, and the feeling of success. It, however, exhibited negative bearings on the level of employment. Nonetheless, the study concluded that MSEs engaged in the commercialisation of indigenous innovations can substantially improve their performance by improving technology absorption capacity and leveraging general-purpose technology such as digitalisation.

8.2.6 Objective 6

The study also found that controlling for government incentives and commercialisation strategies, the selected drivers have less influence on the performance metrics. This suggests that government incentives have some significant direct and intervening effects on firm performance. With regards to objective six of assessing the effects of government incentives, incentives to buyers have significant positive effects on all the performance metrics, while incentives to MSEs have mixed effects. Incentives to MSEs have insignificant effects on profitability, significant negative effects on sales and the feeling of success, and positive effects on employment. It can therefore be concluded that government incentives are key and can enhance the successful commercialisation of indigenous innovation and firm performance. However, demand-side incentives are more effective than supply-side incentives. The findings also call for better strategies for implementing incentives to support indigenous innovation.

8.2.7 Objective 7

In examining commercialisation strategies further in pursuance of objective seven, the result indicates the method of commercialisation is insignificant on sales, profitability, and the feeling of success, and only has significant positive effects on employment. The use of university innovation intermediary services has negative effects on sales but positive effects on profitability, employment and feeling of success. Pricing strategy is insignificant on all the indicators. Relating to commercialisation strategies it can be concluded that innovation intermediary services from universities and other innovation supporting institutions have potentials and emerging models have to be improved. Thus, innovation incubation, use of university facilities, promotion and demand legitimisation programmes can enhance successful commercialisation of indigenous innovation and MSE performance should be promoted to complement the broader strategic STI framework.

8.3 CONTRIBUTION TO KNOWLEDGE

The study made major and incremental contributions to knowledge. Categorically, these contributions can be viewed from the perspectives of the extention of innovation literature, theory, and methodological contributions. These are presented below.

8.3.1 Contribution to innovation literature

By synthesising innovation literature and centering on indigenous innovation and its commercialisation which has received little research attention, this study has made a specific contribution to the extention of innovation literature. Innovation as a concept, no doubt, has been extensively analysed. However, there is limited literature and understanding of the notion of indigenous innovation and its commercialisation generally. This is despite available statistical and empirical evidence and expert views that the problem for many developing economies is the commercialisation and not the creation of indigenous innovative activities (Shpak et al., 2014). Therefore, this study is an incremental contribution to the innovation literature.

Moreover, the current study also deepens the understanding of the role of MSEs in the national innovation system (NIS) in low-income countries' contexts. MSEs are critical to innovation development and its impact in terms of employment generation and increase economic growth (Musah, 2017; Chege & Wang, 2020) Commercialisation factors and business performance linkages are not well researched and integrated into the national innovations in developing countries. Meanwhile, entrepreneurship is being promoted and small-scale entrepreneurs are being encouraged into the indigenous small scale industry sector when the current regulatory, financial, operating and market environment have led to stagnation, slow growth, failure, stale development of indigenous innovation and bankruptcies in the sector (Addo, 2017; Tsatsenko, 2020). The findings provide some fresh thinking for actors in the national innovation system and industrial and STI policies in Ghana and other low-income countries.

Empirically, this study contributed to findings regarding the effects of overall regulation, finance, organisational factors, market factors, technology, government incentives, and firms' commercialisation strategies on indigenous innovation commercialisation and MSE performance. Most of these factors, though very important in the Ghanaian National Innovation System (GNIS), have limited literature and research attention. The results provide empirical evidence and indicate a significant relationship between the drivers, and indigenous innovation and MSE performance in the Volta Region of Ghana. The study also provides new empirical evidence from the Ghanaian context that incentives on the demand side may be more effective than on the supply side of innovation.

8.3.2 Contribution to theory

Primarily, the study made a theoretical contribution to the innovation and entrepreneurship literature by developing and empirically testing a conceptual framework (figure 5.1) that established regulation, finance, organisational factors, market factors and technology as the main drivers for the commercialisation of indigenous innovation and firm performance. The developed model grounded and tested the key drivers as the main predictors of indigenous innovation performance at the firm level in terms of sales, profitability, employment and feeling of achieved success. This model can be applied in any national system of innovation, particularly, in a developing country context by policymakers, small scale entrepreneurs and other actors.

The model provides an understanding of key commercialisation drivers in small scale industry sector where there are challenges with regulatory voids and lacks; finance and other resources are constrained; firms have organisational challenges, customers have affordability constraints, and imports are outcompeting indigenous innovation while technology absorption capacity of indigenous firms is low. The selected commercialisation drivers are key and have significant effects on indigenous innovation and firm performance. The model advocates that policy improvement and strategic focus of MSEs on regulation, finance, organisational factors, market factors and technology absorption can enhance innovation and firm performance in the SSI sector.

8.3.3 Methodological contributions

This study offers several methodological contributions through the adoption of a quantitative case study approach and the use of SEM PLS analysis to examine the commercialisation of indigenous innovation in Ghana. First, in terms of measurement of variables, the current study evaluated MSE performance and commercialisation of indigenous innovation in sales, profitability, employment, as well as owners feeling of success (a measure of sustenance of interest in entrepreneurship). Some studies have measured MSE performance in different contexts (Owusu et al., 2015; Sibanda & Manda, 2016; Musah, 2017; Adomako, 2020). The current study is the first to have measured and tellingly highlighted MSE owners' feeling of success as an innovation performance measure.

Secondly, most previous studies of this nature that examined firm and innovation performance mostly deployed the first generation of regression methods, analysing

Central University of
Technology, Free State

one layer of a relationship at a time. Using SEM-PLS the current study provides a leading contribution to the methodology by addressing all the selected and interrelated factors of commercialisation and measures of firm performance in a single precise model. This enables the findings of the study to be presented in a very thorough manner and can be used as a guideline for future research.

Moreover, the current study is also one of the first to have applied and tested BOP and frugal innovation theoretical frameworks and provides empirical evidence in the Ghanaian context. The study contributes to examining the effects of commercialisation factors on firm performance using the bottom of the economic pyramid (BOP) and frugal innovation theoretical models to provide empirical evidence from Ghana which is quite different from the environments in Southeast Asia and South America where BRTI have been broadly tested. Using SEM-PLS, the study used rigorous measurement models to verify and purify the measurement items to ensure validity and reliability in the Ghanaian context. While the empirical evidence broadly validates BRI views, it also suggests some of the frugal innovation notions might not be applicable in the Ghanaian context. For example, low pricing strategies seem to have insignificant effects on firm performance, presumably, as markets are fragmented, and it is difficult to build volumes in in the Ghanaian environment.

8.4 IMPLICATIONS FOR POLICY AND PRACTICE

The findings of the study have implications for policymakers, firms and other GNIS actors, and the development of indigenous innovation in the Volta Region of Ghana and other developing countries. The key elements in the suggested framework for successful commercialisation of indigenous innovation are discussed below.

8.4.1 Implications for Policy

The Government of Ghana recognised the importance of science, technology, and innovation (STI) from her strategic posture. There are a plethora of innovation policies with respect to industry, STI, ICT and education. Most of these policies also recognised promoting STI and development of the industrial sector required supporting indigenous firms to undertake and exploit science and technology for innovation (Amankwah-Amoah, 2016; UNIDO, 2015; MESTI, 2017a). Despite these nice policy crafts and perhaps few sporadic examples, there is no evidence of any vibrant industry and a well-functioning national innovation system. Official and international reports have rather appalled Ghana's innovation performance (UNIDO, 2015; MESTI, 2017a; UNESCO, 2018; Cornell University et al., 2018; Quaye et al., 2019). UNIDO (2015) observed that the general weakness in the Ghanaian National Innovation System, exacerbated by high barriers to innovation is stifling the rate of innovativeness in economic activity.

Given the current economic challenges and the massive unemployment on one hand, and fortunately rising interest in entrepreneurship, on the other hand, it is the right time to reconfigure and recalibrate the Ghanaian National Innovation System, taking into account regional and local needs. This research has shown that through regulation, finance, organisational factors, market factors and technology, the outcome of indigenous innovation and firm performance could be effectively improved in the Volta Region of Ghana. It demonstrates that the selected drivers have a significant impact on indigenous innovation and MSEs' performance. Industrial and STI policies should be reformed and where applicable new policies designed to improve the regulatory, financial, organisational, the marketing environments and environment for embracing new technology to improve commercialisation of indigenous innovation. The specific policy framework is presented below.

8.4.1.1 Recommended policy strategies for regulation

In respect of regulation, the findings of the study suggest balance and appropriate regulation, not necessarily less regulation as suggested by other studies (Nyarku & Oduro, 2017) is required to improve indigenous innovation and business performance. There is a need to have more simplified regulation for MSEs. Policies must pay attention to regulatory burdens. The evidence of the study and supporting literature suggests the current regulatory environment creates excessive cost burden and deadweight losses which limits the expansion and reduces the profitability of indigenous innovative activities. Where appropriate there should be regulatory incentives instituted and integrated to enable MSEs comply without losing out too much. There should also be more regulations that improve standards, enhance values, and boost the demand for indigenous innovation.

Regulatory frameworks should also ensure KBIs commit to deliver their third missions. Demanding and recognising innovation output in the form of evidence of association with successful indigenous innovation from public universities as part of their regulatory requirements could be useful in reducing commercialisation gaps. It is evident from the study and on the ground that weak demand and competitiveness are the main constraints. Therefore, requiring through regulation that public institutions dedicate a percentage of their budgetary spending on procurement of some approved indigenous innovations can help improve demand, reduce commercialisation gap, and further stimulate indigenous innovation and its commercialisation.

8.4.1.2 Recommended policy strategies for finance

Based on the findings of the study, finance for commercialisation of indigenous innovation is key and should be an essential part of STI policy. There is a need for innovative indigenous innovation commercialisation financing strategies. It is not budgetary provision for STI *per se* that is essential for innovation development but it is when MSEs successfully access funds and widely apply and commercialise research outputs and knowledge that the country would benefit. The findings also imply that indigenous MSEs who are supposed to be the bedrock for entrepreneurship and commercialise indigenous knowledge and research output required access to capital. For commercialisation of innovation, MSEs require cheap, patient, long-term and flexible capital which will not erode profitability, increase risk, or create debt and financial distress. There is therefore the need to institute innovation development grants and steer policy banking to direct low-cost, long-term, and flexible credit to SSI.

On the demand side, with increase access to appropriate finance, MSE can boost demand for indigenous innovation with credit sales. Using policy banking to create and ring-fence low interest or interest-free credits to indigenous innovation buyers can also improve demand and supply of indigenous innovation. Improvement in the payment system generally can help MSEs effectively sell more to people everywhere, collect payment on time and reduce risks.

8.4.1.3 Recommended policy strategies for orgnanisational factors

For policies relating to organisational factors, the findings imply MSEs commercialising indigenous innovation can benefit from further specific training which is already being provided by the Government and NGOs. However, to be beneficial the training should be more specific and focus on technology absorption capacity building. Enhancing and instituting specific skill development grants is therefore recommended to balance the observed current general purpose free training.

The findings of the current study also raise the need to step up policy efforts to improve infrastructure. It is only when industries are well developed, and business infrastructure are available that MSEs can leverage and improve their performance. More investment in business infrastructure and common resources (such as affiliate e-commerce sites or platforms and delivery systems) is therefore recommended, as MSEs by their size cannot on their own make such investment. Scaling up the emerging business and innovation support intermediary services as well as KBIs (particularly the universities) opening their facilities for use by startup MSEs can help in addressing organisational challenges.

Central University of Technology, Free State

8.4.1.4 Recommended policy strategies for market factors

The study provides confirmatory evidence of a strong link between market factors and indigenous innovation and firm performance. This implies that reducing cost of doing business, improving market conditions, and promoting demand of indigenous innovation should be an essential part of STI and industrial policies in Ghana. It is not just the policies, but the right implementation strategies are required to ensure the right outcome. Innovative policy implementation strategies are required to reduce cost of doing business for MSEs in order to make indigenous innovation competitive. Most of the excessive cost constraints faced by MSEs are also because of inefficient processes and procedures for regulatory compliance. Attraction of investment into packaging technologies for use by MSEs in SSI can also be helpful in cutting down cost, improving finishing quality and addressing the competitiveness challenges of indigenous innovation.

Conducting research and articulating uses and benefits of indigenous innovation can enhance demand. STI policy needs to be more robust on promotion and demand legitimisation of indigenous innovation to improve acceptability. There is need to push more local content policies and institute more demand legitimisation programmes. Incentivising private firms and individuals to buy indigenous innovation can increase demand and enhance commercialisation. A policy requiring the use and celebration of at least one indigenous innovation at every public event and encouraging same at private events can, for example, be influential in promoting indigenous innovation.

There is also the need to promote new business models that expand values and increase demand with government programmes. For example, a utility and affiliate model scheme whereby some selected indigenous innovation can be made available in a system to public institutions and some private firms to use as and when required and the Government guaranteeing bill payment, can help improve more value creation and expand sales. The utility models refer to making the innovation or resource available to key customers who would use it as when required and pay periodically, while the affiliate model refers to networking and selling through other businesses that sell complementary goods (Latilla, Frattini, Franzo, & Chiesa, 2020).

This study emphasises that policy strategies to improve demand and market conditions are most crucial for a well-functioning national innovation system and successful commercialisation of innovation. Commercialisation of indigenous innovation involves chicken and egg decisions. Improving quality can improve demand. Nonetheless, it is only when there is a clear effective demand that the right investment that improves quality can be made by firms.

8.4.1.5 Recommended policy strategies for technology

Current Ghana Government policies recognised the importance of technology in driving industrialisation (UNIDO, 2015; MESTI, 2017a; MESTI, 2017b). The findings of this study reemphasised that pursuing more vigorous and strategic STI policies and efficient implementation strategies would improve indigenous MSE performance. The state of the art and turnkey technologies may not be appropriate due to scale, market size and cost limitations. To enhance indigenous innovation, it is more useful promoting frugal and below-the-radar technologies as these may be more efficient to MSEs. In this respect, KBIs as part of their role in the innovation ecosystem should disseminate information on new and appropriate technologies. Offering technology support to MSE and promoting learning by doing, using interacting (DUI) systems, e.g., at universities and incubators can be helpful in improving the technology absorption capacity of small indigenous firms.

In sum, the current government policy strategy to support and promote industrial firms should be more focused on MSEs and small-scale entrepreneurs. Per the evidence from this study, MSEs have shown more willingness to undertake and exploit science and technology and commercialisation of indigenous. These MSEs are also more resilient. Improving their regulatory, financial, operating and marketing environments would significantly improve Ghana’s innovation performance.

8.4.2 Implications for Practice

In addition to policymaking, there are a number of implications of the findings of this study for firms and practitioners involved in the commercialisation of innovation. Some of these findings are particularly important because, regardless of the policy environment, successful commercialisation involves strategic decisions that are internal to firms. In view of the findings, this study also recommends a practical framework that can be followed by MSEs and other actors involved in commercialisation of indigenous innovation in small scale industrial sector to enhance performance.

8.4.2.1 Recommended firm strategies for regulation

One major finding of the current study is that regulation is, overall, a double edge sword. It creates both burdens and opportunities for commercialisation of indigenous innovation. MSEs, as one of the first steps in the commercialisation process should strategise for regulatory compliance as this can reduce the cost burden. MSEs must at the same and all times scan for opportunities arising out of regulation and strategise to take advantage of them. The literature (UINIDO, 2015; Oduro-Marfo, 2015; Amankwah-Amoah et al., 2017) portrayed local businesses play extremely limited or no role in influencing public procurement policy and encouragement of collaboration between GNIS Actors. MSEs should use their trade associations to improve links with institutions and lobby for market augmenting regulations and against unfavourable regulations.

8.4.2.2 Recommended firm strategies for finance

The evidence from finance-firm performance links analyses implies that MSEs have to be strategic in raising finance to be able to expand but not erode their profitability and increase business risks. Taking advantage of the improvements in the payment system MSEs can use credit sales policy, effectively collect payment, use post-paid and subscription payments models to increase sales, increase cash flow, improve efficiency, and reduce risks.

8.4.2.3 Recommended firm strategies for organisational factors

In respect of organisational factors, the practical implications of the findings are, first, improving indigenous innovation and MSE performance would also largely depends on owners/managers' internal abilities. MSEs' ability to deploy resources and capabilities to achieve business result depend on owner/managers' entrepreneurial resilience and on the job experience which can only be improved by MSEs themselves. Secondly, acquiring new skills such as ICT skills, using secondary e-commerce websites, deploring online resources, outsourcing, and using third party services would be beneficial in improving indigenous innovation and MSE performance.

8.4.2.4 Recommended firm strategies for market factors

The findings of this study substantiate the view that market success requires competitive, promotion and distribution strategies. The study recognised MSEs commercialising indigenous innovation operates in resource and affordability constrained environments and recommend they learn to do more with less to be competitive. Indigenous firms should use appropriate package and pricing strategies and deploy a fast and efficient delivery systems. Following examples of imports and multinationals and appropriately packaging and pricing their products and making them available in convenient forms and places can enhance patronage.

Indigenous firms should embrace and use new business models such as utility and affiliate models as these can help expand their sales. Also, how most indigenous innovative products are offered needs to be significantly improved to enhance value propositions in order to gain acceptance and expand sales. Leveraging digitalisation can be useful in expanding economic space and sales. Using social media for example can reduce marketing costs, increase product outreach, and expand economic space.

8.4.2.5 Recommended firm strategies for technology

In respect of technology, the practical implication of the findings of this study is that MSEs engaged in commercialisation of indigenous innovation have only two options. They must either embrace new technology or get extinct. To be commercially successful, MSEs must be flexible and able to incorporate trending ideas. Owners and managers should keep their eyes on emerging technologies in their sector. Using industry-level artifacts can complement, remove constraints, and reduce cost. Digital technology is changing systems, business models and cost structure. MSEs must from the onset develop digitalisation strategy and be clear on how they would use digital technology to reduce cost, enter new markets and operate more efficiently. It is strongly recommended MSEs digitise and embrace digital technology as digitalisation allows for efficient communication, coordinatation and operation as well as the use of e-marketplace, e-procurement, and e-payment all of which enhance sales, profit and feeling of success.

8.4.3 Implications for Researchers

This research on commercialisation of indigenous innovation has provided some insights which may be of interest to future researchers. First, obtaining the interview for primary data collection on innovation commercialisation from MSEs can be difficult. This is particularly so because MSEs engaged in innovative activities tend to protect their business advantage via secrecy and information restrictions. It is important to develop good relationship with the respondents first and work through their associations in order to get the maximum cooperation and support of the MSEs. This researcher paved his way through by associating with the Association of Small-Scale Industry (ASSI) and Association of Ghana Industry (AGI) and attending their programmes to understand the environment and build relationships with influencers.

Building advance relationship with influential MSE owners and association leaders is useful in obtaining high response rate as observed in this study.

Moreover, self-administration of questionnaire as much as possible is useful in getting right information and achieving high response. It is also important researchers provide assurance of confidentiality and animosity from the onset and observe certain decorum when conducting interview relating to innovation and business strategies in such setting. The experience from the current research is that respondents are initially unwilling to grant interview, however, once the trust is built, they become quite willing to provide a lot of useful information which enhance understanding of the issues.

8.5 LIMITATIONS OF THE STUDY

As with many research endeavors, the current study also has some theoretical and methodological limitations that may limit a wide-scale application of some of the findings. These limitations demand further confirmatory investigations of some of the findings.One main limitation of the research is the subjective aspect of the study. The objective data used in the study were self-reported, where MSE respondents gave their assesMSEnts of their innovation performance. This might be subjected to measurement errors and anonymisation challenges. This approach was necessary because of the low record keeping in the MSE sector. It is also believed MSE owners would feel freer and reflect better on their realities when doing subjective assesMSEnts.

Another limitation of the study is that the scope of the study is firm-level and caution is necessary when drawing inference to industry-level as innovation is complicated and some drivers could have an entirely different impacts at the firm and industry levels. Additionally, the study only concentrated on the Volta Region of Ghana. Although, Volta Region can be described as a microcosm of Ghana, the focus on a single region still puts a limitation to the study. A cross-regional study would have provided a better insight into the selected drivers of indigenous innovation and MSE's performance in Ghana.

Moreover, although the research model has been effective in measuring the impact of selected drivers on indigenous innovation and MSE performance, the model does not empirically measure successful commercialisation from the demand side. Since the focus of this study is on MSEs, it was impossible for the research to measure successful commercialisation from the dedmand side. Innovation is successfully commercialised when it is embraced by product pragmatists (Olefirenko & Shevliuga, 2017), therefore understanding the reasons for the purchase and widespread adaptation from buyers' side would have also provided more insights into myriad of issues in commercialisation of innovation.

8.6 FUTURE RESEARCH DIRECTION

The above limitations and findings of the study highlight some areas for future research on commercialisation of indigenous innovation. First and foremost, successful commercialisation is more of demand side issue. An extension of this study is therefore required to provide evidence of how demand side factors also affect the successful commercialisation of indigenous innovation and firm performance in Ghana. In this case, the research unit should focus on buyers and distributors and not the MSE as in the current study.

Secondly, it is suggested that future research could be extended beyond a single region in testing the proposed model. Probably other regions including Greater Accra, where there is a greater market for indigenous innovations. In such ways, the study could extend to cover the whole of Ghana.

Thirdly, the current study followed the research direction of Edler et al. (2016) to investigate the effect of regulation on innovation in different sectors and economies and evaluated the effect of regulation on indigenous innovation in the Ghanaian SSI sector. The consequent findings of mixed effects of regulation on indigenous innovation and MSE performance in this study implied there is a need for further research to identify areas for regulatory improvement to enhance commercialisation of indigenous innovation in low-income economies.

In addition, the negative effect of finance on profitability and feeling of success revelation by the current study calls for further investigation into the use of credit by MSEs in low-income economies. The abundant evidence of finance and firm performance linkages in the literature is well acknowledged. Nevertheless, future research could particularly test the use of credit finance in commercialisation of indigenous innovation in low-income economies.

Moreover, the measurement of indigenous innovation performance in the current study is limited to firm level. However, based on other views from the literature (Tassinari, & Maccarrone, 2017; Schmidlechner & Peruffo, 2017; Calvino & Virgillito, 2018) that the effect of innovation on some of the selected indicators, may differ at a higher aggregation level. It is therefore suggested future researchers evaluate indigenous innovation performance at the industry level or even macro level. This may present further and better evidence for policy.

In sum, there are many aspects of indigenous innovation commercialisation that required research attention. The current study is one of the first to have empirically examined commercialisation of indigenous innovation tellingly in the context of Ghana. Indeed, there is limited literature on commercialisation of innovation in general and particularly in sub-Sahara African countries.

REFERENCE LIST

Ababio, B.T. 2016. Actions to improve current state of student employability skills development in Ghana’s public universities: A case study of Geography departments. *International Journal of Education Evaluation*. 2(9):65–82.

Abdelnour, S. & Saeed, A.M. 2014. Technologizing humanitarian space: Darfur advocacy and the rape-stove Panacea. *International Political Sociology* 8 (2): 145–163.

Abdulai, A. F. L Murphy, L. & Thomas, B. 2020. University knowledge transfer and innovation performance in firms: The Ghanaian experience. *International Journal of Innovation Management,* 24(3): 2050023.

Abdullah, M., Zailani, S., Iranman, A. M. & Jayaraman, K. 2016. Barriers to green innovation initiatives among manufacturers: The Malaysian case. *Review of Managerial Science,* 10 (1): 683–709.

Abugre, J.B. 2018. Institutional governance and management systems in Sub-Saharan Africa higher education: developments and challenges in a Ghanaian Research University. *High Education*, 75, 323–339.

Acimovic, J. Erize, F. Thomas D. J. & Van Mieghem J.A. 2017. Forecasting Product Life Cycle Curves: *Practical approach and empirical analysis. Manufacturing & Service Operations Management*, Forthcoming; Vanderbilt Owen Graduate School of Management Research Paper No. 2867538*.*

Ackah, C. G Atta-Ankomah, R. & Appiah Kubi, J. (2021). The Effect of Kaizen on Performance: Evidence from Manufacturing Enterprises in Ghana. *The European Journal of Development Research*, 1-26.

Ackah, C., Adjasi, C. & Turkson, F. 2016. Industrial Policy in Ghana. *In*: Newman C, Page J, Rand J, Shimles A, Söderbom M, Tarp F (eds) *Manufacturing transformation: comparative studies of industrial development in Africa and emerging Asia*. Oxford University Press, Oxford.

Acs, Z. J., Autio, E., and Szerb, L. 2014. National systems of entrepreneurship: Measurement issues and policy implications. *Research Policy*, 43(3): 476-494.

Acs, Z., Astebro, T., Audretsch, D. & Robinson, D. T. 2016. Public policy to promote entrepreneurship: A call to arms. *Small Business Economics*, 47: 35–51.

Adam, A. M. 2020. Sample size determination in survey research. Journal of Scientific Research and Reports, 90-97.

Addo, E.O. 2017. The impact of manufacturing industries on Ghana's economy. *International Journal of Research Studies in Management*, 6(2): 73-94.

Adjimah, H.P., Atiase, V.Y. and Dzansi, D.Y. 2022. Examining the Role of Regulation in the Commercialisation of Indigenous Innovation in Sub-Saharan African Economies: Evidence from the Ghanaian Small-Scale Industry", *Administrative Sciences*, *12(*3): 118-1138

Adjimah, H. P., Atiase, V. Y., & Dzansi, D. Y. 2022, August. Propelling indigenous innovations in low-income economies: Do financial incentives help?, BAM

Adjimah, P.H. & Perry, A.L. 2014. Effectiveness of entrepreneurship development programs in Ghanaian polytechnics" .*International Review of Management and Marketing*, *4* (1):78-89.

Adolwa, I.S., Schwarze, S., Bellwood-Howard, I., Nikolaus S. & Andreas B. 2017. A comparative analysis of agricultural knowledge and innovation systems in Kenya and

Ghana: Sustainable agricultural intensification in the rural–urban interface. Springer, *Agric Hum Values* 34, (June) 453–472.

Adrian S., Mariano F. & Hernán T. 2014. Grassroots innovation movements: challenges and contributions. *Journal of Cleaner Production*, 63:114-124.

Adrian S., Mariano F. & Hernán T. 2014. Grassroots innovation movements: challenges and contributions. *Journal of Cleaner Production*, 63:114-124.

Adu, I.N., Boakye, K.O., Suleman, A.R. & Bingab, B.B.B. 2020. Exploring the factors that mediate the relationship between entrepreneurial education and entrepreneurial intentions among undergraduate students in Ghana. *Asia Pacific Journal of Innovation and Entrepreneurship*, 14(2): 215-228.

Afful, J.B. & Owusu G. 2017. Types and drivers of innovation in the manufacturing sector of Ghana, Network for Socioeconomic Research and Advancement: Working Paper.

African Business. 2015. Welcome to Ghana, Africa's Shining Star. *Supplement Investing in Ghana*, 15 April: 6–7.

Aggestam, M. 2014. Conceptualising entrepreneurial capital in the context of institutional change. *International Entrepreneurship and Management Journal*, 10 (1): 165–18.

Agostino Menna, A. & Walsh, P.R. 2019. Assessing environments of commercialization of innovation for MSEs in the global wine industry: A market dynamics approach. *Wine Economics and Policy*, 8(2):191-202.

Akinboade, A. O. 2015. Determinants of MSEs growth and performance in Cameroon's Central and Littoral provinces' manufacturing and retail sectors. African Journal of Economic and Management Studies, 6 (2) 183-196.

Akrong, R. Mbogoh, S. G. & Irungu, P. 2021. Youth agripreneurship in the horticultural value chain: The case of small scale mango farmers in Southern Ghana, *African Development Review.*

Akter, S., Fosso Wamba, S. & Dewan, S. 2017. Why PLS-SEM Is Suitable for Complex Modelling? An Empirical Illustration in Big Data Analytics Quality. *Production Planning & Control*, 28: 1011-1021

Al Qershi, N. 2021. Strategic thinking, strategic planning, strategic innovation and the performance of MSEs: The mediating role of human capital. *Management Science Letters*, 11(3), 1003-1012.

Al Qershi, N., Abas, Z., & Mokhtar, S. S. M. 2018. Strategic innovation as driver for MSE performance in Yemen. *Journal of Technology and Operations Management*, 13(1): 30-41.

Alene, E. T. 2020. Determinants that influence the performance of women entrepreneurs in micro and small enterprises in Ethiopia. *Journal of Innovation and Entrepreneurship*, 9(1):1-20.

Alhassan, M & Habib, A.M. 2016. The constraints of Ghanaian polytechnics in adopting competency based training (CBT): The case of a pilot-tested programme, *Journal of Education and Practice*, 7(24):178-185.

Allen, F., Qian, M., Xie, J. 2018. Understanding informal financing. *J. Finance and Intermediation*, 39(1): 19-33.

Altaf, N. and Ahmad, F. 2019. Working capital financing, firm performance and financial constraints: Empirical evidence from India. *International Journal of Managerial Finance*, 15(4):464-477.

Altmann, P. 2015. Studying Discourse-Innovations: The Case of the Indigenous Movements in Ecuador. *Historical Social Research* 40 (3): 161-84. doi: 10.12759/hsr.40.2015.3.161-184.

Amankwah-Amoah, J. & Sarpong, D. 2015. Historical pathways to a green economy: the evolution and scaling-up of solar P.V. in Ghana, 1980–2010. *Technology. Forecast and Social Change.*

Amankwah-Amoah, J. 2015. Solar energy in sub-Saharan Africa: the challenges and opportunities of technological leapfrogging. Thunderbird Int. Bus. Rev. 57 (1), 15–31.

Amankwah-Amoah, J. 2016. The evolution of science, technology and innovation policies: A review of the Ghanaian experience. Technol. Forecast. Soc. Chang. 110 134–142.

Amankwah-Amoah, J. 2019. Technological revolution, sustainability, and development in Africa: Overview, emerging issues, and challenges. *Sustainable Dev*elopment. 27, 910–922.

Amankwah-Amoah, J., Debrah, Y. A., Honyenuga, B. Q. & Adzoyi, P.N. 2017. Business and government interdependence in emerging economies: Insights from hotels in Ghana: *International Journal of Tourism Research*, 20(1): 72-81.

Amegbe, H., Owino, J. O., & Nuwasiima, A. 2017. Green Marketing Orientation (GMO) and Performance of MSEs in Ghana. Journal of Marketing Development and Competitiveness, 11(1). [Online]. Available: https://articlegateway.com/index.php/ [2020, October 2].

Ametowobia, D., Baur, N., & Jungmann, R. 2015. Methods of innovation research: Qualitative, quantitative and mixed methods approaches. GESIS, Leibniz Institute for the Social Sciences.

Anderson, D. M. 2020. *Design for manufacturability: How to use concurrent engineering to rapidly develop low-cost, high-quality products for lean production*, Second Edition, Productivity Press.

Anderson, J., & Markides, C. 2007. Strategic Innovation at the Base of the Pyramid. *MIT Sloan Management Review*, 49 (49116): 83 – 88..

Anning-Dorson, T. 2018. Customer involvement capability and service firm performance: The mediating role of innovation. *Journal of Business Research*, 86, 269-280.

Antons, D., Grünwald, E., Cichy, P., & Salge, T. O. 2020. The application of text mining methods in innovation research: current state, evolution patterns, and development priorities. *R&D Management*, *50*(3): 329-351.

Aryeetey, E., & Kanbur, S. R. 2017. *The Economy of Ghana Sixty Years after Independence.* Oxford University Press.

Asheim, B., Grillitsch, M. & Trippl, M. 2016. Regional Innovation Systems: past – present – future Paper 2 in R Shearmur, C. Carrincazeaux and D. Doloreux (eds) Handbook of Geographies of Innovation Cheltenham: Edward Elgar, (45-62).

Asiedu, M. 2016. Innovation among small and medium scale enterprises (MSEs) in Ghana: Assessing the constraining factors. Retrieved from http://www.ugspace.ug.edu.gh [2020, Sept 13].

Astebro, T., Braguinsky, S., Braunerhjelm, P. & Brostro¨m, A. 2015. Academic Entrepreneurship: Bayh-Dole versus the 'Professor's Privilege [online]. Available: http://ssrn.com/abstract=2677283 [2019, June 12].

Atiase, V. Y., Kolade, O., & Liedong, T. A. 2020. The emergence and strategy of tech hubs in Africa: Implications for knowledge production and value creation. *Technological Forecasting and Social Change*, 161, 120307

Atiase, V. Y., Wang, Y., & Mahmood, S. 2019. FNGOs and financial inclusion: Investigating the impact of microcredit on employment growth in Ghana. The *International Journal of Entrepreneurship and Innovation*, 20(2): 90–106

Atiase, V.Y. and Botchie, D. 2018. Does Managerial Training have any impact on the performance of MSE Managers? Empirical evidence from Ghana. BAM Conference (2018, September), University of West of England, Bristol, United Kingdom.

Atiase, Y. V. 2018. The impact of FNGO services on the performance of micro and small enterprises: Empirical evidence from the Volta Region, Ghana', PhD Dissertation, University of Wolverhampton. Available: https://wlv.openrepository.com/ [2019, Jan 13]

Ávila, L.V., Filho, W.L., Brandli, L., Macgregor, C.J., Molthan-Hill, P., Özuyar, P.G. & Moreira, R.M. 2017. Barriers to innovation and sustainability at universities around the world. *Journal of Clean Production*, 164:1268–1278.

Ayelazuno, J.A. 2014. Neoliberalism and growth without development in Ghana: A case for state-led industrialisation. *Journal of Asian and African Studies*, 29(3–4): 205–225

Azarmi, D. 2016. Factors Affecting Technology Innovation and Its Commercialisation in Firms. *Modern Applied Science*, 10(7) 36-46).

Azila-Gbettor, E. M., Adjimah, H. P., & Tibu, S. K. 2014. Fiscal decentralization and poverty reduction: Citizens view. *Journal of Social Economics Research*, 1(6): 118-128.

Azila-Gbettor, E.M. and Adjimah, H.P. 2013. Entrepreneurship training and capacity building of Ghanaian polytechnic graduates, *International Review of Management and Marketing*, 3(3): 102-111.

Baark E. 2016. The Chinese State and Its Role in Shaping China's Innovation System. In: Chu Y. (eds). *The Asian Developmental State*. Palgrave Macmillan, New York

Baker, T., & Nelson, R. E. 2005. Creating Something from Nothing: Resource Construction through Entrepreneurial Bricolage. *Administrative Science Quarterly*, 50(3), 329–366.

Baker, T., Miner, A. & Easley, D. 2003. Improvising Firms: Bricolage, Retrospective Interpretation and Improvisational Competencies in the Founding Process. *Research Policy* 32: 255–76.

Baker, T., Miner, A. & Easley, D. 2003. Improvising Firms: Bricolage, Retrospective Interpretation and Improvisational Competencies in the Founding Process. *Research Policy 32:* 255–76.

Balabanis, G. & Diamantopoulos, A. 2016. Consumer Xenocentrism as Determinant of Foreign Product Preference: A System Justification Perspective. *Journal of International Marketing*: 24 (3) 58-77.

Baoko, G., Acheampong, I. A., & Ibrahim, M. 2017. Determinants of bank credit in Ghana: A bounds-testing cointegration approach. *African Review of Economics and Finance,* 9(1): 33-61.

Barr, S. H., Baker, T., Markham, S. K. & Kingon, A. L. 2014. Bridging the valley of death: lessons learned from 14 years of commercialisation of technology education Eng. Manag. Rev. IEEE, 42 (1): 13-34.

Bartels, F. L., Koria R. & Vitali, E. 2016. Barriers to innovation: The case of Ghana and implications for developing countries. *Triple Helix*, 3(12)

Bawumia M. 2020. Ghana launches universal QR payment system, *Digital Watch* [Online]. Available: https://dig.watch/updates/ghana-launches-universal-qr-payment-system [2020, November 7].

Bayen, M, & Giuliani D. 2018. Tech Hubs Ecosystems across Africa and Asia, *GSMA* [Online]. Available: https://briterbridges.com/618-active-tech-hubs [9 November 2019].

Bayen, M.; Giuliani, D. 2020. A look at the 442 active tech hubs of the continent. Mobile for Development, *GSMA* [online] Available online https://www.gsma.com/mobile fordevelopment/blog [14 January, 2020]

Bayer, E., Srinivasan, S., Riedl, E. J., & Skiera, B. 2020. The impact of online display advertising and paid search advertising relative to offline advertising on firm performance and firm value. *International Journal of Research in Marketing*, 37(4): 789-804.

Băzăvan A. 2019. Chinese government's shifting role in the national innovation system. *Technological Forecasting and Social Change*, 148, (November), 119738

Băzăvan, A. 2019. Chinese government's shifting role in the national innovation system. *Technological Forecasting and Social Change*, 148, 119738.

Becker, J. M., Ringle, C. M., & Sarstedt, M. 2018. Estimating moderating effects in PLS-SEM and PLSc-SEM: Interaction term generation* data treatment. *Journal of Applied Structural Equation Modeling*, 2(2), 1-21.

Behfar, K. & Okhuysen, .A. 2018. Perspective—Discovery within Validation Logic: Deliberately Surfacing, Complementing, and Substituting Abductive Reasoning in Hypothetico-Deductive Inquiry. *Organization Science*, 29(2): 191-355.

Béland, D., Foli, R., & Kpessa-Whyte, M. 2018. Social policy as nation-building: Identity formation, policy feedback, and social citizenship in Ghana. *Canadian Journal of African Studies*, 52(1):19-36.

Bell-Masterson, J., & Stangler, D. 2015. Measuring an entrepreneurial ecosystem. Arlington, Virginia: Kauffman Foundation

Benitez, J., Henseler, J., Castillo, A., & Schuberth, F. 2020. How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Information & Management*, 57(2): 103168.

Bergek, A., Hekkert, M., Jacobsson, S. 2015. Technological innovation systems incontexts: Conceptualising contextual structures and interaction dynamics. *Environmental Innovation and Societal Transitions*, 16(3): 51-64

Bhatti, Y. A. 2012. What is Frugal, What is Innovation? Towards a Theory of Frugal Innovation [online] Available: http://dx.doi.org/10.2139/ssrn.2005910 [2019, Jan 15]

Bianchi, C., Bianco, M., Ardanche, M., & Schenck, M. 2017. Healthcare frugal innovation: a solving problem rationale under scarcity conditions. *Technology in Society,* 51, 74-80.

Bin, P., Chen, X., Fracasso, A., & Tomasi, C. 2019. Firm employment growth in China: The role of marketization and regional economic factors. *Growth and Change*. Wiley Periodicals.

Blanc, J. & DeMSEdt, L. 2014. In search of a 'crude fancy of childhood': deconstructing mercantilism. *Cambridge Journal of Economics* 38: 585-604.

Central University of Technology, Free State

Bloomfield, J., & Fisher, M. J. 2019. Quantitative research design. Journal of the Australasian Rehabilitation Nurses Association, 22(2): 27-30.

Blowfield, M. & Dolan, C.S. 2014. Business as a development agent: Evidence of possibility and improbability. *Third World Quarterly* 35 (1): 22–42.

Boame, I., Solace, K., & Issaka, S. 2014. Adoption of accounting practices and its effects on MSESs: Financial Perspective of sachet water producers in Northern Ghana. *Research Journal of Finance and Accounting*, 5(17):166-179.

Bogdanova, S.V., Kozel, I.V., Ermolina, L.V., Litvinova, T.N. 2016 Management of small innovational enterprise under the conditions of global competition: possibilities and threats. European Resource Studies, 19(2 Special Issue), 268–275.

Boso, N., Story, V.M., Cadogan, J.W. 2013. Entrepreneurial orientation, market orientation, network ties and performance: Study of entrepreneurial firms in a developing economy. *Journal of Business Venturing*, 28 (6): 708–727.

Botchie, D. & Atiase, V. 2018. Nexus between technology absorption and firm growth in Africa: A resource-based perspective. Britsih Academy of Management Conference Proceedings, 2018:1-22.

Botchie, D., Sarpong, D. & Bi, J. 2017. Technological inclusiveness: Northern versus Chinese induced technologies in the garment industry. *Technological Forecasting and Social Change,* 119: 310–322.

Bruton, G., Khavul, S., Siegel, D., & Wright, M. 2017. Newfinancial alternatives in seeding entrepreneurship: microfinance, crowdfunding, and peer–to–peer innovations. *Entrepreneurship Theory and Practice*, 39(1): 9–26.

Busseri, M. A. 2018. Examining the structure of subjective well-being through meta-analysis of the associations among positive affect, negative affect, and life satisfaction. *Personality and Individual Differences*, 122(1): 68–71.

Cabrera, E.M. and Mauricio, D. 2017. Factors affecting the success of women's entrepreneurship: a review of literature. *International Journal of Gender and Entrepreneurship*, 9(1): 31-65.

Calvino, F., & Virgillito, M. E. 2018. The innovation-employment nexus: a critical survey of theory and empirics. *Journal of Economic surveys*, 32(1): 83-117.

Castillo-Apraiz, J. & Matey, J. 2020. Customizing competitive strategy to entry timing: Implications for firm performance in the pharmaceutical industry. *Managerial and Decision Economics,* 41(6): 883-1140.

Chataway, J., Hanlin, R. & Kaplinsky, R. 2014. Inclusive innovation: An architecture for policy development*. Innovation and Development* 4 (1): 33–54.

Chatterji, M. 2016. Technology Transfer in the Developing Countries. London: Palgrave MacMillian.

Chege, S.M. & Wang, D. 2020. Information technology innovation and its impact on job creation by MSEs in developing countries: An analysis of the literature review. *Technology Analysis & Strategic Management*, 32(3): 256-271.

Chen, T., Qian, L. & Narayanan, V. 2017. Battle on the Wrong Field? Entrant Type, Dominant Designs, and Technology Exit. *Strategic Management Journal*, .38, 2579–2598.

Cheong, S. T., Li, J., Ung, C. O. L., Tang, D., & Hu, H. 2020. Building an innovation system of medical devices in China: Drivers, barriers, and strategies for sustainability. SAGE *open medicine*, 8, 2050312120938218.

Carboni, O. A. 2017. The effect of public support on investment and R&D: An empirical evaluation on European manufacturing firms. *Technological Forecasting and Social Change*, 117, 282-295.

Choudhary, M. A., & Jain, K. A. 2020. How public information affects asymmetrically informed lenders: Evidence from a credit registry reform. *Journal of Development Economics,* 143(2), 102407.

Christensen, C.M., Raynor, M.E., & McDonald, R. 2015. What is disruptive innovation? *Harvard business review* (December 2015 Issue).

Cirera, X., Lage, F. L. & Sabetti, L. 2016. *ICT use, innovation, and productivity: evidence from Sub-Saharan Africa.* Washington, DC: World Bank.

Cirera, X., & Maloney, W. F. (2017). The Nature of Innovation in Developing Countries. Available: https://elibrary.worldbank.org [30 Oct 2021]

Cirera, X., & Muzi, S. (2016). Measuring firm-level innovation using short questionnaires: evidence from an experiment. World Bank Policy *Research Working Paper,* (7696).

Clark, N., Chataway J., Hanlin R., Kale, D., Kaplinsky R., Muraguri L. & Wamae W. 2009. *Below the radar: What does innovation in the Asian driver economies have to offer other low income economies, Innogen Working Paper Series No. 69*, Economic and Social Research Council, Open University, U.K.

Clayton, P., Feldman, M., & Lowe, N. 2018. Behind the scenes: Intermediary organizations that facilitate science commercialization through entrepreneurship. *Academy of Management Perspectives*, 32(1): 104–124.

Council for Scientific and Industrial Research (CSIR) Act 1996 (Act 521) [Online]. Available: http://www.csir.org.gh/Doc/CSIR-Act_521 [2020, October 2]

Cozzens, S. and Sutz, J. 2014. Innovation in informal settings: Reflections and proposals for a research agenda. *Innovation and Development* 4 (1): 5–31.

Cramer, J. and Krueger, A. B. 2016. Disruptive change in the taxi business: The case of Uber. American Economic Review, 106 (5): 177–182.

CSIR, (Council for Scientific and Industrial Research). 2014. About the Institute. [Online]. Available: http://www.csir-iir.org/about.html [2020, March 2].

CSIR. 2015. Background. [Online]. Available: http://www.csir.org.gh/ [2020, March 2].

Cusmano, L., Koreen, M., & Pissareva, L. 2018. 2018 OECD ministerial conference on MSEs: key issues paper.

D. Ciriaci, P. Moncada-Paternò-Castello, P. Voigt Innovation and job creation: a sustainable relation? *Eurasian Business Review*. 6 (2016): 189-213.

Dale, W.J. and Khuong, M.V. 2016. The ICT Revolution, World Economic Growth, and Policy Issues. *Telecommunications Policy*, 40 (1): 383-397.

Danquah, M., & Amankwah-Amoah, J. 2017. Assessing the relationships between human capital, innovation and technology adoption: Evidence from sub-Saharan Africa. *Technological Forecasting and Social Change*, 122, .24–33.

Dansoh, A., Frimpong, S. & Oteng, D. 2017. Industry environment features influencing construction innovation in a developing country: a case study of four projects in Ghana. *International Journal of Technological Learning, Innovation and Development* 9(1): 65-95.

David-West, O., Iheanachor, N., & Umukoro, I. O. 2019. Mobile money as a frugal innovation for the bottom of the pyramid–Cases of selected African countries. *Africa Journal of Management*, 5(3), 274-302.

Dayan, R., Heisig, P. & Matos, F. 2017. Knowledge management as a factor for the formulation andimplementation of organization strategy. *Journal of Knowledge Management,* 21(2): 308-329.

De Toni, D., Milan, G. S., Saciloto, E. B., & Larentis, F. 2017. Pricing strategies and levels and their impact on corporate profitability. *Revista de Administração*, 52(2): 120–133.

De Zubielqui, GC, N Lindsay & A O'Connor. 2014. How product, operations, and marketing sources of ideas influence innovation and entrepreneurial performance in Australian MSEs. *International Journal of Innovation Management*, 18(2): 1450017

Dell, R. B., Holleran, S., & Ramakrishnan, R. 2002. Sample size determination*. ILAR journal,* 43(4), 207-213.

Denzin, N. K., & Lincoln, Y. S. 2013. *The Sage handbook of qualitative research*. Thousand Oaks, CA: Sage.

Dijkhuizen, J., Gorgievski, M., van Veldhoven, M., & Schalk, R. 2018. Well-being, personal success and business performance among entrepreneurs: A two-wave study. *Journal of Happiness Studies*, 19(8), 2187-2204.

Dijkstra, T.K., & Henseler, J. 2015. Consistent Partial Least Square Path Modeling. *MIS Quartley*, 39 (2): 297-316.

Divakaran, S., Schneider & S. McGinnis, P. 2018. Ghana Private Equity and Venture Capital Ecosystem Study. Policy Research Working Papers [Online]. Available: elibrary.worldbank.org [2020, March 3]

Do, H., Mazzarol, T., Soutar, G. N., Volery, T., & Reboud, S. 2018. Organisational factors, anticipated rents and commercialisation in MSEs. *International Journal of Innovation Management*, 22(02): 1-30.

Do, TH (2014). Determinants of innovation commercialization management and anticipated returns: An exploratory typology of MSEs. *International Journal of Innovationand Technology Management,* 11(06): 1450042.

Doku, I., Adjei, E., Adjimah, H., & Akuma, J. 2016. Determinants of capital structure of listed oil marketing companies in Ghana. *American Academic Scientific Research Journal for Engineering, Technology, and Sciences*, *18*(1):171-181.

Donkor, J., Donkor, G.N.A. & Kwarteng, C.K. 2018. Strategic planning and performance of MSEs in Ghana: The moderating effect of market dynamism. *Asia Pacific Journal of Innovation and Entrepreneurship*, 12 (1): 62-76.

Donkor, J., Donkor, G.N.A., Kankam-Kwarteng, C. & Aidoo, E. 2018. Innovative capability, strategic goals and financial performance of MSEs in Ghana. *Asia Pacific Journal of Innovation and Entrepreneurship*, 12(2): 238-254.

Dzansi, D. Y., P. Rambe, & W. J. Coleman. 2015. Enhancing new venture creation success in South Africa: A project management perspective. *Problems Perspective in Management* 13(2): 418-426.

Dzhandzhugazova, E.A., Ilina, E.L., Latkin, A.N. & Kosheleva, A.I. 2016. Development of creative potential of cinema tourism. International Journal of Environmental and Science Education, 11: 4015-4024.

Easmon, R.B., Kastner, A.N.A., Blankson, C. and Mahmoud, M.A. 2019. Social capital and export performance of MSEs in Ghana: the role of firm capabilities. *African Journal of Economic and Management Studies,* 10 (3): 262-285.

Ebere, O. P. 2017. The Role of national directorate of employment and small Scale enterprises in reducing Unemployment in the economy (Doctoral dissertation).

Edler, J. & Fagerberg, J. 2017. Innovation policy: What, why, and how. *Oxford Review of Economic Policy*, 33(1): 2–23.

Edler, J., Cunningham P., & Gök, A. 2016.The impact of direct support to R&D and innovation in firms: In *Handbook of Innovation Policy Impact*. Cheltenham: Edward Elgar Publishing.

Edusah, S. E., & Antoa, E. (2014). The socio-economic contribution of rural small-scale industries in Ghana. *Journal of Economics and Sustainable Development*, 5(2), 161–172.

Eisenberg, R.S. & W. Price, W.N. 2017. Promoting healthcare innovation on the demand side, Journal of Law and the Biosciences, 4(1) 3–49.

Eldridge, D., Nisar, T. M & Torchia, M. 2019. What impact does equity crowdfunding have on MSE innovation and growth? An empirical study. Small Business Economics, 56(2): 105-120.

El-Jardali F., Ataya N. & Fadlallah, R. 2018. Changing roles of universities in the era of SDGs: rising up to the global challenge through institutionalising partnerships with governments and communities. *Health Res Policy System*, 16:38

Elsenhauer, N., Bowker, M., Grace, J., & Powell, J. 2015. From Patterns to Causal Understanding: Structural Equation Modeling (SEM) in Soil Ecology. *Pedobiologia*, 58 (2): 65-72.

Engelhardt, A. 2015. The Sociology of Knowledge Approach of Discourse Analysis in Innovation Research: The Case of Evaluation in Contemporary Fine Art, Historical Social Research 40 (3): 130-60.

Engerman, S.L. & Rosenberg, N.2016. Innovation in Historical Perspective. In: Diebolt C., Haupert M. (eds) *Handbook of Cliometrics*. Springer, Berlin, Heidelberg.

EPA Act 1994 (Act 490) [Online]. Available: https://www.bcp.gov.gh/acc/registry/docs [2020, January 2]

Eshun, J. F. 2019. A critical look at the Ghanaian one district one factory industrial policy in relation to climate change*. African Journal of Environmental Science and Technology* 13(4):155-161.

Essel, B.K.C., Adams, F. & Amankwah, K. 2019. Effect of entrepreneur, firm, and institutional characteristics on small-scale firm performance in Ghana. *Journal of Global Entrepreneurship Research* 9(1): 1-20

Eton, M. Mwosi, F. & Mutesigensi, D., Ebong, C.D. 2017. Credit Financing and Performance of MSEs in Lira Municipality, Uganda. *Research Journal of Finance and Accounting*, 8(8) [online]. Avaialable: www.iiste.org [2021, January 2]

Etzkowitz, H. & Leydesdorff, L. 2000. The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations, *Research Policy*, 29: 109–123

Eurofound, E. F. for the I. of L. and W. C.2016. *Job Creation in MSEs: ERM Annual Report 2015*. Luxembourg.

European Commission .2015. Digital Entrepreneurship Monitor [online]. Available: https://ec.europa.eu/ growth/tools-databases/dem/monitor/. [2021, April 3].

Ewurah, S. 2017. The Concept of eGovernment: ICT Policy Guidelines for the Policy Makers of Ghana. *Journal of Information Security*, 8(2): 106-124.

Fan Z. P., Che Y. J. & Chen Z. Y. 2017. Product sales forecasting using online reviews and historical sales data: A method combining the Bass model and sentiment analysis. Journal of Business Research, 74: 90-100, Elsevier.

Fan, Y., Chen, J., Shirkey, G., John, R., Wu, S. R., Park, H., & Shao, C. 2016. Application of Structural Equation Modeling (SEM) in Ecological Studies: An Updated Review, *Ecological Process*, 5(19): 1-12.

Farjoun, M., Ansell. C & Boin, A. 2015. Pragmatism in organisation studies: Meeting the challenges of a dynamic and complex world. Organisation Science. 26(6):1787–1804

Fechner, H., & Shapanka, M. S. 2018. Closing diversity gaps in innovation: Gender, race, and income disparities in patenting and commercialization of inventions. *Technology & Innovation*, 19(4): 727-734.

Feige, D. & Vonortas, S. N. 2017. Context appropriate technologies for development: Choosing for the future. *Technological Forecasting and Social Change*, 119, 219–226

Feldman, M. P. 2014. The character of innovative places: Entrepreneurial strategy, economic development, and prosperity. *Small Business Economics*, 43(9)

Feng, C., Ma, R., & Jiang, L. 2020. The impact of service innovation on firm performance: a meta-analysis. *Journal of Service Management*, *32*(3): 289-314.

Folger, R. & Stein, C. 2017. Abduction 101: Reasoning processes to aid discovery. *Human Resource Management Rev*iew. 27(2):306–315.

Fowler, F. J. 2014. *Survey research methods*. Sage Publications.

Fowowe. B 2017. Access to finance and firm performance: Evidence from African countries. *Review of Development Finance*, 7(1): 6-17.

Francesco, Q. & Stefano, U. 2017. Knowledge flows, externalities and innovation networks. *Regional Studies* 51(8): 1133-1137.

Fu, X., Mohnen, P. & Zanello, G. 2018. Innovation and productivity in formal and informal firms in Ghana. *Technological Forecasting and Social Change*, 131(C):315-325, Elsevier.

Fusch, P. Fusch, G.E. & Ness R.L. 2018. Denzin's Paradigm Shift: Revisiting Triangulation in Qualitative Research. *Journal of Social Change*, 10(1): 19–32.

Futterer, F., Schmidt, J. & Heidenreich, S. 2018. Effectuation or causation as the key to corporate venture success? Investigating effects of entrepreneurial behaviors on business model innovation and venture performance. Long Range Planning, 51(1):64-81.

Gachie, W. 2020. Higher education institutions, private sector and government collaboration for innovation within the framework of the Triple Helix Model. *African Journal of Science, Technology, Innovation and Development*, 12(2): 203-215.

Gachie, W. & Govender, D.W. 2017. Commercialization of higher education institutions' research within the National System of Innovation. *African Journal of Science, Technology, Innovation and Development*, 9(4): 387-397.

Gao, Y.   Hafsi, T. 2015. R & D spending among Chinese MSEs: the role of business owners' characteristics. *Management Decision,* 53 (8) 1714-1735.

Gastrow, M., Kruss, G., & Petersen, I. H. 2016. Connecting capabilities in highly unequal developing countries: The case of the Square Kilometre Array telescope in South Africa. *Development Southern Africa*, 33(3), 361-375.

Giele, H. P. (2021). Supporting the call for improving the code of publication ethics to incorporate editorial decisions regarding the causation of harm by publication. *Clinical Ethics*, 16(3): 163-164

Gläser, J. & Grit L. 2015. A Bibliometric Reconstruction of Research Trails for Qualitative Investigations of Scientific Innovations, *Historical Social Research*, 40 (3): 299-330.

Global Innovation Index. 2016. Winning with Global Innovation, Cornell University, INSEAD and WIPO, Ithaca, Fontainebleau, and Geneva.

Global Innovation Index. 2017. Innovation Feeding the World, *Cornell University, INSEAD and WIPO,* Ithaca, Fontainebleau, and Geneva.

Global Innovation Index. 2018. Energizing the World with Innovation, *Global Innovation Index*, Ithaca, Fontainebleau, and Geneva

Global Innovation Index. 2019. Creating healthy lives—the Future of Medical Innovation, *Cornell University, INSEAD and WIPO,* Ithaca, Fontainebleau, and Geneva

Glover, M., Obubuafo, J. & Agyeman-Duah, M. 2017. Constraints associated with the marketing channel of lettuce and cabbage trade in Ghana. *Journal of Agriculture and Sustainability* 10(2): 116-143.

Goertzen, M. J. 2017. Introduction to quantitative research and data. *Library Technology Reports*, *53*(4):12-18.

Gordon, C. 2018. Charity begins at home: The University and the delivery of the Sustainable Development Goals, Inter-College Lecture Series, College of Basic and Applied Sciences University of Ghana, April 12 2018 [Online]. Available: https://www.youtube.com/watch?v=ZiVhVcHM11U [2020, December 12]

Gosens, J., Hellsmarka, H., Kåbergerb, T., Liuc, L., Sandéna, B. A., Wang, S. & Zhaoe, L. 2018. The limits of academic entrepreneurship: Conflicting expectations about commercialisation and innovation in China's nascent sector for advanced bio-energy technologies. *Energy Research & Social Science* 37 (1), Elsevier.

Government of Ghana (GoG). 2017. The coordinated programme of economic and social development policies 2017-2024: An agenda for jobs-creating prosperity and equal opportunity for all. In: Presented by Nana Addo Dankwa Akufo-Addo, President of the Republic to the 7th Parliament of the 4th Republic, 20 October 2017. Accra, Ghana

Guan, J., & Yam, R. C. (2015). Effects of government financial incentives on firms' innovation performance in China: Evidences from Beijing in the 1990s. *Research Policy*, 44(1), 273-282.

Gupta, N., & Mirchandani, A. (2018). Investigating entrepreneurial success factors of women-owned MSEs in UAE. *Management Decision*. 56(1): 219-232

Guy, T., Agyapong, F. & Mmieh, C.M. 2018. Factors influencing the growth of MSEs: The case of Ghana. *Thunderbird International Business Review, Emerging Market Perspectives,* 60(4): 549-563.

Hahn, R. 2012. Inclusive business, human rights and the dignity of the poor: A glance beyond economic impacts of adapted business models. *Business Ethics*: *European Review,* 21 (1): 47–63.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. 2019. When to use and how to report the results of PLS-SEM. *European business review, 31(1).*

Hair, J.F, Hult, G.T.M., Ringle, C.M., & Sarstedt, M. 2014. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).* Thousand Oaks: SAGE Publications.

Hair, J.F., Hult, G.T.M., Ringle, C.M., Sarstedt, M. and Thiele, K.O. 2017b. Mirror, Mirror on the wall: acomparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, 45 (5): 616-632.

Hall, B.H & Sena, V. 2017. Appropriability mechanisms, innovation, and productivity: evidence from the U.K. *Economics of Innovation and New Technology*, 26:1-2,

Harilal, M. 2017. Below the radar innovations and emerging property right approaches in Tibetan medicine. *The Journal of World Intellectual Property* 20(6): 239–257.

Hart, S. 2011. Taking the Green Leap to the Base of the Pyramid. In T. London & S. L. Hart (Eds.), *Next Generation Business Strategies for the Base of the Pyramid. New Approaches for Building Mutual Value*. Upper Saddle River, New Jersey: Pearson Education.

Hart, S., & Christensen, C. 2002. The great leap. Driving innovation from the Base of the Pyramid. *MIT Sloan management review*, 44(1), 51–56

Haryanto, T., & Retnaningrum, M. (2020).The Impact of Marketing Expenditure on Firm Performance. *Jurnal Manajemen Bisnis*, 11(2), 188-201

Henseler, J., Ringle, C. M., & Sarstedt, M. 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science,* 43(1): 115-135.

Hizarci-Payne, A. K., Ipek, I., & Kurt Gümüş, G. 202). How environmental innovation influences firm performance: A meta-analytic review. *Business Strategy and the Environment*, *30*(2), 1174-1190.

Central University of Technology, Free State

Hongyang Z., Huibin, D. & Jingzheng, J. 2017. Market dynamics, innovation, and transition in China's solar photovoltaic (P.V.) industry: A critical review. *Renewable and Sustainable Energy Reviews*, 69(3):197-206

Hossain, M., 2018. Motivations, challenges, and opportunities of successful solvers on an innovation intermediary platform. *Technological Forecasting and Social Change*, 128, 67-73.

Howell, R., van Beers, C., & Doorn, N. 2018. Value capture and value creation: The role of information technology in business models for frugal innovations in Africa. *Technological Forecasting and Social Change*, 131, 227-239

Hu, X., Danso, B.A., Mensah, I.A. & Addai, M. 2020. Does Innovation type influence firm performance? A dilemma of star-rated hotels in Ghana. *Sustainability*, 12(23).

Huang. J., Hao, Y. & Leid, H. 2017. Indigenous versus foreign innovation and energy intensity in China. *Renewable and Sustainable Energy Reviews*; 81(2): 1721-1729

Hudson, B.A. & Okhuysen, G.A. 2014. Taboo topics: Structural barriers to the study of organisational stigma. *Journal of Management Inquiry* 23(3): 242–253.

Huergo, E., Trenado, M., & Ubierna, A. (2016). The impact of public support on firm propensity to engage in R&D: Spanish experience. *Technological Forecasting and Social Change*, 113, 206-219.

Hussain, A. & Thapa, G. B. 2015. Fungibility of smallholder agricultural credit: Empirical evidence from Pakistan.*The European Journal of Development Research*, 28(5): 826–846.

Hutter, Michael, Hubert Knoblauch, Werner Rammert & Arnold Windeler. 2015. Innovation Society Today. The Reflexive Creation of Novelty. *Historical Social Research*, 40 (3): 30-47.

IATT. 2018. IATT Background Paper: Science, Technology and Innovation for SDGs Roadmaps (Draft). New York.

Ibrahim, I. 2017. Impact of Sino Africa economic relations on the Ghanaian Economy: The Case of Textiles. *International Journal of Innovation and Economic Development*; 3(1):1-27.

Iizuka, M. & Gebreeyesus, M. 2017. Using Functions of Innovation Systems to Understand the Successful Emergence of Non-traditional Agricultural Export Industries in Developing Countries: Cases from Ethiopia and Chile European. *Journal of Devevelopment Research*, 29: 384-395.

Iosifides, T. 2016. *Qualitative Methods in Migration Studies*. London: Routledge.

Iyortsuun, A.S. 2017. An empirical analysis of the effect of business incubation process on firm performance in Nigeria. *Journal of Small Business & Entrepreneurship,* 29(6): 433-459.

Jamil, F., Ismail, K., & Mahmood, N. (2015). University Incubators: A gateway to an entrepreneurial society. *Journal of Economics and Sustainable Development*, 6(6): 153-160.

Jiménez, A., & Zheng, Y. 2021. Unpacking the multiple spaces of innovation hubs. *The Information Society*, 37(3), 163-176.

Jinbaan, A.N., Donkoh, S.A., Mabe, F.N. & Kodwo, I.G. 2016. Commercialising innovations from agricultural research in Northern Ghana and farmers` willingness to pay. *African Journal of Business Management*, 10(7):140-150.

Johnson, N.B. 2018. Facilitating Innovation in Technology Startups in Ghana : A Multiple Case Study of the Technology Entrepreneurship Ecosystem in Ghana. Dissertation, Available: http://urn.kb.se/ [2020, March 13]

Jowi, J. O., Obamba, M., Sehoole, C., Alabi, G., Oanda, O. and Barifaijo, M. 2016. Governance of higher education, research and innovation in Ghana, Kenya and Uganda. OECD Programme on Innovation, *Higher Education and Research for Development (IHERD*).

Kagel, J.H. & Roth, A.E. 2016. *The handbook of experimental economics*, (vol 2) Princeton, University Press.

Kaplinsky, R., Chataway, J., Clark, N., Hanlin, R., Kale, D., Muraguri, L., & Wamae, W. 2009. Below the radar: what does innovation in emerging economies have to offer other low-income economies? *International Journal of Technology Management and Sustainable Development*, 8(3):177-197.

Karakara, A. A. & Osabuohien, S.E. 2019. Households' ICT access and bank patronage in West Africa: Empirical insights from Burkina Faso and Ghana, Technology in Society, 56, February, 116-125.

Karnani, A. 2007a. Fortune at the Bottom of the Pyramid: A Mirage. Business Management Review, 49(4): 481-509.

Karnani, A. 2007b. The Mirage of Marketing to the Bottom of the Pyramid: How the Private Sector can help Alleviate poverty. *California Management Review*, 49(4), 90–112.

Karnani, A. 2009. The Bottom of the Pyramid Strategy for Reducing Poverty : A Failed Promise. *Selling,* 80, 1–14.

Karnieli, O & Gur-Lavie, B. 2015. Cell therapy: Early process development and optimization of the manufacturing process are critical to ensure viability of the product, quality, and consistency and cost efficiency. *Journal of Commercial Biotechnology*. 21(1): 83-90.

Kelly, T.; Firestone, R. 2016. How tech hubs are helping to drive economic growth in Africa. In *World Development Report 2016 Digital Dividends*; World Bank Publications: Washington, DC, USA.

Kenton W.2020. Corporate Finance and Accounting Financial Ratios [online] Available: https://www.investopedia.com/terms/p/profitabilityratios.asp [Jan 25, 2021]

Khan, K. A., Dankiewicz, R., Kliuchnikava, Y., & Oláh, J. 2020. How do entrepreneurs feel bankruptcy? *International Journal of Entrepreneurial Knowledge*, 8 (1): 89-101.

Khanna, T. & Palepu, K. G. 2006. Emerging Giants: Building World-Class Companies in Developing Countries. *Harvard Business Review,* 84(10): 60-72.

Kharub, M., Mor, R.S. and Sharma, R. 2019.The relationship between cost leadership competitive strategy and firm performance: A mediating role of quality management. *Journal of Manufacturing Technology Management*, 30(6): 920-936.

Klepper, S. 2016. *Experimental Capitalism: the Nanoeconomics of American High-Tech Industries*. Princeton, Princeton University Press.

Klyton, V. A. & Rutabayiro-Ngoga, S. 2017. MSE finance and the construction of value in Rwanda. *Journal of Small Business and Enterprise Development*, 25(4): 628-643

Knorringa, P., Peša, I. & Leliveld, A. 2016. Frugal Innovation and Development: Aides or Adversaries?. *European Journal of Development Research*, 28, 143–153.

Kofidant .2019. Research shows that only 18% of goods sold in top supermarkets are made in Ghana [online]. Available: http://www.konfidants.com/2019/07/01/ [2020, October 10]

Konfinant. 2021. How well are made in Ghana products represented in Ghana's leading supermarkets [online]. Available: http://www.konfidants.com/2021/03/15/ [2021, July 25]

Krasniqi, B. 2012. Building an Expanded Small Firm Growth Model in a Transitional Economy: Evidence on Fast Growing Firms. *Journal of East-West Business*, 18(3): 231-273.

Krasniqi, B. 2014. Characteristics of self-employment: A refuge from unemployment or road to entrepreneurship. *Small Enterprise Research*, 21(1) 33–53.

Krasniqi, B. and Desai, S. 2016. Institutional drivers of high-growth firms: country-level evidence from 26 transition economies. *Small Business Economics*, 47 (4): 1075-1094.

Kreager, D.A., Young J.T.N., Haynie, D.L., Bouchard, M., Schaefer, D.R, & Zajac. G. 2017. Where "old heads" prevail: Inmate hierarchy in a men's prison unit. American Sociological Review, 82(4):685–718.

Kumar, A.; Singh, R.K.; Sachin, M. 2020. Exploring the relationship between ICT, SCM practices and organizational performance in agri-food supply chain. *Benchmarking*, 27, 1003–1041.

Kwarteng, A. & Aveh, F. 2018. Empirical examination of organizational culture on accounting information system and corporate performance: Evidence from a developing country perspective, *Meditari Accountancy Research*, 26 (4): 675-698.

Kyriazos, T.A. 2018. *Applied Psychometrics: Sample Size and Sample Power Considerations in Factor Analysis (EFA, CFA) and SEM in General*. Scientific Research Publishing.

Latilla, V. M., Frattini, F., Franzo, S., & Chiesa, V. 2020. Organisational change and business model innovation: An exploratory study of an energy utility. International Journal of Innovation Management, 24(04): 2050036.

Laube, W., Awo, M. A. & Derbile, E. K. 2017. Smallholder integration into the global shea nut commodity chain in northern Ghana (No. 153). ZEF Working Paper Series.

Leal-Rodríguez, A. L., Roldán, J. L., Ariza-Montes, J. A., & Leal-Millán, A. 2014. From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context. *International journal of project management*, 32(6): 894-907.

Lee, H.-H., Zhou, J., & Wang, J. (2018). Trade Credit Financing Under Competition and Its Impact on Firm Performance in Supply Chains. *Manufacturing & Service Operations Management*, 20(1), 36–52.

Lehtimäki, H. Helén, I., Snell, K., Eriksson, P. & Montonen T. 2019. Sustainable value creation in the commercialisation of innovation: the case of Auria Biobank. *International Journal of Entrepreneurship and Innovation Management*, 23(5).

Leila Namdarian, Ali Naimi-Sadigh. 2018. Towards an understanding of the commercialization drivers of research findings in Iran. *African Journal of Science, Technology, Innovation and Development*, 10(4): 389-399.

Lhuillery, S. 2014. Marketing and persistent innovation success. Economics of Innovation and New Technology. 23(5-6), 517-543.

Lhuillery, S., Raffo, J. & Hamdan-Livrament, I. 2016. Measuring creativity: Learning from innovation measurement. WIPO Economic Research Working Papers 31, WIPO, Economics and Statistics Division.

Li, J., Sutherland, D. & Ning L. 2017. Inward FDI spillovers and innovation capabilities in Chinese business: exploring the moderating role of local industrial externalities. *Journal of Technology Analysis & Strategic Management* 29(8): 932-945.

Li, S., Clark, T. & Sillince, J. 2017. Constructing a strategy on the creation of core competencies for African companies. *Technology Forecasting and Social Change*, *131*, 204-213.

Lim C & Fujimoto T. 2019. Frugal innovation and design changes expanding the cost-performance frontier: A Schumpeterian approach. *Research Policy*, 48 (4)1016-1029.

Lindholm Dahlstrand, Å. & Billström, A. 2014. Corporate and University Spin-Offs: A study of long-term performance, Working Paper, Working paper, paper presented at Entreprenörskapsforum, May 17-18, 2013, Lund, Sweden.

Lindholm Dahlstrand, Å. Andersson, M., & Carlsson, B. 2016. Entrepreneurial experimentation: A key function in entrepreneurial systems of innovation. Papers in Innovation Studies Paper No 2016/20.

Lindholm-Dahlstrand, Å., Andersson, M., & Carlsson, B. 2019. Entrepreneurial experimentation: a key function in systems of innovation. *Small Business Economics*, 53(3), 591-610.

Lingstone, S. K. & Frimpong K. 2020. Role of higher education and science, technology and innovation in capacity development in Ghana. *African Journal of Rural Development,* 5(1): 147-166.

Littlewood, C. D. & Kiyumbu, L. 2017. Hub organisations in Kenya: What are they? What do they do? And what is their potential? *Technological Forecasting and Social Change*, 131, 276-285.

Liu, W., & Atuahene-Gima, K. 2018. Enhancing product innovation performance in a dysfunctional competitive environment: The roles of competitive strategies and market-based assets. *Industrial Marketing Management*, 73, 7–20.

London, T. 2009. Making Better Investments at the Base of the Pyramid. *Harvard business review*, *87*(5): 106-113

M A.S.S. and Zhengge, T. 2016. The Impact of Organizational Factors on Financial Performance: Building a Theoretical Model. *Journal of International Business Research and Marketing*, 7(2): 51-56.

Mack, E., & Mayer, H. 2015. The evolutionary dynamics of entrepreneurial ecosystems. *Urban Studies*, 53(10). 2118-2133.

Madaio, M.A.; Grinter, R.E.; Finin, T. & Zegura, E.W. 2016. Experiences with MOOCs in a West-African technology hub. In *Proceedings of the Eighth International Conference on Information and Communication Technologiesand Development ICTD*, Ann Arbor, MI, USA, 3–6 June 2016:1–4.25.

Madar, M. J., Subari, M. D., & Baqutayan, S. M. S. 2018. Incorporating science and technology in higher education into strategic planning for sustainable Development in Somaliland. *Journal of Science, Technology and Innovation Policy*, 3(2):40-45.

Madar, M. J., Subari, M. D., Baqutayan, S. & Mohamed, S. 2016. Strengthening higher institutions towards dustainable development in Somaliland. *International Journal of Multidisciplinary Approach & Studies,* 3(1):210-219.

Maeda, H. 2015. Response option configuration of online administered Likert scales. *International Journal of Social Research Methodology* 18 (1): 15-26.

Magro, E., & Wilson, J. R. 2013. Complex innovation policy systems: Towards an evaluation mix. *Research policy*, 42(9), 1647-1656.

Mahmoud, M.A., Blankson. C., Owusu-Frimpong, N., Nwankwo, S. & Trang, T.P. 2016. Market orientation, learning orientation and business performance: The mediating role of innovation. International Journal of Bank Marketing. 34(5): 623-648.

Mahmutaj, L.R. & Krasniqi B. 2020. Innovation types and sales growth in small firms: Evidence from Kosovo. *South East European Journal of Economics and Business*, 15(1):27-43.

Malesky, E., & Taussig, M. 2017. The danger of not listening to firms: Government responsiveness and the goal of regulatory compliance. *Academy of Management Journal*, 60(5), 1741-1770.

Mallett, O., Wapshott, R., & Vorley, T. 2019. How do regulations affect MSEs? A review of the qualitative evidence and a research agenda. *International Journal of Management Reviews,* 21(3), 294-316.

Mallett, Oliver Wapshott, Robert Vorley, Tim. 2018. Understanding the firm-level effects of regulation on the growth of small and medium-sized enterprises.

Mann, W., 2018. Creditor rights and innovation: evidence from patent collateral. Journal of Finance and Economics. 130 (1), 25–47.

Markard, J., Hekkert, M., & Jacobsson, S. 2015. The technological innovation systems framework: Response to six criticisms. *Environmental Innovation and Societal Transitions*, 16, 76–86.

Markard, J., Wirth, S., Truffer, B., 2014. *Institutional dynamics in emerging technological fields and their context –legitimacy of biogas technology in Germany, Mimeo*, ETH/EAWAG, Zürich.

Martela, F. 2015. Fallible inquiry with ethical ends-in-view: A pragmatist philosophy of science for organisational research. *Organisational Studies*, 36(4):537–563.

Martínez-Azúa, B.C., López-Salazar, P.E. & Sama-Berrocal. 2020. Determining Factors of Innovative Performance: Case Studies in Extremaduran Agri-Food Companies. *Sustainability MDPI*, 12(21): 1-11.

Marx, M., J.S. Gans & D.H. Hsu. 2014. Dynamic Commercialization Strategies for Disruptive Technologies: Evidence from the Speech Recognition Industry. *Management Science,* 60(12): 3103–3123.

Mason, C. & Brown, R. 2014. Entrepreneurial Ecosystems and Growth-Oriented Enterprises: Background Paper Prepared for the Workshop Organised by the OECD LEED Programme and the Dutch Ministry of Economic Affairs.

Matthews, J.R. 2017. Understanding Indigenous Innovation in Rural West Africa: Challenges to Diffusion of Innovations Theory and Current Social Innovation Practice. *Journal of Human Development and Capabilities* 18(2): 223-238.

Mayer, A. (2018). A just transition for coal miners? Community identity and support from local policy actors. *Environmental Innovation and Societal Transitions*, 28, 1-13.

McAfee, D., Doubleday, Z. A., Geiger, N., & Connell, S. D. 2019. Everyone loves a success story: optimism inspires conservation engagement. *BioScience*, 69(4): 274-281.

McGuirk, H., Lenihan, H. & Hart, M. 2015. Measuring the impact of innovative human capital on small firms' Propensity to Innovate. *Research Policy*, 44 (4): 965–976.

Mensah, A.M. & Gordon C. 2020. Strategic partnerships between universities and non-academic institutions for sustainability and innovation: Insights from the University of Ghana. In: Gasparatos A. et al. (eds) *Sustainability Challenges in Sub-Saharan Africa I. Science for Sustainable Societies*. Springer, Singapore.

Mersky, A. C., Sprei, F., Samaras, C. & Qian, Z. S. 2016. Effectiveness ofincentives on electric vehicle adoption in NorwayTransport. Res. Part D, *Transp. Environ*. 46, November, 56–68.

MEST, 2010. *National Science, Technology and Innovation Policy*. Ministry of Environment, Science and Technology, Republic of Ghana, Accra.

MESTI. 2017a. *Ghana Science, Technology, and Innovation Baseline Survey Report* Republic of Ghana .Accra.

MESTI. 2017b. *National Science, Technology and Innovation (DRAFT) Policy (2017-2020)*. Republic of Ghana, Accra.

Mian, S., Lamine, W., & Fayolle, A. 2016. Technology Business Incubation: An overview of the state of knowledge. *Technovation*, 50: 1-12.

Miller, C.C. & Bamberger, P. 2016. Exploring emergent and poorly understood phenomena in the strangest of places: The footprint of discovery in replications, meta-analyses, and null findings. *Academy of Management Discoveries*, 2(4):313–319.

Mishkin, F. S. and Eakins, S (2018). *Financial Markets and Institutions*, (9th ed). New Jersey: Pearson.

Mittal, S. K., Momaya, K., & Sushil. 2016. A Framework Conceptualization for National Technological Competitiveness. In Sushil, K. T. Bhal, & S. P. Singh (Eds.), *Managing Flexibility*. Springer India.

Mohannak, K. & Samtani, L. 2014. A *Criteria-based Approach for Evaluating Innovation Commercialization.* Proceedings from: DRUID Society Conference 2014, CBS, Copenhagen, June 16-18.

Montresor, S., Perani, G., & Vezzani, A. 2014. *How do companies 'perceive' their intangibles? New statistical evidence from the INNOBAROMETER 2013*. European Commission. JRC report, 26561.

Mortazavi, R., Sara, S., Ehsan, M., Audrius, B. & Nerija, B. 2016. Framework for assessing technological innovation capability in research and technology organisations. *Journal of Business Economics and Management* 17: 825–47.

Moss, T and Majerowicz, S. 2012. No Longer Poor: Ghana's New Income Status and Implications of Graduation from IDA. CGD Working Paper 300. Washington, D.C.: Center for Global Development.

Mountjoy, A. B. 2017. *Industrialization and underdeveloped countries*. Routledge.

Muhammad, A. & Sadia, A. 2016. A systematic review of knowledge management and knowledge sharing: Trends, issues, and challenges. *Cogent Business & Management*, 3(1).

Musah, A. 2017. Benefits and Challenges of Bookkeeping and Accounting Practices of MSEs and Its Effect on Growth and Performance in Ghana. *Journal of Accounting, Business and Management (JABM)*, 24(2):16-36.

Musah, A., & Ibrahim, M. 2014. Record keeping and the bottom line: Exploring the relationship between record keeping and business performance among small and MSEs in the Tamale Metropolis of Ghana. *Research Journal of Finance and Accounting* 5(2):107 - 117.

Muthuveloo, R., Shanmugam, N., & Teoh, A. P. (2017). The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. *Asia Pacific Management Review*, 22(4), 192-201.

Central University of Technology, Free State

Nair, S. S., & Prem, S. S. 2020. A framework for mixed-method research, Shanlax International Journal of Management, 8(2), 45-53.

Narassimhan, E. & Johnson, C. 2018. The role of demand-side incentives and charging infrastructure on plug-in electric vehicle adoption: Analysis of US States. Environmental Research Letteter. 13 (7).

Navalta, J. W., Stone, W. J., & Lyons, T. S. 2019. Ethical issues relating to scientific discovery in exercise science. *International Journal of Exercise Science*, 12(1).

Ndirangu, A. N. 2017. Determinants of innovation performance in youth entreprises in Kenya (Doctoral dissertation, COHRED, JKUAT).

NDPC (National Development Planning Commission). 2014. *Ghana Shared Growth and Development Agenda (GSGDA II), 2014-2017,: Policy framework. Medium term National Development Framework*, Republic of Ghana, Accra.

NEIP [Online]. 2017, Available: http://www.neip.gov.gh. [2019, March 22].

Neumeyer, X., & Chen, S. (2021, May). Towards a Holistic View of Technology Commercialization. In *2021 IEEE Technology & Engineering Management Conference-Europe*: TEMSCON-EUR): 1-6. IEEE.

Newman, C., Page, J., Rand, J., Shemeles, A., Söderbom, M., & Tarp, F. 2016*. Made in Africa: Learning to compete in industry.* Brookings Institution Press.

Nkegbe, P. K. 2018. Credit access and technical efficiency of smallholder farmers in northern Ghana: Double bootstrap DEA approach. *Agricultural Finance Review*, 78(5), 626–639.

Central University of Technology, Free State

Ntuli, H., Inglesi-Lotz, R., Chang, T., & Pouris, A. 2015. Does research output cause economic growth or vice versa? Evidence from 34 OECD countries. *Journal of the Association for Information Science and Technology,* 66(8): 1709-1716.

Nwaka, S. 2021. African Traditional Knowledge, Other Technologies and Emerging Areas. In *Social and Technological Innovation in Africa* (83-97). Palgrave Macmillan, Singapore.

Nwosu, E. O., & Orji, A. 2017. Addressing poverty and gender inequality through access to formal credit and enhanced enterpriseperformance in Nigeria: An empirical investigation. *African Development Review*, 29 (Suppl.1): 56–72.

Nwuke, K. 2015. Science, Technology and Innovation Policy in Africa in the Age of Brilliant and Disruptive Technologies: An Analysis of Policies at the National, Regional and Continental Levels. Background Paper for ARIA VII. Addis Ababa: Economic Commission for Africa.

Nyarku, K.M. & Oduro, S. 2017. Effect of legal and regulatory framework on MSEs growth in the Accra Metropolis of Ghana*. International Journal of Entrepreneurship and Innovation*. 19 (3): 207-217.

Obeysekare, E., Mehta, K., & Maitland, C. 2017. *Defining success in a developing country's innovation ecosystem: The case of Rwanda. In 2017 IEEE Global Humanitarian Technology Conference (GHTC) (pp. 1-7).* IEEE. San Jose, CA, USA, 19–22 October 2017: 1–7.

Oderanti, F.O. & Li F. 2018. Commercialisation of eHealth innovations in the market of the U.K. healthcare sector: A framework for a sustainable business model. *Psychology & Marketing*, 35(2): 120-137.

Oduro, S. & Nyarku, K.M. 2018. Incremental Innovations in Ghanaian MSEs: Propensity, Types, Performance and Management Challenges. *Asia-Pacific Journal of Management Research and Innovation* 14(1-2): 10-21

Oduro, S. 2020. Exploring the barriers to MSEs' open innovation adoption in Ghana: A mixed research approach", *International Journal of Innovation Science*, 12(1). 21-51.

Oduro-Marfo, S. 2015. Toward a national innovation strategy: a critique of Ghana's science, technology and innovation policy. *Innovation Journal 20(3):*1-11.

OECD & EUROSTAT. 2018. Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation (4th Edition) The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat,Luxembourg. https://doi.org/ 0.1787/9789264304604-en.

Ofori, K.R. 2019. Prospects and Challenges of the One District One Factory (1D1F) Policy: Experiences from the Akuapem North Municipal Assembly (ANMA) [Online]. Available: http://ugspace.ug.edu.gh/handle/123456789/30860 [2020, December 16].

Okoe, A.F. & Boateng, H. 2016. Consumers' preference for foreign products in an emerging market: Do family communication patterns play a role? *International Journal of Business and Emerging Markets*, 8(2): 210-221.

Olefirenko, O. & Shevliuga. O. 2017. Commercialization of innovations: peculiarities of sales policy at innovation active enterprise. *Innovative Marketing*, 13(2): 6-12.

Olcay, G. A., & Bulu, M. 2015. Who should really get government support: an analysis of Turkish MSE cases. *International Journal of Knowledge-Based Development,* 6(1), 34-49.

Omane Boamah, E.K & Atta-Boateng, G. 2020. Digitization of Ghana's Economy [Online]. Available: www.myjoyonline.com/opinion/opinion-digitization-of-ghanas-economy [2020, September 7].

Ong, M. H. A., & Puteh, F. 2017. Quantitative data analysis: Choosing between SPSS, PLS, and AMOS in social science research. *International Interdisciplinary Journal of Scientific Research,* 3(1):14-25.

Onufrey, K., Bergek, A., 2015. Self-reinforcing mechanisms in a multi-technology industry: understanding sustained technological diversity in a context of path dependency. *Journal of Industry and Innovation*, 22 (6):531-555.

Orlova, L.N. (2016). Underlying principles and approaches to the management of sustainable innovation development of economic systems*. Management in Russia and Abroad,* 13(3): 3-9.

Osei, A., Yunfei, S., Ansah Appienti, W., & Kwarteng Forkuoh, S. 2016. Product innovation and MSEs performance in the manufacturing sector of Ghana. *Journal of Economics, Management and Trade*, 15(3):1-14.

Osei, R. D., & Jedwab, R. 2016. Structural change in a poor African country: New historical evidence from Ghana. *Margaret McMillan, Dani Rodrick, and Claudia Sepúlveda.: International Food Policy Research Institute*. Washington, DC.

Osoro, O., Kirama, S., Knoben, J., & Vermeulen, P. A. M. (2015). Factors Affecting Engagement and Commercialization of Innovation Activities of Firms in Tanzania. (DFID Working Paper).

Padula, G, E Novelli and R Conti. 2015. MSEs inventive performance and profitability inthe markets for technology.*Technovation,*41–42, 38–50.

Panhwar, A. H., Ansari, S., & Shah, A. A. 2017. Post-positivism: An effective paradigm for social and educational research, *International Research Journal of Arts & Humanities (IRJAH),* 45(45).

Pansera, M. 2013. Frugality, grassroots and inclusiveness: new challenges for mainstream innovation theories. *African Journal of Science, Technology, Innovation and Development,* 5(6):469-478.

Papaioannou, T. 2014. How inclusive can innovation and development be in the twenty-first century?. *Innovation and Development* 4 (2):187–202.

Park, E. & Gachukia, M.K. 2020. The Role of the Local Innovation System for Inclusive Upgrading in the Global Value Chain: The Case of KenyaGAP in the Kenyan Horticultural Sector. European Journal of Development Research.

Park, E., & Gachukia, M. K. E. 2021. The role of the local innovation system for inclusive upgrading in the global value chain: The case of KenyaGAP in the Kenyan Horticultural Sector. The European Journal of Development Research, 33, 578-603.

Patents Act 2003 (Act 657) [Online]. Available: https://bcp.gov.gh/acc/registry/docs/PATENT. [2020, October 2]

Patterson, W., & Ambrosini, V. 2015. Configuring absorptive capacity as a key process for research intensive firms. *Technovation*, 36, 77-89.

Pavlenko, I. 2015. Modern mechanisms of commercialization of innovations. *Agrosvit*, 5:25-28.

Pece, A. M., Simona, O. E. O., & Salisteanu, F. 2015. Innovation and economic growth: An empirical analysis for CEE countries. *Procedia Economics and Finance*, 26:461-467.

Pelinescu, E. 2015. The impact of human capital on economic growth. *Procedia Economics and Finance*, 22, October:184–190.

Pelkmans, J & Renda, A. 2014. How can EU legislation enable and/or disable innovation. Report for the European Commission DG Research.

Perez Vico, E. 2014. An in-depth study of direct and indirect impacts from the research of a physics professor. *Science and Public Policy*, Oxford University Press, 41(6):701-719.

Phelps, E. 2017. The dynamism of nations: Toward a theory of indigenous innovation. Capitalism and Society: J*ournal of Applied Corporate Finance* 30(3): 8-26.

Pick, B. & Nishida, T. 2015. Digital divide in the world and its regions: A spatial and multivariate analysis of technological utilisation. *Technological Forecasting and Social Change,* 91:1–17.

Popa, A.E. & Ciobanu, R. 2014. The Financial factors that Influence the Profitability of MSEs. *International Journal of Academic Research in Economics and Management Sciences*, 3(4):177-185.

Pradhan, R.P., Arvin, M.B. & Bahmani, S, 2018. Are innovation and financial development causative factors in economic growth? Evidence from a panel granger causality test. *Technological Forecasting and Social Change,* Elsevier, 132(C):130-142.

Prahalad, C. K. & Mashelkar, R. A. 2010. Innovation's Holy Grail. *Harvard Business Review,* July-August.

Prahalad, C. K. 2010. *The fortune at the bottom of the pyramid: eradicating poverty through profits (2nd ed.)*. Upper Saddle River, New Jersey: Pearson Education.

Prahalad, C. K. 2012. Bottom of the Pyramid as a Source of Breakthrough Innovations. *Journal of Product Innovation Management*, 29(1):6–12.

Pratono, A.H. 2018. From social network to firm performance: The mediating effect of trust, selling capability and pricing capability, *Management Research Review,* 41(6), 680-700.

Proksch, D., Haberstroh, M. M., & Pinkwart, A. (2017). Increasing the national innovative capacity: Identifying the pathways to success using a comparative method. Technological *Forecasting and Social Change*, 116:256-270.

Public Health Act 2012 (Act 851) [Online]. Available: https://bcp.gov.gh/acc/registry/ docs [2020, October 2].

Quaye, W, Yamga, G. A. & Tetteh, E. K. 2020. A national framework for research, innovation, and Commercialisation in Ghana. Science Innovation and Enterprise No 7 [Online]. Available: http://hdl.handle.net/10625/59592 [2020, Oct 8 2020].

Quaye, D. and Mensah, I. 2019. Marketing innovation and sustainable competitive advantage of manufacturing MSEs in Ghana. *Management Decision*, 57(7):1535-1553.

Quaye, D. M., Sekyere, N. K. & Acheampong, G. 2017. Export promotion programmes and export performance: A study of selected MSEs in the manufacturing sector of Ghana. *Review of International Business and Strategy*, 27(4):466-483.

Quaye, W., Akon-Yamga, G., Daniels, C., Ting, B. & A Asante A. 2019. Mapping of Science, Technology and Innovation Policy Development in Ghana Using the Transformative Change Lens [Online]. Available: www.tipconsortium.net/wpcontent /uploads/2019/07/Ghana [2020, December 16].

Radjou, N. & Prabhu, J. 2014. *Frugal Innovation: How to do more with less*. London: Profile Books.

Radjou, N., Prabhu, J., Ahuja, S., & Roberts, K. 2012. *Jugaad Innovation: Think frugal, be flexible, and generate breakthrough growth*. San Francisco: Jossey-Bass.

Ragasa, C., Andam, K. S., Asante, S. B., & Amewu, S. 2020. Can local products compete against imports in West Africa? Supply-and demand-side perspectives on chicken, rice, and tilapia in Ghana. *Global Food Security*, 26, 100448.

Rahman, A. M. & Zaman, M. 2016. Human Capital and technological catch-up of Developing Countries in search of a technological leader, *Journal of Developing Areas,* 50(1):158-174.

Ramadani, V., Hisrich, R. D., Abazi-Alili, H., Dana, L.-P., Panthi, L. & Abazi-Bexheti, L. 2018. Product innovation and firm performance in transition economies: A multi-stage estimation approach. *Technological Forecasting and Social Change*, 40(C): 271-280.

Rambe, P., & Makhalemele, N. 2015. Relationship between managerial competencies of owners/managers of emerging technology firms and business performance: A Conceptual Framework of internet cafe performance in South Africa. *International Business & Economics Research Journal (IBER),* 14(4):677-690.

Ramírez-Montoya, M. S., & Lugo-Ocando, J. 2020. Systematic review of mixed methods in the framework of educational innovation.

Rass, M., Dumbach, M., Danzinger, F., Bullinger, A.C. and Moeslein, K.M. 2013. Open innovation and firm performance: the mediating role of social capital. *Creativity and Innovation Management,* 22(2):177-194.

Republic of Ghana. 2017. The Coordinated Programme of Economic and Social Development Policies (2017-2024):Accra.

Richter, N.F., Sinkovics, R.R., Ringle, C.M., & Schlägel, C. 2016. A critical look at the use of SEM in international business research. *International Marketing Review*, 33(3): 376-404.

Ringle, C.M., Wende, S., & Becker, J.M. (2015). *SmartPLS 3,* SmartPLS GmbH, Bönningstedt

Robinson, M. A. 2018. Using multi-item psychometric scales for research and practice in human resource management. *Human Resource Management*, 57(3):739-750.

Rorwana, A., &Tengeh, R. K. 2015. The role of academic entrepreneurs in the process of technology transfer and commercialization: The case of a University of Technology in South Africa. *Environmental Economics*, 6(4):25-37.

Rossetto, D. E., Bernardes, R. C., Borini, F. M., & Gattaz, C. C. 2018. Structure and evolution of innovation research in the last 60 years: Review and future trends in the field of business through the citations and co-citations analysis. Scientometrics, 115(3), 1329-1363.

Rosli, M.M. and Sidek, S. 2013. The impact of innovation on the performance of small and medium manufacturing enterprises: Evidence from Malaysia. *Journal of Innovation Management in Small & Medium Enterprise,* 2013:794-809.

Sá, C.M. 2015. Perspective of industry's engagement with African Universities. For the African Association of Universities [Online]. Available: http://www.heart/resources.org [2020, October 2].

Saari, U. A., Damberg, S., Frömbling, L., & Ringle, C. M. 2021. Sustainable consumption behavior of Europeans: The influence of environmental knowledge and risk perception on environmental concern and behavioral intention. *Ecological Economics*, 189, 107155.

Sabatini-Marques, J., Yigitcanlar, T. & Da Costa, E., 2015a. Incentivizing innovation. *Asia Pacific Journal of Innovation and Entrepreneurship*, 9(1), 31-56.

Sabatini-Marques, J., Yigitcanlar, T. & Da Costa, E., 2015b. Australian innovation ecosystem. *Asia Pacific Journal of Innovation and Entrepreneurship*, 9 (2): 3–28.

Sangwa, N.R. and Sangwan, K.S. 2018a. Leanness assesMSEnt of organizational performance: a systematic literature review. *Journal of Manufacturing Technology Management,* 29(5): 768-788.

Sarpong, D., AbdRazak, A., Alexander, E. & Meissner, D. 2017. Organising practices of university, industry and government that facilitate (or impede) the transition to a hybrid triple helix model of innovation. *Technology Forecast Social Change* 123:142–152.

Savona, M. & Pellegrino, G. 2017. No money, no honey? Financial versus knowledge and demand constraints on innovation. *Research Policy*, 46(2):510 – 521.

Schmidlechner, L. and Peruffo, E. 2017. *A literature review on the implications of platforms for work and employment,* Eurofound, Dublin.

Schmitt, D. & Muyoya, C. 2020. Influence in technological innovation spaces: A network science approach to understand innovation for sustainability in the global south. *Sustainability, MDPI, Open Access Journal*, 12(5):1-18.

Schmitt, D., & Muyoya, C. 2020. Influence in technological innovation spaces: a network science approach to understand innovation for sustainability in the global south. *Sustainability*, 12(5):1858.

Sekyi, S., Abu, B. M., & Nkegbe, P. K. 2020. Effects of farm credit access on agricultural commercialization in Ghana: Empirical evidence from the northern Savannah ecological zone. *African Development Review*, 32(2):150–162.

Sexton, K. B., & Ligler, F. S. 2018. Strategies to close the gender gap in invention and technology commercialization. *Technology & Innovation*, 19(4):701-706.

Seyfang, G. & Haxeltine, A. 2012. Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy transitions. Environment and Planning C: *Governing and Policy*, 30(3):381–400.

Sharma, A., & Iyer, G. R. 2012. Resource-constrained product development: Implications for green marketing and green supply chains. *Industrial Marketing Management*, 41(4):599–608.

Sheng, S., Zheng, K., Leopold Z. 2013, NPD speed vs. innovativeness: The contingent impact of institutional and market environments, *Journal of Business Research,* 66(11): 2355-2362.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. 2019. Predictive model assesMSEnt in PLS-SEM: guidelines for using PLSpredict. *European Journal of Marketing*, 53(11): 2322-2347.

Shpak, N., Kniaz, S., Myroshchenko, N., & Kolomiyets, O. 2014. Commercialization of high-tech products: theoretical-methodological aspects. *Econtechmod*, 3(1):81-88.

Simons, B.B. 2014. Guest post: silicon Savannah comes of age [Online]. Available: http://blogs.ft.com/beyond-brics/2014/01/13/guest-post-silicon-savannah-comes-of-age. [2020, October 2].

Sitnikova, S. E., Halo, L. A., & Polusmakova, N. S. 2017. Problems and perspectives of improving the process of innovations' commercialization in a modern university. In

International conference on Humans as an Object of Study by Modern Science (321-327). Springer, Cham.

Smith, H.L. 2018. Entrepreneurship Policies and the Development of Regional Innovation Systems: Theory, Policy and Practice. In: *Isaksen A., Martin R., Trippl M. (eds) New Avenues for Regional Innovation Systems - Theoretical Advances, Empirical Cases and Policy Lessons*. Springer, Cham.

Song, C. & Oh, W. 2015. Determinants of innovation in energy intensive industry and implications for energy policy. *Energy Policy, Elsevier*, 81(C):122-130

Soofi, S. A. 2017. A comparative study of Chinese and Iranian science and technology, and techno-industrial development policies, *Technological Forecasting and Social Change,* 122:107–118.

Soriano, F.A., Villano, R.A., Fleming, E.M. & Battese, G.E. 2018. What's driving innovation in small businesses in Australia? The case of the food industry, Australian Journal of Agricultural and Resource Economics.

Soriano, F.A., Villano, R.A., Fleming, E.M. & Battese, G.E. 2018. What's driving innovation in small businesses in Australia? The case of the food industry, *Australian Journal of Agricultural and Resource Economics*, 63(1):39-71.

Soumare, M.; Velluet, Q.; Galtier, M. 2020. Tech Hubs not Hype. [Online]. Available: https://www.pressreader.com/france/the-africa-report [14 January 2020).

Sparks, S. 2017. *Nanotechnology: Business applications and commercialisation*. Business & Economics, Sydney, CRC Press.

Spinuzzi, C., Pogue, G., Nelson, R. S., Thomson, K. S., Lorenzini, F., French, R. A. 2016. How Magnets Attract and Repel: Interessement in a Technology Commercialization Competition. *Written Communication*. 33 (1):33-41.

Srhoj, S. & Walde, J. 2020. Getting ready for EU Single Market: The effect of export-oriented grant schemes on firm performance. *Structural Change and Economic Dynamics* 52 (2):279-293.

Sridevan, P. 2015. Intellectual property in the ancient Indian texts. In I. Calboli & S. Raghavan (Eds.), *Diversity in intellectual property: Identities, interests, and intersections*. Cambridge University Press.

Stam, E. 2015. Entrepreneurial eco-systems and regional policy – A sympathetic critique. *European Planning Studies*, 23 (9):1759-1769.

Story, D. A., & Tait, A. R. 2019. Survey research. *Anesthesiology*, *130*(2), 192-202.

Sun, K. 2019, June. The construction of quantitative research on evaluation of independent innovation ability of small and medium-sized industrial enterprises. In *2019 International Conference on Robots & Intelligent System (ICRIS)*: 531-534). IEEE.

Suseno, Y., Standing, C., Kiani-Mavi, R. & Jackson, P.2020. National innovation performance: the role of human capital and social capital, Innovation. *The European Journal of Social Science Research,* 33(3):296-310.

Syed, H. H., Muzaffar, A. & Minaa F. 2017. Entrepreneurial Orientation and Business Performance of Manufacturing Sector Small and Medium Scale Enterprises of Punjab Pakistan. *European Business & Management*, 3(2):21-28.

Tang, K., Qiu, Y. & Zhou, D. 2020. Does command-and-control regulation promote green innovation performance? Evidence from China's industrial enterprises. *Science of Total Environmen*t 712, April:136-142.

Tassinari, A. and Maccarrone, V. 2017. Organising the unorganisable? Gig economy couriers' mobilisations in Italy and the UK', paper presented at the Platform Labour in the Digital Economy workshop, 17 May, University of Milan.

Technical Universities Act 2017 (Act 922) [Online]. Available: http://hdl.handle.net/12 [2020, October 2].

Thorbecke E. 2018. Is the Structure of Growth Different in Sub-Saharan Africa? *Journal of African Economies*, 27(1):66-91.

Tigabu, A. D., Berkhout, F., & van Beukering, P. 2015. The diffusion of a renewable energy technology and innovation system functioning: Comparing bio-digestion in Kenya and Rwanda. *Technological Forecasting and Social Change*, 90(Part A):331-345

Tiwari, R., Kalogerakis, K. & Herstatt, C. 2014. *Frugal innovation and analogies: Some propositions for product development in emerging economies*. Proceedings of the R&D Management Conference, June 3–6, Stuttgart, Germany:15–23.

Tsatsenko N.A. 2020. MSE development, economic growth and structural change: evidence from Ghana and South Africa. *Journal of Agriculture and Environment* 14(2): 38-50.

Tura, N., Hannola, L. & Pynnönen, M. 2017. Agile Methods for Boosting the Commercialization Process of New Technology. *International Journal of Innovation and Technology Management,* 14(03),175-183.

Twesige, D. and Gasheja, F., 2019. Effect of tax incentives on the growth of small and medium-sized enterprises (MSEs) in Rwanda: A case study of MSEs in Nyarugenge district. *Journal of Accounting and Taxation*, 11(5):89-98.

Tzeng, B. H., Wang, M. Y., Hsu, S. S., & Yuan, B. J. 2019. Determinants of Using Standards to Upgrade Chinese Industrial Structure From the Context of Sectoral System of Innovation. *IEEE Transactions on Engineering Management*

Udimal, T., Jincai, Z., Ibn Musah, A. A. 2019. Determinants of new products innovation in Ghanaian MSEs sector. *Journal of Global Entrepreneurship Research*, 9(21):1-11.

Ullah, B. 2019. Firm innovation in transition economies: The role of formal versus informal finance. Journal of Multinational Financial Management 50(1):58-75.

UNCTAD. 2019. Report of Ghana private sector development strategy 2010-2015[Online]. Available: https://unctad.org/en/Pages/DIAE/Entrepreneurship [2020, October 8].

UNCTAD. 2020. Port Management Series - Vol 8, October [Online]. Available: UNCTAD/DTL/KDB/2020/2 Case Studies [2020, Oct 8 2020].

UNDP.2017.Sustainabledevelopmentgoals[Online].Available.http://www.gh.undp.org/content/ghana/en/home/sustainable-development-goals.html [2020, Oct 8].

UNESCO. 2018. Higher education and the sustainable development Goals [Online]. Available: https://en.unesco.org/themes/higher-education/sdgs. [March 16, 2020].

UNIDO. 2015a. Technology foresight [Online]. Available: http://www.unido.org/foresight.html [2020, March 2].

UNIDO. 2015b. Ghana industrial policy. [Online]. Available: https://moti.gov.gh/docs/Industrial Policy [2020, March 2].

University of Health and Allied Sciences (UHAS), 2011 (Act 828) [Online]. Available: https://www.uhas.edu.gh/ about/us/overview [2020, November 2]

University of Mines and Technology, Tarkwa Act 2004 (Act 677) [Online]. Available: http://elibrary.jsg.gov.gh/fg/laws of ghana/2 [2019, October 20]

Valdez-Juárez, L.E, García-Pérez-de-Lema, D. & Maldonado-Guzmán, G. 2018. ICT and KM, Drivers of Innovation and Profitability in MSEs. *Journal of Information & Knowledge Management,* 17(1):1-34.

Van Roy, V., Vértesy, D., & Vivarelli, M. 2018. Technology and employment: Mass unemployment or job creation? Empirical evidence from European patenting firms. Research Policy, 47(9):1762-1776.

Vasilachis de Gialdino, I. 2017. Ontological and Epistemological Foundations of Qualitative Research. Forum of Qualitative Social Research, 10(10).

Vaske, J. J. 2019. *Survey research and analysis*. Sagamore-Venture. 1807 North Federal Drive, Urbana, IL 61801.

Victoria, G-M, van Der Sijde, P., Groenewegen, P. & Baaken, T. 2015. Nurture overnature; how do European Universities support their collaboration with business? Journal of Technology Transfer, 42(1), 1–22.

Wach, D., Stephan, U., & Gorgievski, M. 2016. More than money: Developing an integrative multi-factorial measure of entrepreneurial success. *International Small Business Journal*, 34(8):1098-1121.

Wach, D., Stephan, U., Marjan, J. G., & Wegge, J. (2020). Entrepreneurs' achieved success: developing a multi-faceted measure. *International Entrepreneurship and Management Journal*, 16(3):1123-1151.

Wachinga, H. 2019. National innovation system factors, incentives, culture and institutional linkages in Kenyan ICT innovation firms, School of Business, University of Nairobi [online]. Available: erepositoryuonbi.ac.ke [2020, March 13].

Wandera, F.H. 2020. The innovation system for diffusion of small wind in Kenya: Strong, weak or absent? A technological innovation system analysis. African Journal of Science, Technology, Innovation and Development, 13(5):1-13.

Watkins, A., Papaioannou, T., Mugwagwa, J. & Kal, D. 2015. National innovation systems and the intermediary role of industry associations in building institutional capacities for innovation in developing countries: a critical review of the literature. *Research Policy*, 44(8):1407–1418.

Weiss, G., Ludvig, A., & Živojinović, I. 2020. Four decades of innovation research in forestry and the forest-based industries–a systematic literature review*. Forest Policy and Economics, 120*, 102288.

Weyori, A. E., Amare, M., & Garming, H. 2018. Agricultural innovation systems and farm technology adoption: findings from a study of the Ghanaian plantain sector, *Journal of Agricultural Education and Extension*, 24(1):65-87.

World Bank (online). The World Development Indicators [Online].Available: http://datatopics.worldbank.org/world-development-indicators [2020, Dec 8].

World Bank Group. 2019. Ghana Digital Economy Diagnostic. World Bank, Washington, DC. [Online]. Available: https://openknowledge.worldbank.org/handle [2020, October 2].

Woschke, T. Haase, H. and Kratzer, J. 2017. Resource scarcity in MSEs: effects on incremental and radical innovations. *Management Research Review*, 40 (2):195-217.

Yigitcanlar, T., Sabatini Marques, J., da Costa, E., Moreira, K.M.D., & Ioppolo, G. 2019. Stimulating technological innovation through incentives: Perceptions of Australian and Brazilian firms. *Technological Forecasting and Social Change*, 146: 403-412.

Yuandi, W., Lutao, J. L. & Prevezer, M. 2016. Foreign direct investment spill overs and the geography of innovation in Chinese Regions: The role of regional industrial specialisation and diversity. *Regional Studies*, 50(5):805-822.

Zeschky, M., Winterhalter, S. and Gassmann, O. 2014. From cost to frugal and reverse innovation: Mapping the field and implications for global competitiveness. *Research Technology Management,* 57(4):20–27.

Zhang Y, Qian Z S, Sprei F and Li B. 2016. The impact of car specifications, prices and incentives for battery electric vehicles in Norway: choices of heterogeneous consumers. *Transportation Research Part C: Emerging Technologies*, 69:386-401.

Zhang, J., & Guan, J. (2018). The time-varying impacts of government incentives on innovation. *Technological Forecasting and Social Change*. 135, October:132-144.

Zhu, L., Wang, P., & Zhang, Q. 2019. Indirect network effects in China's electric vehicle diffusion under phasing out subsidies. *Applied Energy*, 251:113350.

APPENDICES

Appendix 1: Ethics Clearance form for Student Research

Central University of Technology, Free State

FACULTY OF MANAGEMENT SCIENCES

10 YEARS AS A UNIVERSITY OF TECHNOLOGY

ETHICS CLEARANCE FORM FOR STUDENT RESEARCH

Research projects in which human beings are the subject of research requires completion of this form and submission, for approval, together with your protocol to the DEPARTMENTAL AND FACULTY RESEARCH COMMITTEES.

1.

1.	**GENERAL PARTICULARS**		
1.1	Name of the student	ADJIMAH HARRISON PAUL	
1.2	Student number	218004528	
1.3	Department where study is located	BUSINESS SUPPORT STUDIES	
1.4	Qualification linked to the study	DOCTOR OF BUSINESS ADMINISTRATION	
1.5	Title of the research	**DRIVERS OF SUCCESSFUL COMMERCIALISATION OF INDIGENOUS INNOVATION IN GHANA: A CASE STUDY IN THE VOLTA REGION**	
1.6	Source of funding	HTU-CUT	
2.	**INFORMATION TO SUBJECT**		
2.1	What information will you provide to participants before they consent to participate?	All information concerning or related to the research and also the relevance of the study.	
2.2	Who will provide this information?	The researcher	
2.3	State how complete and accurate the information provided will be	100% complete	
2.4	If not 100% accurate/ complete, justify the necessity for this "deception".		
3.	**PARTICIPANT GROUP (SAMPLE)** **State YES or NO otherwise N/A**		
3.1	Are particular characteristics of any kind required in the participant group (e.g. age, cultural derivation, background, physical characteristics, disease states, etc)?	YES	If necessary, explain
3.2	Are Participants drawn from CUT students at large?	NO	If necessary, explain
3.3	Are Participants drawn from specific groups of CUT students?	NO	Identify the group
3.4	Are participants drawn from a school population?	NO	Identify School (s): Tertiary, Pre-primary, Primary, High school etc.
3.5	Are participants drawn from an institutional population? (e.g. Hospital, Prison, Mental Institution, organisation, etc)	YES	Identify the institution SMMEs in the Volta region of Ghana
3.6	Will any records be consulted for information	NO	Specify source of records
3.7	Will individual participants know their records are being consulted?	N/A	State how these records will be obtained and whose permission is required: no individual reports will be accessed
3.8	Are all participants over 18 years of age?	YES	If No, state justification for inclusion of minors in study. All participants are over 18 years.
3.9	State the minimum number of participants needed	400	
3.10	State the maximum number of participants needed	400	

Management Sciences Research Office • Private Bag X20539 • Bloemfontein • SOUTH AFRICA • 9300 •
Tel: +27 051 507 3218 • **Fax:** +27 051 507 3133 • **E-mail:** cchipunza@cut.ac.za • **Website:** www.cut.ac.za

4.	**RISKS AND BENEFITS OF PROJECT**		
4.1	Is there any risk of harm, embarrassment or offence, however slight or temporary, to the participant, to third parties, or to the community at large?	NO	If yes, explain
4.2	Are all risks reversible?	N/A	If No, specify
4.3	Are remedial measures available, if risks are not reversible?	N/A	Explain
4.4	Are alternative procedures available?	N/A	
4.5	Has the person administering the project previous experience with the particular risk factors involved?	N/A	
4.6	Are any benefits expected to accrue to the participant personally? (e.g. improved health, mental state, financial, social life, skills, knowledge, etc)	NO	
4.7	Will you be using equipment of any sort?	NO	
4.8	Will any article of property, personal or cultural, be collected in the course of this project?	NO	If Yes, specify
5.	**CONSENT OF PARTICIPANTS**		
5.1	Is consent to be given in writing?	NO	If Yes, *append consent form*
5.2	Do any participants suffer from a legal disability preventing them from giving effective informed consent (e.g. under 18 years, declared insane by a court of law, unconscious, etc)	N/A	If Yes, specify and indicate what measures will be taken to obtain informed consent:
5.3	Do any participants operate in an institutional environment which may cast doubt on the voluntary aspect of consent?	N/A	If Yes, specify and state what special precautions will be taken to obtain informed consent:
5.4	Will participants receive remuneration for their participation?	NO	If Yes, state the basis on which remuneration is calculated, and indicate what measures have been taken to ensure that it cannot be considered a perverse incentive.
5.5	Do you require consent of an institutional authority for this project?	NO	If Yes, specify; and *append letter of consent.*
6.	**PRIVACY, ANONYMITY AND CONFIDENTIALITY OF DATA**		
6.1	Are provisions made to protect participant's rights to privacy and anonymity and to preserve confidentiality with respect to data?	YES	Specify: Respondents will not be identifiable.
6.2	Will mechanical methods of observation be used? (e.g. one-way mirrors, recordings, videos, etc)	NO	Specify
6.3	Will participants' consent to such mechanical methods of observation be obtained?	N/A	If no, give reasons
6.4	Will data collected be stored in any way?	NO	If Yes (a) By whom: (b) How many copies: (c) For how long: (d) For what reasons: (e) How will subject's anonymity be protected:
6.5	Will stored data be made available for re-use?	NO	If Yes, how will participants consent be obtained for such re-usage:
6.6	Will any part of the project be conducted on private property (includes shopping centres)?	NO	If Yes, specify and state how consent of property owner is to be obtained, or *attach letter of consent:*
7	**FEEDBACK**		
7.1	Will feedback be given to participants?	NO	If Yes, indicate whether this is to be given to each individual immediately after participation; to each participant after the entire project is complete; to all participants in a group setting; or other manner and specify whether feedback will be written, oral or by other means.

Management Sciences Research Office • Private Bag X20539 • Bloemfontein • SOUTH AFRICA • 9300 •
Tel: +27 051 507 3218 • **Fax**: +27 051 507 3133 • **E-mail**: cchipunza@cut.ac.za • **Website**: www.cut.ac.za

Central University of Technology, Free State

Central University of Technology, Free State

7.2	If you are working in a school or other institutional setting will you be providing teachers, parents, school authorities or equivalent a copy of your results and/or report?	N/A	
8.	**DECLARATION**		
8.1	Any changes made to the above arrangements or procedures will be brought to the attention of the Chairperson of the Faculty Research Committee.		
8.2	We/I hold accountable to the Research Ethics Committee for conducting this research project in the manner herein described and in accordance with the spirit of the ethical guidelines of the Central University of Technology, Free State. We/I undertake to assume responsibility to advise the Faculty Research Committee promptly of any deviations, waivers, irregularities or harm occurring during the conduct of this research project.		
8.3	Signature of Student		
8.4	Signature(s) of Project Supervisor(s):		
8.5	Signature of HOD		
8.6	Date approved by FRIC		
8.7	Signature of FRIC Chairperson		
8.8	Ethical Clearance Number Allocated by FRIC	FMSEC........	

Management Sciences Research Office • Private Bag X20539 • Bloemfontein • SOUTH AFRICA • 9300 •
Tel: +27 051 507 3218 • **Fax**: +27 051 507 3133 • **E-mail**: cchipunza@cut.ac.za • **Website**: www.cut.ac.za

Appendix 2: Quantitative Questionnaire for MSEs in Ghana

CENTRAL UNIVERSITY OF TECHNOLOGY
FACULTY OF MANAGEMENT SCIENCES
DEPARTMENT OF BUSINESS SUPPORT STUDIES

QUANTITATIVE QUESTIONNAIRE FOR MSEs IN SMALL SCALE INDUSTRY IN GHANA

Dear Sir/Madam,

I am Harrison Paul Adjimah studying for the Doctor of Philosophy degree in Business at the Central University of Technology (CUT), Free State, South Africa.

I am collecting data for my thesis titled: Drivers of successful commercialisation of indigenous innovation in Ghana. This survey collects data on your perception about the link between some selected drivers and successful commercialisation of indigenous innovation in Volta Region. Dr. Victor Atiase of De Montfort University, United Kingdom and Prof Dennis Dzansi of the Central University of Technology are my supervisors.

I would be glad if you could spare 20 minutes of your time to answer some few questions for me. Please your name is not required as this questionnaire is completely anonymous, and would be used purposely for academic exercise. Your responses shall be treated as confidential.

If you would like to receive an executive summary of the research report, please tick the appropriate box. Yes [ ] No [ ]

Please would you like to participate further in the survey? Yes [ ] No [ ]

Thank you very much for your time and contributions.

FOR INTERNAL USE ONLY

Questionnaire Code: ……………………………..………………………..........................

Date Administered: ………………………………………………………..........................

Date of Retrieval: ………………………………...

Contact of Respondent: ……………………………………………..............................

Business Location: ....

Instructions:

1. Please tick the box that best represents your perspective or specify where appropriate.
2. Please, note that the numbers inserted in the boxes (e.g. [1]) are for coding purposes only.

SECTION A: PERSONAL PROFILE

1. Gender:	[1] Male		[2] Female		
2. Age:	[1] 25 and under	[2] 26–35	[3] 36–45	[4] 46 – 55	[5] 55+
3. Marital Status:	[1] Married	[2] Single	[3] Divorced	[4] Widowed	
4. Highest level of education:	[1] No formal education [3] Secondary school [5] Postgraduate degree	[2] Primary school [4] Undergraduate degree [6] Others, please specify:			
5. Types of Training:	[1] Apprenticeship [2] Technical / Vocational [3] On-the-job training				

SECTION B: BUSINESS PROFILE

6. Business category:			
[1] Food processing	[2] Cash crop processing (cocoa, oil palm etc)		
[3] Kente Weaving	[4] Other textile & garment		
[5] Wood works	[6] Metal works		
[7] Pottery & Ceramics	[8] Others, please specify		
7. What is your role with this innovation?			
[1] Owner/ Developer	[2] Manager	[3] Team member	
8. What is the age of the innovation/business?			
[1] 0-2 years	[2] 3-5 years	[3] 6-10 years	[4] Over 10 years
9. Types of indigenous innovation:			
[1] Further application of indigenous knowledge [2] Use of indigenous inputs [3] Adaptation of technology to indigenous knowledge [4] Others, please specify:			
10. Please select if you have received any types of government incentives for your innovation.			
[1] None	[2] Grant		
[3] Regulatory relaxation	[4] Free or subsidized inputs		
[5] Concessionary loans	[6] Free Training		
[7] Others, please specify:			
11. Please select if your customers enjoy any type of government incentives for using your innovation.			
[1] None	[2] Grant		
[3] Tax rebate	[4] Government purchase		
[5] Subsidised complements	[6] Concessionary loans		
[7] Others, please specify:			
12. Please select your method of commercialisation.			
[4] Start-ups by the entrepreneur or innovator [3] Corporate venturing by existing firm. [2] Business spinoffs from knowledge-based institution (KBI). [1] Licensing to others			
13. Please select if you have used any university or other innovation intermediary services in the development and commercialisation of your innovation.			
[1] None	[2] University Lab/workshop	[3] Hub/incubator	
[4] Mentoring	[5] Promotion & Demand legitimisation	[6] Others, please specify:	

14. Please indicate the adopted pricing strategy in the commercialisation of your innovation.
[1] We package and price our innovation well below the industry average. [2] We package and price our innovation around the industry average. [3] We package and price our innovation around the upper end of the industry price.

SECTION C: DRIVERS OF INDIGENOUS INNOVATION COMMERCIALISATION

REGULATION

15. How would you agree to the following regarding regulation and innovation commercialisation by rating on a scale between 1 and 5, where 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA)?

Regulation	SD	D	N	A	SA
a) The number of regulatory rules for MSEs in the small scale industry (SSI) are reasonable and easy for compliance.	1	2	3	4	5
b) Attitudes of staff are reasonable and supportive					
c) The cost of regulation compliance in SSI are bearable and affordable to me.	1	2	3	4	5
d) Approval and permits are timely and the process do not delay commercialisation decisions	1	2	3	4	5
e) The time burden or the time it takes for MSEs to comply with all required rules is reasonable.	1	2	3	4	5
f) Most customers/users of our innovation required regulatory compliance before buying	1	2	3	4	5
g) Government regulations and policies create new demand opportunities for our innovation	1	2	3	4	5
h) Overall government regulations help us to create more values and improve standards for customers.	1	2	3	4	5

INANCE

16. How would you agree to the following regarding finance and indigenous innovation by rating on a scale between 1 and 5, where 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA)?

Finance	SD	D	N	A	SA
a) My personal savings form small part of my invested capital for the development and commercialisation of my innovation.	1	2	3	4	5
b) I relied heavily on "susu" (cooperative contribution) to fund the development and commercialisation of my innovation.	1	2	3	4	5
c) I relied heavily on credit/investment from family and friends.	1	2	3	4	5
d) I relied heavily on credit purchases.	1	2	3	4	5
e) Government grants and concessionary loans form substantial part of my invested capital for the development of innovation.	1	2	3	4	5
f) Bank/micro credit loans form substantial part of my capital.	1	2	3	4	5
g) Loans from high interest financial institution or money lenders form small part of my capital	1	2	3	4	5
h) Credit is accessible, my business get it when we need it					
i) Costs of credit/capital are bearable and do not increase my risks	1	2	3	4	5
j) k) Repayment terms of credit/capital are flexible and do not increase my business risks	1	2	3	4	5
k) Repayment terms of credit/capital are long enough	1	2	3	4	5

ORGANISATIONAL FACTORS

17. How would you agree to the following regarding organisational factors and innovation commercialisation by rating on a scale between 1 and 5, where 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA)?

Organisational Factors	SD	D	N	A	SA
a) The technical skills required by my team to produce and deliver services is adequate.	1	2	3	4	5
b) Peoples' skills of my team members is adequate.	1	2	3	4	5
c) We are highly able to gather financial and other resources when required	1	2	3	4	5
d) We are highly able to use our capacity (material, equipment logistics and staff to undertake and achieve results.	1	2	3	4	5
e) We are able to leverage on other existing business infrastructure in our commercialisation process.	1	2	3	4	5

MARKET FACTORS

18. How would you agree to the following regarding market factors and commercialisation of innovation by rating on a scale between 1 and 5, where 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA)?

Market Factors	SD	D	N	A	SA
a) We adopt aggressive low cost/cost cutting strategies at every stage and are able to offer lower cost to customers	1	2	3	4	5
b) We are well able to preserve and brand the crown jewel (the key values) of our innovation on the market	1	2	3	4	5
c) Our innovations are appropriately packaged and prices are affordable to the target market	1	2	3	4	5
d) Customers accept our innovation and are willing to pay patriotic premium for the indigenous (made in Ghana) brand	1	2	3	4	5
e) Our innovation is available everywhere customers need them	1	2	3	4	5
f) Our product outreach is increasing	1	2	3	4	5
g) Distributors do not require high distributive margin and extras to accept and place our products on the market	1	2	3	4	5
h) It is easy to attain large volume potentialities on our target market.	1	2	3	4	5

TECHNOLOGY

19. How would you agree to the following regarding technology and commercialisation of innovation by rating on a scale between 1 and 5, where 1 = Strongly disagree (SD), 2 = Disagree (D), 3 = Neutral (N), 4 = Agree (A), and 5 = Strongly Agree (SA)?

Technology	SD	D	N	A	SA
a) We are able to use specific purpose technology (new process, equipment, material) in related sectors to improve our indigenous innovation or introduce new ones.	1	2	3	4	5
b) We are confident our business would not be crowded out by competition from the emerging technologies in the industry.	1	2	3	4	5
c) We extensively use digital technology (social media and Ecommerce sites) to promote our products.	1	2	3	4	5
d) We extensively use E-payment platforms and accept E-money.	1	2	3	4	5
e) Our usage of digital technology is effective as substantial part of our sales are via Ecommerce and this is growing strongly.	1	2	3	4	5
f) Substantial part of our purchases are via Ecommerce.	1	2	3	4	5

SECTION D: BUSINESS PERFORMANCE

20. Please indicate the sales revenue and growth of your commercial activities for the last five years where applicable

a. Please tick sales revenue in thousand Ghana cedis (GH¢) by selecting the right scale.				
2016	**2017**	**2018**	**2019**	**2020**
[1] Below 5,000 [2] 5,000-9,999 [3] 10,000-24,999	[1] Below 5,000 [2] 5,000-9,999 [3] 10,000-24,999	[1] Below 5,000 [2] 5,000-9,999 [3] 10,000-24,999	[1] Below 5,000 [2] 5,000-9,999 [3] 10,000-24,999	[1] Below 5,000 [2] 5,000-9,999 [3] 10,000-24,999

[4] 25,000-49,999 [5] 50,000-74,999 [6] 75,000 & over	[4] 25,000-49,999 [5] 50,000-74,999 [6] 75,000&over	[4] 25,000-49,999 [5] 50,000-74,999 [6] 75,000 & over	[4] 25,000-49,999 [5] 50,000-74,999 [6] 75,000 & over	[4] 25,000-49,999 [5] 50,000-74,999 [6] 75,000 & over

b. Please tick year on year sales growth of your innovation in the last five years by selecting the right scale.

2016	2017	2018	2019	2020
[1] Below 10% [2] 10-19% [3] 20-29% [4] 30-49% [5] 50-79% [6] 80% & over	[1] Below 10% [2] 10-19% [3] 20-29% [4] 30-49% [5] 50-79% [6] 80% & over	[1] Below 10% [2] 10-19% [3] 20-29% [4] 30-49% [5] 50-79% [6] 80% & over	[1] Below 10% [2] 10-19% [3] 20-29% [4] 30-49% [5] 50-79% [6] 80% & over	[1] Below 10% [2] 10-19% [3] 20-29% [4] 30-49% [5] 50-79% [6] 80% & over

21. Please indicate the number of people engaged full time and part-time by your innovation and commercialisation activities and growth of this employment in the last five years.

a. Please tick the number of employees engaged by your innovation and commercialisation activities by selecting the right scale.

2016	2017	2018	2019	2020
[1] 1 [2] 2-5 [3] 6-19 [4] 20-29 [5] Over 29	[1] 1 [2] 2-5 [3] 6-19 [4] 20-29 [5] Over 29	[1] 1 [2] 2-5 [3] 6-19 [4] 20-29 [5] Over 29	[1] 1 [2] 2-5 [3] 6-19 [4] 20-29 [5] Over 29	[1] 1 [2] 2-5 [3] 6-19 [4] 20-29 [5] Over 29

b. Please indicate the year-on-year growth of employment for your business in the last five years by selecting the right scale.

2016	2017	2018	2019	2020
[1] 0-24% [2] 25-49% [3] 50-74% [4] 75-100% [5] Over 100%	[1] 0-24% [2] 25-49% [3] 50-74% [4] 75-100% [5] Over 100%	[1] 0-24% [2] 25-49% [3] 50-74% [4] 75-100% [5] Over 100%	[1] 0-24% [2] 25-49% [3] 50-74% [4] 75-100% [5] Over 100%	[1] 0-24% [2] 25-49% [3] 50-74% [4] 75-100% [5] Over 100%

22. Please describe profitability of your innovation and commercialisation activities in the last five years.

Please describe profitability of your commercialisation activities by selecting the right scale for the last five years.

2016	2017	2018	2019	2020
[1] Loss or 0% [2] 1-9% [3] 10-19% [4] 20-29% [5] 30-49% [6] 50% & over	[1] Loss or 0% [2] 1-9% [3] 10-19% [4] 20-29% [5] 30-49% [6] 50% & over	[1] Loss or 0% [2] 1-9% [3] 10-19% [4] 20-29% [5] 30-49% [6] 50% & over	[1] Loss or 0% [2] 1-9% [3] 10-19% [4] 20-29% [5] 30-49% [6] 50% & over	[1] Loss or 0% [2] 1-9% [3] 10-19% [4] 20-29% [5] 30-49% [6] 50% & over

23. Please describe people and your personal feelings about your innovation and its performance in the last five years where applicable.

a. Please how would you rank peoples' recognition of your innovation and its performance on percentage scale in the last five years?

Note: Use complements, associated invitations, customer reviews and acceptance, media reviews and mentions etc., relative to other successful firms, as a guide.

2016	2017	2018	2019	2020
[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70%

[5] 71-80% [6] Over 80%	[5] 71-80% [6] Over 80%	[5] 71-80% [6] Over 80%	[5] 71-80% [6] Over 80%	[5] 71-80% [6] Over 80%
b. Please what is your personal level of satisfaction, relative to your goals, for the innovation and its performance on percentage scale in the last five years?				
2016	**2017**	**2018**	**2019**	**2020**
[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70% [5] 71-80% [6] Over 80%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70% [5] 71-80% [6] Over 80%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70% [5] 71-80% [6] Over 80%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70% [5] 71-80% [6] Over 80%	[1] Below 40% [2] 40-50% [3] 51-60% [4] 61-70% [5] 71-80% [6] Over 80%

Thank you for participating in this study.