UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

HUMAN CAPITAL, RESEARCH AND DEVELOPMENT AND EXPORTS: FIRM-LEVEL EVIDENCE FROM GHANA

BY

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILOSOPHY (M. PHIL) DEGREE IN ECONOMICS

JULY, 2018

DECLARATION

I, ABDUL WAHAB AMADU, hereby declare that this thesis is my own work towards the award of Master of Philosophy (M. Phil) degree in Economics. This work has not been presented by anyone for any academic honour in this or any other university.

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CERTIFICATION

I hereby certify that this thesis has been assessed and all corrections have been made in accordance with the comments made by my supervisors and procedures laid down by the University.

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SUPERVISOR

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PROF. WILLIAM BAAH-BOATENG **DATE**

SUPERVISOR

DEDICATION

I dedicate this thesis to my late father Amadu Alhassan (May his perfect soul rest in perfect peace), my lovely mother Ayi Alhassan and my grandfather Alhassan Andani.

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I thank Almighty Allah for His mercies and granting me the required knowledge that has seen me through this programme.

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LIST OF ABBREVIATIONS

ACET	African Center for Economic Transformation
AGI	Association of Ghana Industries
CEPS	Customs, Excise and Preventive Services
CIS	Community Innovation Survey
CSIR	Center for Scientific and Industrial Research
EDIF	Export Development and Investment Fund
ERP	Economic Recovery Programme
ES	Enterprise Survey
FDA	Food and Drugs Authority
FAGE	Federation of Associations of Ghanaian Exporters
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEPA	Ghana Export Promotion Authority
GHATIG	Ghana Trade Investment Gateway Programme
GNCCI	Ghana National Chamber of Commerce and Industry
GSS	Ghana Statistical Service
ICS	Innovation Capability Survey

ICT	Information and Communication Technology
IFS	Innovation Follow-up Survey
IIR	Institute of Industrial Research
IMF	International Monetary Fund
ISI	Import Substitution Industrialization
IV	Instrumental Variable
MDGs	Millennium Development Goals
MOTI	Ministry of Trade and Industry
MOFA	Ministry of Food and Agriculture
NBSSI	National Board for Small Scale Industries
NDPC	National Development Planning Commission
NES	National Export Strategy
NRIF	National Research and Innovation Fund
NTEs	Non-Traditional Exports
OECD	Organization for Economic Corporation and Development
OLS	Ordinary Least Square
PEF	Private Enterprise Foundation

R&D	Research and Development
RBV	Resource-Based View
REP	The Rural Enterprise Project
SAP	Structural Adjustment Programme
SSA	Sub-Saharan Africa
SMEs	Small and Medium Enterprises
TFP	Total Factor Productivity
TT	Technology Transfer
VALCO	Volta Aluminum Company
WDI	World Development Indicators
WTO	World Trade Organization

ABSTRACT

Despite the vast and growing body of empirical literature focusing on the drivers of export performance of firms, the empirical evidence on the channels through which human capital and R&D affect firm export is dearth even though this relationship seems to be important, specifically for developing economies. In this study, a conceptual model is developed drawing on the Resource-Based View (RBV) theory of the firm to conduct a detailed evaluation of whether firm export is explained by R&D and human capital effects, and perhaps more importantly, whether firm innovation has a mediating role in this relationship. Export performance, innovation and R&D are measured as the propensity to export, innovate and conduct R&D by a firm respectively, whilst human capital is measured by formal training, employee schooling and employee slack time. We use a unique dataset that combines the Ghana 2013 Enterprise Survey (ES), the Ghana 2013 Innovation Follow-up Survey (IFS) and the Ghana 2013 Innovative Capability Survey (ICS). Using both simple probit and bivariate probit regression techniques, the results indicate that R&D and the components of human capital (i.e. formal training, employee slack time and employee schooling) are imperative for firm export performance in this context. Also, our findings suggest that human capital (or R&D) in the presence of innovation produces inconsequential effects on firm export. Specifically, after using a consistent estimator for the interaction effects (cross difference approach), the results reveal that the interaction terms (education and innovation, and R&D and innovation) affect export performance positively but their statistical significance differ widely by observation. Moreover, we find that manufacturing firms are more likely to participate in export activities, compared to service firms. Given, the significant roles of R&D, innovation and human capital in enhancing firm-level exports in Ghana, it is our expectation that the findings of this research would help in formulating appropriate policy lessons for firm competitiveness and inclusive growth in Ghana.

CHAPTER ONE
INTRODUCTION

1.1 Introduction

The main aim of this chapter is to present a detailed introduction to the study and the outline of the contents of the research. It starts by providing an in-depth discussion of the research background and the problem statement. It then presents the objectives, methodology, data source and significance of the study. The organization of the study is the last section of this chapter.

1.2 Research Background

In recent times, the attraction of foreign direct investment and the liberalization of international trade have become the core of many development policies (Altomonte et al., 2016). Both theoretical and empirical findings as examined by Bernard et al. (2007) and Alvarez and Lopez (2005) suggest that firms that focus on the international market are mostly productive and larger than those firms that focus only on the local market. The openness and access to foreign competition and foreign markets by an economy may increase the pressure on domestic firms to cut inefficiencies and raise productivity (Badri et al., 2015).

In addition, the exchange of goods, communication, information and technology have increased and developed more than ever. Due to this, firms and exporters of goods and services have a higher probability to compete in the global market and increase their innovative activities than in the past (Girma et al., 2008; Braymen et al., 2011). It is however not surprising that the growth in the volume of exports in developing countries increased by 4.7% in 2011 (WTO, 2011). When export power is increased within sectors such as agriculture, industry, mining, among others, it improves the quality of products and creates competition (Siba & Gebreeyesus, 2016).

In developing countries, the issue of exports is regarded as one of the most important activity. This is because it has been acknowledged that higher exports are linked to higher economic growth in these countries (Van Dijk, 2002). Also, export performance has been extensively researched and surprisingly still the least understood area in international business. Somewhat, this issue can be attributed to difficulties in measuring, operationalizing and conceptualizing the concept of export performance, which results in conflicting and inconsistent results (Katsikeas et al., 2000). Specifically, more emphasis has been laid on the external and internal drivers of export performance, which indicates that export performance has both micro and macro dimensions. The strong competition in both the local and international markets have made exporting imperative in determining firm-level innovation, survival and competitiveness (Wakelin, 1998). According to Roper and Love (2002), the earnings that firms get from exports help in increasing their sales and productivity, and hence, higher profits.

Concentrating on the role of entrepreneurs in enhancing competition on the international market, a crucial observation that has been made over the years reveals that, firms experience the same macroeconomic conditions, yet, they respond and perform differently in terms of their export behaviour. This implies that, there must be some significant firm-specific characteristics and capabilities that affect the export activities of firms. The prevailing theory explaining this phenomenon since the mid-1980s is the resource-based view (RBV) theory of the firm. The resource-based view (RBV) theory propounds a theoretical underpinning that explains how the export activity of a firm is built on different aspects of its capabilities and resources. This theory has therefore shifted recent research focus on investigating the different factors that affect firm export performance (Van Dijk, 2002). Also, the recent trend towards globalization of trade and marketing activities has necessitated the need to understand how firms behave in foreign markets

(Katsikeas et al., 2000). Therefore, it is an imperative initiative for firms to remain competitive in the international market to enhance their export performance.

Consequently, the capabilities of firms have been shown in the literature to be the significant factors that drive the export performance of firms. These firm capabilities are part of the firm-specific characteristics established by the RBV theory of the firm that might account for the differences in the export activities and performance of firms (Del Canto et al., 1998). It has been shown that the real effects of knowledge and technologies are felt when they are accepted by a vast number of firms, within a country. Empirical indicators of firm capabilities usually only include innovation, human capital and R&D (Gourlay et al., 2005). Economists have made conscious efforts in showing that, human capital, innovation and R&D are crucial in enhancing firm performance.

Generally, innovation is defined in the economic literature as the technological or technical change in the method through which organizations continuously produce new knowledge or new ideas (Bamijan et al., 2010). In addition, firm capability is referred to how a given firm can adopt and implement both external and internal information for transfer into new knowledge (Rodríguez et al., 2005). Furthermore, human capital is referred to as the unique skills, knowledge and capabilities of individuals that have economic value to a firm (Crook et al., 2011). Finally, Research and development (R&D) is referred to as the investigative activities firms undertake to improve existing processes and products or to lead to the development of new processes and products (Ballot et al., 2001).

Consequently, a holistic review of African economies clearly shows that few firms export because of lack of innovation, which explains why many countries are under-developed (Teal et al., 2006;

Goedhuys & Sleuwaegen, 2010). In the specific setting of Ghana, Robson et al., (2012) found that the innovative efforts in the manufacturing sub-sector of Ghana is very low. The manufacturing sub-sector has experienced a steep decline in its contribution to GDP over the years. In 2017, the contribution of manufacturing stood at about 3.1%, thus reflecting the dismal growth performance of the sector over the past decades (see GSS, 2018). Manufacturing basically continues to shrink and does not have effective linkages with the export market and domestic raw materials (Sarpong & Wolf, 2008).

Furthermore, the growth rate of Ghana for the past two decades has been robust and resilient compared to other developing countries which share the same characteristics. The weak employment and poverty impact of the recent growth over the last two decades can be associated with the abysmal performance in the manufacturing sub-sector. Goods manufactured locally are mostly uncompetitive (i.e. in terms of price and quality) (IMF, 2016). The service sector cannot be left out as it also contributes less to the export-led economic growth. Traditionally, services are difficult to export since they are mostly home-based and their production and consumption are co-located. Figure 1.1 shows the annual growth rate within the various sectors of the economy of Ghana for the period 2010 to 2017.

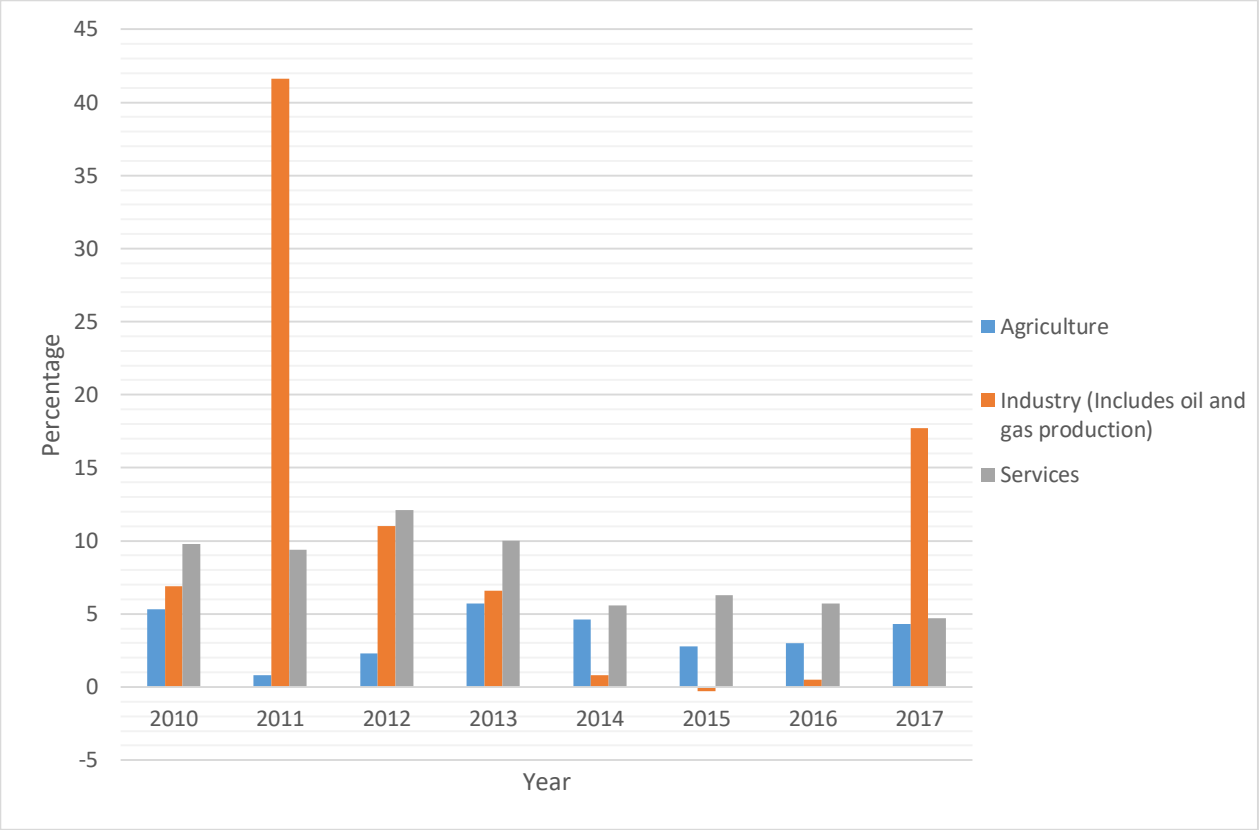


Figure 1.1: Annual Growth Rate within the various sectors in Ghana (2010-2017)

Source: Ghana Statistical Service, 2018

The service sector records the highest growth rate with regards to its contribution to Ghana's GDP (except in 2011 and 2017, where there was a steep rise in the growth of industry), followed by the industry and agriculture. The industrial sector (specifically, manufacturing) remains one of the lowest contributors to Ghana's GDP. The major cause of this disappointing performance by the manufacturing sector is that, Ghana has generally not been a higher value addition exporting country but the manufacturing sector, which include oil and gas has been significant. Due to this, policies have been put in place to upgrade the technologies and skills (R&D and human capital) of firms mainly to improve exports and firm performance in Ghana. This will help in drawing effective policy lessons for firm competitiveness, inclusiveness and sustainable growth in Ghana.

1.3 Statement of Problem

Export-led growth policies geared at building quality export performance of firms are crucial in maintaining strong and resilient manufacturing and service firms' performance (Rodil et al., 2016). One major export-led growth policy in Ghana has been the implementation of the the National Export Strategy (NES), which was launched in August 2013. Spanning a five-year period, the main objective of the NES is to develop the potential of the non-traditional export sector to enable it to make maximum contribution to GDP growth and national development to consolidate and enhance Ghana's middle-income status (ACET, 2015). Due to this, the export of non-traditional goods has been encouraged to promote exports among firms in Ghana.

Over the years, the National Export Strategy has not been effective as the total export revenue is still dominated by the traditional sector of Ghana. But on the world market, the prices of these exports have been unstable. This phenomenon negatively affects the regular flow of export revenue into Ghana. As in the previous years, in 2016 cocoa and minerals continued to be the top export earners of Ghana whilst the earnings from other exports, including non-traditional exports continued to decrease (ISSER, 2016). The government in an attempt to diversify exports (i.e. improving non-traditional exports) to meet the objective of the National Export Strategy has adopted measures intended to enhance exports at the firm-level (ACET, 2015). A lot of firms have been established in Ghana to engage in non-traditional exports especially in agriculture, handicrafts, processed and semi processed products. Figure 1.2 shows the annual growth rate of the total exports of goods and services in Ghana for the period 2007 to 2017. The highest growth was recorded in 2011 (53.8%), which was due to the production of oil in commercial quantities in September 2010, whilst the lowest growth was recorded in 2014 (-5.8%), which was partly due to a severe energy crisis.

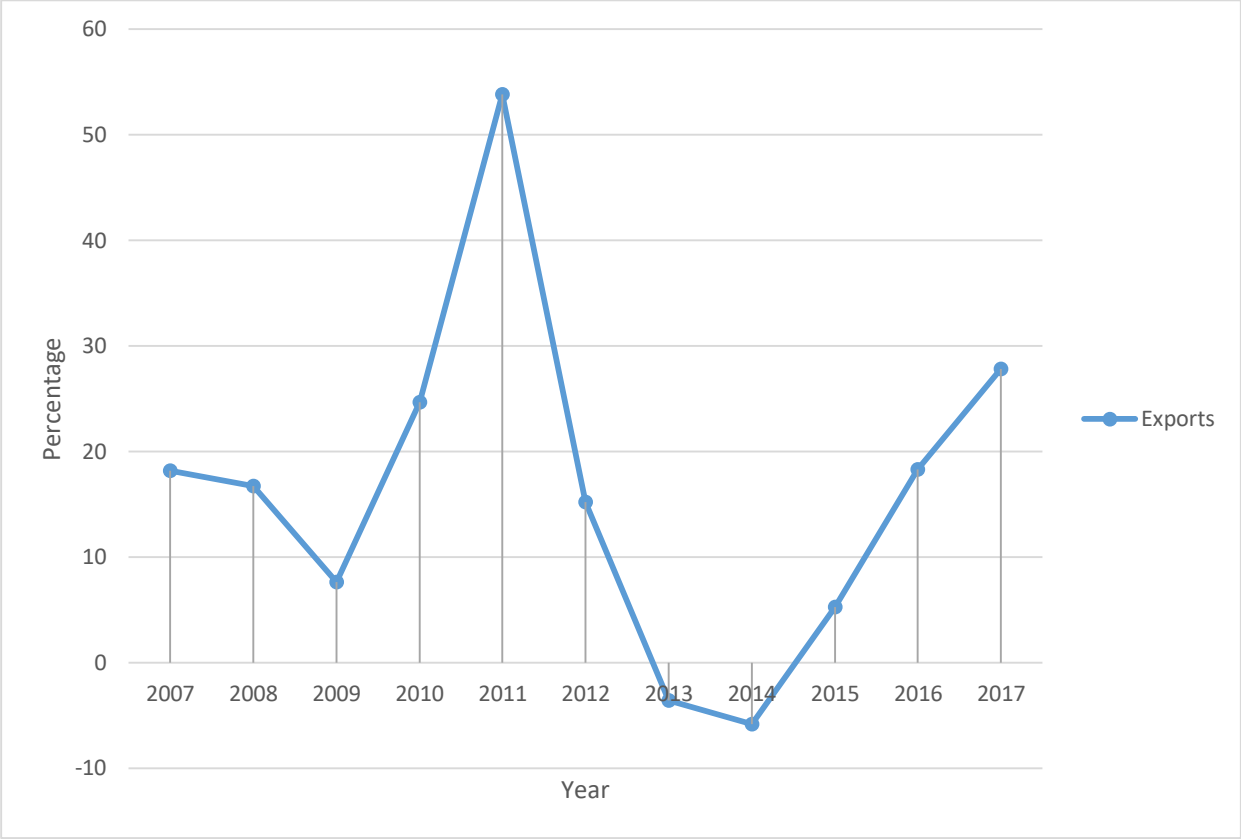


Figure 1.2: Annual Growth Rate of Exports of Goods and Services in Ghana (2007-2017)

Source: Author's computation, 2018 from WDI (2018)

Consequently, existing evidence from the literature proposes that trade is mostly carried out by a comparatively small number of firms in Ghana (Robson & Freel, 2008). Recently, much attention has been drawn to export-led growth by the government, given its significant role in the development process, specifically, the focus on the manufacturing of value-added export goods. The main goal of Ghana is to boost its socio-economic development through its value-added export sector (ACET, 2015). This has moved the concentration of recent research from the country-level to the basic micro-economic drivers of firm export performance with a focus on innovation activities and R&D. The development of a comprehensive framework in this regard proposes that human capital development and R&D spending are the keys to unlocking the difficulties exporting firms face in Ghana. The advancement of theory and literature in this setting is imperative to the

development of exports since the recent globalization of markets has helped in increasing opportunities for domestic firms that are growth-oriented.

However, most studies conducted in developing countries with a focus on human capital and R&D often concentrate on their effects on the growth of Total Factor Productivity (TFP), economic growth (see Fleisher et al., 2010) or FDI (see Cleeve et al., 2015). It is notable that, most of these studies are carried out at the country-level and therefore explain only a little of the relationship that exists between these factors at the firm-level. Also, existing studies at the firm-level that have focused on this relationship concentrate on firms in developed countries (see Lefebvre, 1998; Munch & Skaksen, 2008; Wagner, 2011, among others). In addition, most previous literature has only recently focused either on the effect and role of human capital in enhancing firm export performance (see Munch & Skaksen, 2008; Crook, 2011; Bastos et al., 2016, among others) or the effect and role of R&D in boosting firm export performance (see Ito & Pucik, 1993; Aw et al., 2007; Girma et al. 2008, among others), but not a combination of the effects of these two factors (human capital and R&D) on firm export performance. Also, most studies only concentrate on how human capital and R&D affect export directly but not a transitional effect through innovation. Hence, the contemporaneous links between them are unaccounted for.

It is surprising on the part of firms in developing countries not concentrating on the stimulation of educational levels and the fostering of R&D since these factors are the foundations of many development policies and initiatives. Therefore, studies at the firm-level that provide a detailed evaluation of the effects and roles of human capital and R&D on firm export performance are much needed for a developing country like Ghana.

1.4 Research Objectives

1.4.1 General Objective

This research mainly seeks to conduct a detailed evaluation of the effects and roles of R&D and human capital in enhancing firm export performance in Ghana.

1.4.2 Specific Objectives

The study is motivated by the following specific research objectives:

I. Ascertain the effects of human capital (formal training, employee schooling and employee slack time) and R&D on firm export performance.

II. Investigate how human capital and R&D affect firm export performance in the light of innovation.

III. Investigate how firms (manufacturing and service firms) vary in terms of their export performance.

1.5 Methodology and Scope of the Study

This study adopts a probit regression approach to address the research objectives on the interplay between human capital, R&D and the exports of firms in Ghana. The study involves a sample of 720 firms in Ghana, selected strictly based on the availability of data. The data for the study spans from 2011 to 2013, which is sourced from the Ghana 2013 Enterprise Survey (ES), the Ghana 2013 Innovation Follow-up Survey (IFS) and the Ghana 2013 Manufacturing Innovation Capability Survey (ICS). The three datasets are merged to enable an in-depth examination of the links between human capital, R&D and firm-level exports in Ghana.

1.6 Significance of the Study

The study seeks to make substantial contributions to the existing research on firm export performance. Specifically, this study adds to the extant literature on the relationship that exists between human capital, R&D and firm export performance for the case of a developing economy (Ghana) and proceeds to address the econometric issues of endogeneity and heterogeneity that could confound the causal influence of R&D on firm export performance. An examination of the effects of human capital and R&D on firm export performance in Africa is essential because the current phase of development strategy in most parts of Africa concentrates on export-led growth. The findings of the study would help in formulating effective policy lessons for firm competitiveness and inclusiveness coupled with sustainable growth in Ghana. We also hope that the findings in this study might help to resolve conflicts, reconcile disagreements and clarify existing uncertainties and speculations among academics, practitioners and government policy makers regarding the export performance of firms in Ghana.

1.7 Organization of the Study

This research comprises six (6) chapters.

The first chapter focuses on the introduction, which delves into the research background, statement of the problem, objectives, significance and the scope of the research. This chapter ends with the organization of the study. This chapter gives a thorough elucidation of the reason for conducting the study in the Ghanaian context.

The second chapter gives an in-depth discussion of the context of the study by giving a brief overview of exports, R&D and human capital in Ghana. It starts by presenting the growth performance within the main sectors of the economy. The policy environment of Ghana regarding

the various export development programmes and initiatives by the Ghanaian government are also broadly discussed. Moreover, the various research and development initiatives and the level of human capital in Ghana are discussed as well.

The third chapter focuses on the theoretical framework and the empirical studies on human capital, R&D and firm export performance, which produces a good screening of the literature on which the study is built upon. This chapter specifically proposes the resource-based view theory as the main theoretical underpinning of this study. The review of literature is important in this context in developing a conceptual framework and the modelling strategy of the study.

The fourth chapter explains the methodology used for the study with a clear focus on the specification of the model, sources of data, description of variables and the key estimation techniques used in the study. The fifth chapter also concentrates on the empirical estimation results and the discussion of the research findings, while the sixth chapter deals with the summary, conclusion of the study, policy recommendations with regards to the empirical findings and limitations of the study.

CHAPTER TWO

OVERVIEW OF EXPORT, HUMAN CAPITAL AND RESEARCH AND DEVELOPMENT IN GHANA

2.1 Introduction

This chapter mainly focuses on the presentation of the context of the study. It starts by presenting the contributions of the main sectors of the economy to GDP and export growth. The policy environment of Ghana regarding the various export development initiatives and programmes established by the government of Ghana to enhance value-added exports are also broadly deliberated. Also, the various research and development initiatives and the level of human capital in Ghana are discussed as well.

2.2 The Main Sectors (Service, Agriculture and Industry) of the Economy

The economy of Ghana is broadly classified into three (3) sectors: Services, Industry and Agriculture of which for the past decades the agricultural sector has been the main driver of GDP growth. In recent times, the agricultural sector have been outpaced by the industrial and services sectors. However, the services sector has been the largest contributor to GDP.

2.2.1 Service Sector

The services sector remains the largest sector of the economy accounting for 55.9% of GDP in 2017, a marginal decrease from 56.8% in 2016 (GSS, 2018). Service sector growth is estimated to be 4.7% in 2017. The Information and Communication Technology (ICT) and Education are expected to be the largest contributors in the sector with 10.7% and 9.1% contribution to GDP respectively. Growth was positive for all sub-sectors with the exception of Community, Social and Personal Service activities which is estimated to record a negative growth of 0.5% in 2017. The

improved growth performance of Finance and Insurance from 3.5% to 4.1% in 2017 is indicative of the subsector's slow recovery from the severe slowdown in 2015. The services sector is expected to grow by 6.2%, 6.5% and 6.1% in 2018, 2019 and 2020 respectively (GSS, 2018).

2.2.2 Agricultural Sector

In recent years, the contribution of agriculture sector to GDP has declined, from 21.7% of GDP in 2014 to 20.3% of GDP in 2015 although 44.3% of the estimated workforce are employed in this sector (GLSS, 6). Cocoa is the main export crop, accounting for about 19.4% of export earnings in 2015, followed by non-traditional products such as fish, horticulture and pineapples. In 2015, the sector experienced a growth of 2.5%, compared to a growth of 4.6% in 2014. In the third quarter of 2016, the sector grew by 2.3% compared to 24.5% in the third quarter of 2015. The sector's contribution however increased marginally to 24.8% in the third quarter of 2016 (GSS, 2017).

2.2.3 Industrial Sector

The industrial sector (including manufacturing) contributed about 29% to GDP in 2017 from 25.1% in 2015 and 24.2% in 2016 (GSS, 2018). The sector's growth recorded a significant growth from -0.3% and 0.5% in 2015 and 2016 respectively to 17.7% in 2017, which is mainly driven by the quarrying and mining subsector. Manufacturing is estimated to grow by 3.1%, compared with 2.7% recorded in 2016. The manufactures that contribute significantly to the GDP of Ghana include cement, aluminum smelting, light manufacturing, food processing, textiles, pharmaceuticals, small commercial ship building, and the processing of wood and metals. Most of these products are mainly for exportation and domestic consumption. In 2016, the electricity sub-

sector recorded the highest growth with a growth rate of 11.7% followed by the construction and manufacturing subsectors with a growth rate of 2.9% and 2.7% respectively (GSS, 2017).

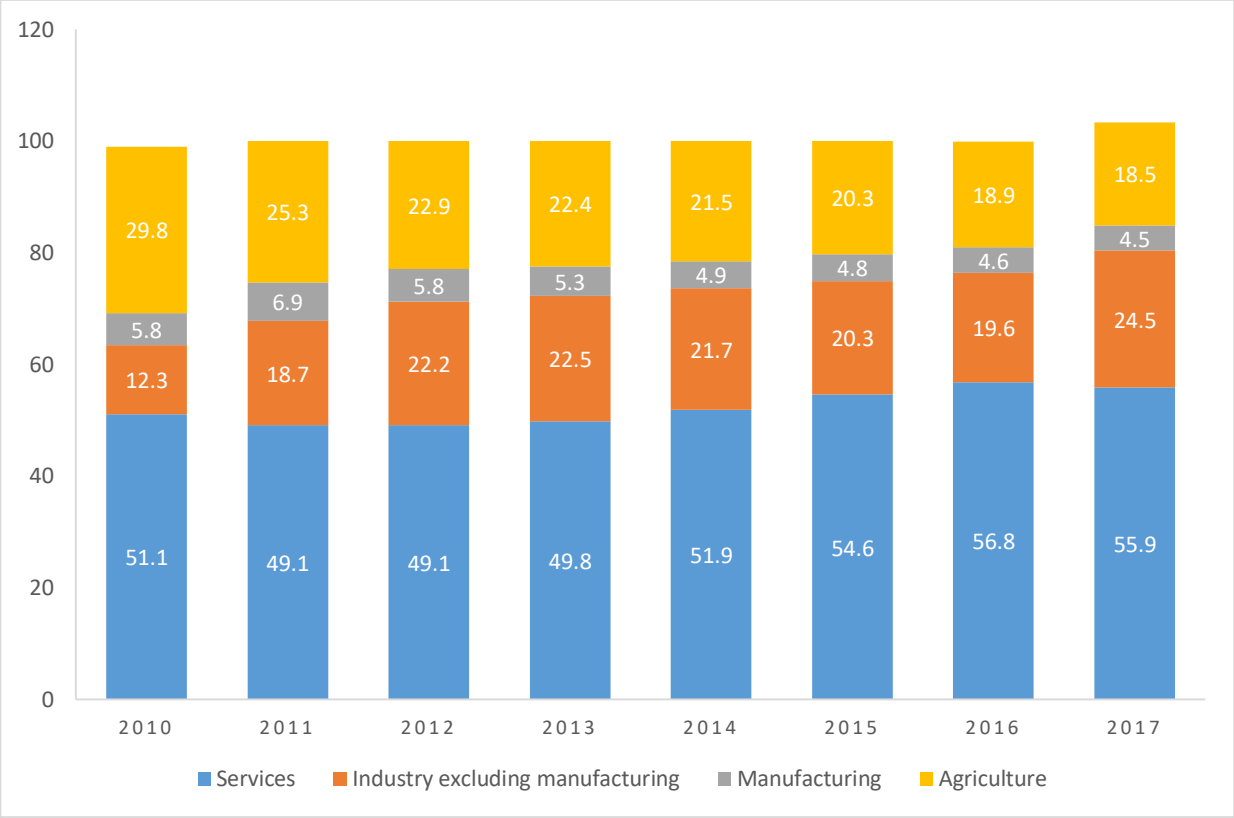


Figure 2.1: Sectoral distribution of the GDP for Ghana (2010-2017).

Source: Ghana Statistical Service, 2018

2.3 The State of Exporting in Ghana

Over the years, the status of Ghana in international trade has been enhanced, which has led to a considerable growth in exports (both traditional and non-traditional) (MOTI, 2016). Nevertheless, traditional exports since the colonial era is known to dominate the external trade sector. According to MOTI (2016), the external trade of Ghana has been dominated by traditional exports such as gold, cocoa and timber, and they account for about 70% of total exports. In addition, the total earnings from the exports of Ghana increased to 4102.80 USD Million in the first quarter of 2018

from 3747.50 USD Million in the fourth quarter of 2017, while the average earnings from exports from 2003 to 2018 was 2095.24 USD Million (GSS, 2018). According to the World Bank (2017), Ghana is among the developing economies in Sub-Saharan Africa (SSA) with the highest per capita income. Also, in 2016 the International Monetary Fund's executive board stressed that Ghana had recently experienced a vibrant and a broadly inclusive growth in industry, with highly-rated business climate that attract foreign direct investments, which in turns boosts the exports of goods and services. They also opined that the medium-term projections of Ghana were reinforced by the expansion in energy production (see IMF, 2016). Consequently, over the last decade, the export sector of Ghana has increased substantially. Figure 2.2 shows total export earnings from the three main traditional export commodities in Ghana as well as the NTEs and others.

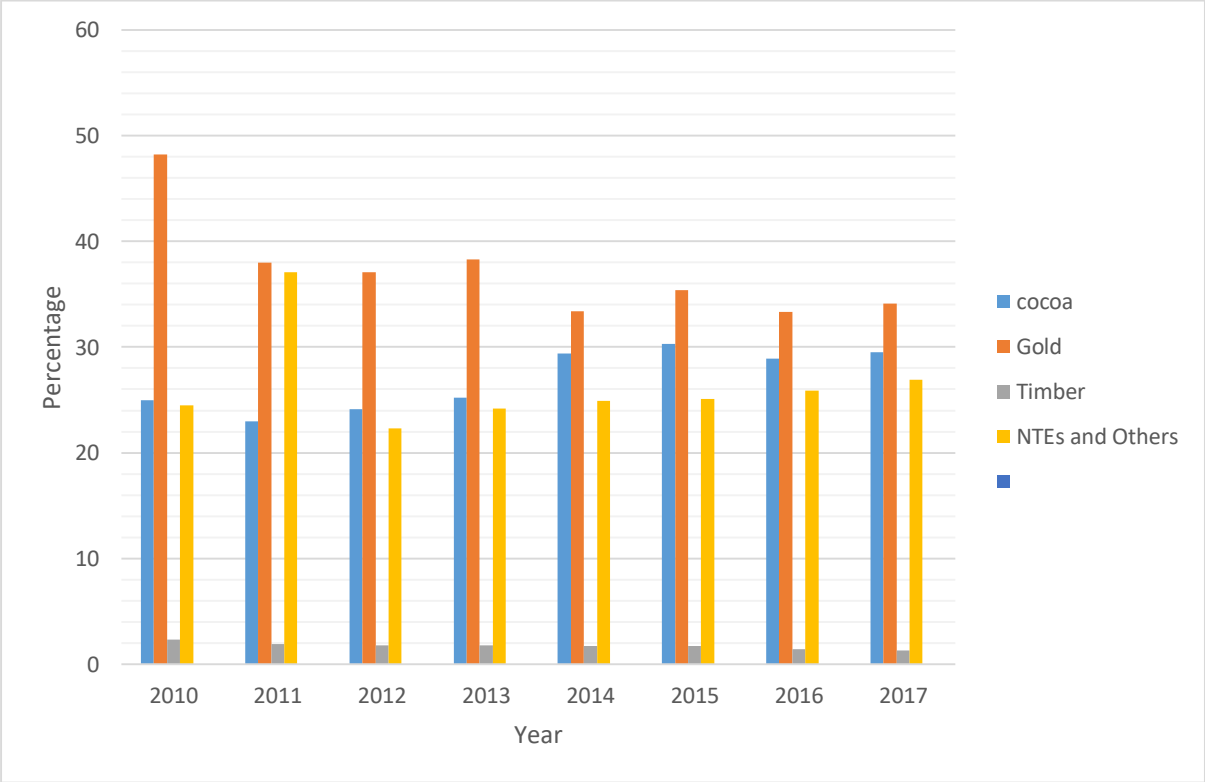


Figure 2.2: Export Earnings and Percentage Contribution of Key Commodities to Export Earnings, 2010-2017

Source: Bank of Ghana, 2018

From Figure 2.2, it is shown that cocoa and gold have been the two key export commodities in Ghana over the years. The contribution of timber to export earnings has been declining over the years. This may be due to high incidence of deforestation. Ghana has heavily relied on these traditional exports for the past decades for source of foreign exchange earnings, however, the prices of these exports are unstable on the international market. Thus, export diversification to non-traditional products is encouraged by the government. Due to this, there was a steep rise in the contribution of NTEs to total exports from about 25% to 37% in 2010 and 2011 respectively. This was also partly due to the production of oil in commercial quantities in September 2010. Also, due to the significant role played by the NTEs in the economic growth of Ghana, the manufacturing sector has been targeted by the government to increase economic growth through value- added exports, thereby leading to the internationalization of Ghanaian firms. Therefore, the development of firms in the non-traditional export sector of Ghana has become an important initiative by the government to accomplish its poverty reduction objectives as well as achieving the Millennium Development Goals.

2.4 Institutions Responsible for Export Promotion in Ghana

The main goal of the government of Ghana is to boost earnings from foreign exchange through a well-organized export sector to achieve competitive advantage in skilled activity to add value to products being exported. The government therefore implemented a lot of export-led programmes to encourage the small, medium and large firms to engage in the export of non-traditional goods to boost the growth in the exports sector. The programmes that were established in Ghana that specifically intended to enhance exports included the Structural Adjustment Programme (SAP) and the Economic Recovery Programme (ERP) in 1983. These programmes were endorsed and

implemented jointly by the IMF and the World Bank. Ghana's economic paradigm prior to the ERP and SAP in 1983 had emphasized on inward looking policy initiatives. However, the ERP and SAP changed the country's economic paradigm to focus on export oriented strategies. Consequently, in Ghana, several institutions collectively contribute substantially to the promotion of export activities. The Ministry of Trade and Industry (2012) has identified these ministries, councils and authorities as part of a holistic export strategy to boost export performance in Ghana.

- **The Ministry of Trade and Industry (MOTI)**

This ministry is the main body of the government of Ghana that has the overall mandate to formulate, develop, implement, monitor and evaluate policies in trade and industry in Ghana. This body of the government has a goal of maintaining a vibrant, opened, technology-driven and a competitive industrial sector and trade. This extensively helps to generate employment and economic growth. The Ministry set up policies that concentrate on enhancing enterprise development (including SMEs), expansion in the industrial sector and promoting Ghana's vigorous participation in global trade. As part of the policy measures to achieve an accelerated and sustainable economic growth, which aims at promoting FDI and the advancement in Ghana's manufacturing sector, the Ghana Trade and Investment Gateway Programme (GHATIG) was implemented.

- **The Ghana Export Promotion Authority (GEPA)**

This authority is mandated to providing leadership in implementation of policies which are directed towards the coordination of various export promotion activities. The major part of the authority's service portfolio is dominated by exporters and potential exporters. The provision of

relevant and timely trade information, building export related issues and dissemination of research findings are other functions of the GEPA. Finally, the authority plays an important role in pushing for an increase in government budgetary support mainly through the Export Development and Investment Fund (EDIF).

- **The Ministry of Food and Agriculture (MOFA)**

This ministry is mandated to formulate policies in agriculture, which is intended to boost the exports of agricultural goods. MOFA ensures that agricultural products are available all the time for industrial processing and export. The development of horticultural exports is the current initiative of the ministry. This is intended to increase the availability of agro-based raw materials to the various processing industries in Ghana.

- **The Ghana Standards Authority (GSA)**

This authority has the responsibility of ensuring that products are of high quality through testing, certification and accreditation. The GSA is mandated to perform product assessment through inspection and issuance of a certificate. Ghanaian exporters gain the recognition and certification to export their products abroad through the testing facilities of the GSA.

- **Food and Drugs Authority (FDA)**

This authority is a regulatory body under the Ministry of Health and mandated to regulate the manufacture, exportation, importation, distribution, advertisement and use of drugs, food and cosmetics to make them safe for consumption. The FDA makes sure that food products manufactured locally for domestic consumption or for exports satisfy the requirements established by the Ghana Standards Authority (GSA).

- **Customs, Excise and Preventive Services (CEPS)**

This institution, apart from collecting revenue from firms, they are also responsible for determining what goods and services are exported and imported into Ghana. They also enforce rules in trade that conform to the laws and standards governing the importation of commercial goods into the country. The CEPS contributes significantly in reducing the barriers to the export of goods and services.

- **National Board for Small-Scale Industries (NBSSI)**

This board has a main aim of enhancing exports through the development of Small and Medium Enterprises (SMEs) in the county. The NBSSI was formed by an act of parliament in 1985 to develop the private sector and create jobs so that the national economy can grow. They provide technical, financial training and loan schemes to SMEs.

There are quite a lot of other agencies providing support services to the industrial and service sectors of Ghana. They include: The Federation of Associations of Ghanaian Exporters (FAGE), Private Enterprise Foundation (PEF), the Association of Ghana Industries (AGI), Ghana National Chamber of Commerce and Industry (GNCCI) and the Private Enterprise Foundation (PEF).

2.5 Research and Development (R&D) in Ghana

Successful technology transfer (TT) among the sectors of the economy has been subjected to the availability of well trained and skilled personnel, researchers and technicians in Ghana. This has called for the availability of well-funded academic and research institutions in Ghana. Currently, South Korea is noted to be among the countries with the best educational systems in the whole

world. However, as measured by the engineering enrolment index in terms of technical education, Ghana has performed badly.

Gross expenditure on R&D was less than 0.5% during the period 1990-2000, certainly, Ghana's R&D is insignificant. The most common factors that limit research activities in Ghana are the lack of skilled research personnel and insufficient financial resources. In the private sector, the limited market research has become an eternal factor that hinders Research and development activities in the country. Also, most government research institutions purposely for higher learning has been impeded due to low emphasis on the role of research and development activities. The agencies responsible for the enhancement of research and development in Ghana are:

- **The Centre for Scientific and Industrial Research (CSIR)**

This research institution is known to be the leading national science and technology institution in Ghana. It has the responsibility of conducting scientific and technological research on individuals and firms for the development of the country. This institution focuses on the following areas:

Enhancing Food Security and Reducing Poverty. Food security is referred to the ability of all citizens to have access to food always for a healthy life. The first Millennium Development Goal (MDG) concentrates on eradicating abject poverty and hunger globally. Apart from these issues on the theme, there are other important issues that concentrate on entrepreneurial opportunities for the vulnerable in the society (youth, women and the handicapped). These include, land access rights, markets and micro-finance, benefit sharing to ensure food security, improve incomes from agriculture, safe environmental conditions, among others.

Climate Change, Environmental Conservation and Green Technology. In recent times, there have been many calls on the policy environment in finding solutions to the climate change crisis as well

as the development needs of Ghana. Among these environmental problems are; the climate change, ecosystem disturbance, rising sea levels, water and air pollution. The temperature in Ghana has increased by approximately 1°C within the past 40 years, and in the forest zone, rainfall has decreased by about 20%. This has serious consequences on food security, socio-economic development, health and livelihoods of the people. In minimizing the impact of the crisis, research and the development of climate change strategic policies and actions have been enacted by policy makers.

Material Science and Manufacturing. Research and innovation are the main blocks in material science and manufacturing by the CSIR. This helps in improving the competitiveness of industries in Ghana. The CSIR helps in adding value to the resources and output of manufacturing industries in Ghana.

Climate-Friendly Energy Production**.** Research and development on this mainly analyses the key energy sources to provide information to policy makers on the right source of energy. This will enhance a reliable and sustained supply of power to industries and households. Finally, conducting Research in Electronics and ICT. This type research conducted by the CSIR benefits firms located in the rural areas of Ghana. The CSIR also help in the development of communication devices.

- **The Science and Technology (S&T) Infrastructure in Ghana**

This body is basically composed of public institutions in Ghana. Majority of these institutions rely on the support from the Council for Scientific and Industrial Research (CSIR). They are responsible for conveying scientific information to firms and promoting research and industrial standards. However, the Science and Technology (S&T) programme in Ghana is hindered by some

constraints, mainly, lack of infrastructure development and inadequate R&D funding. These funds are mainly sourced from the government budgetary allocations and donor grants.

It has been shown that, Ghana does not fund innovation, technological development and research on competitive basis. The country lacks the equivalent of the national and innovation research funds to oversee and review the implementation of competitive research and innovation funding activities. Moreover, Ghana lacks the coordination and programs for research priorities. The National Research and Innovation Fund (NRIF) that is yet to be established has the main goal of filling this gap, but it is uncertain whether the funds for this project would be enough for the universities, polytechnics and the private sector.

- **The Institute of Industrial Research (IIR)**

The Institute of Industrial Research (IIR) was formed to boost the CSIR drive for research commercialization. Its mandate is to; ensure adaptive technology and scientific instrumentation, undertake research into innovation by industries, and repair precision equipment. The institution's mandate is to respond to the national need through the provision of technological support and the application of foreign technologies for industrial needs. However, the institution does not have a strategy for reaching out to entrepreneurs and enterprises. This institute's mandate is in line with the recent commercialization drive that concentrates on boosting the level of development in the country rather than the normal basic research, especially in the process of technology.

- **The Rural Enterprise Project (REP)**

This project was designed to focus on rural development in Ghana. The rural enterprise project (REP) focuses on promoting agro-based and small-scale industries and they also replace inefficient or obsolete technologies with modern and more efficient ones.

2.6 The level of Human Capital in Ghana

It has been widely acknowledged among development economics theorists that the level and quality of the human resource of a given economy exerts an important bearing on its level of economic growth and development. The human capital level of an economy, which is mostly measured by the level of education of its citizens is not only a driver of the economic development of a country but more prominently, the possibility for future growth (Baah-Boateng, 2013). However, the recent global economic transformation undoubtedly continues to elude Ghana mainly because of the constraints in human capital, which is in the form of knowledge, skills and the technical know-how to promote industrialization and hence, economic growth (Robson et al., 2012). In a speech by Kofi Atta Annan, stated that "knowledge is power, but information is redemptive. Education is the foundation of growth in every society and family".

Human capital, which has recently been the main engine of the growth of firms and countries in the world, has been lacking in Ghana. The human capital development base of Ghana is observed to be weak. Ghana is faced with inadequate and inappropriate institutions that support skill development and education. In terms of the school enrolment rate for the young population, it has been increasing over the years even though it is not actually very consistent (see Figure 2.3). The highest gross secondary school enrolment rate was recorded in 2017 with a rate of 72.3%. The

lowest rate was recorded in 2012 (57%). Figure 2.3 shows the gross secondary school enrolment rate for the period 2010-2017.

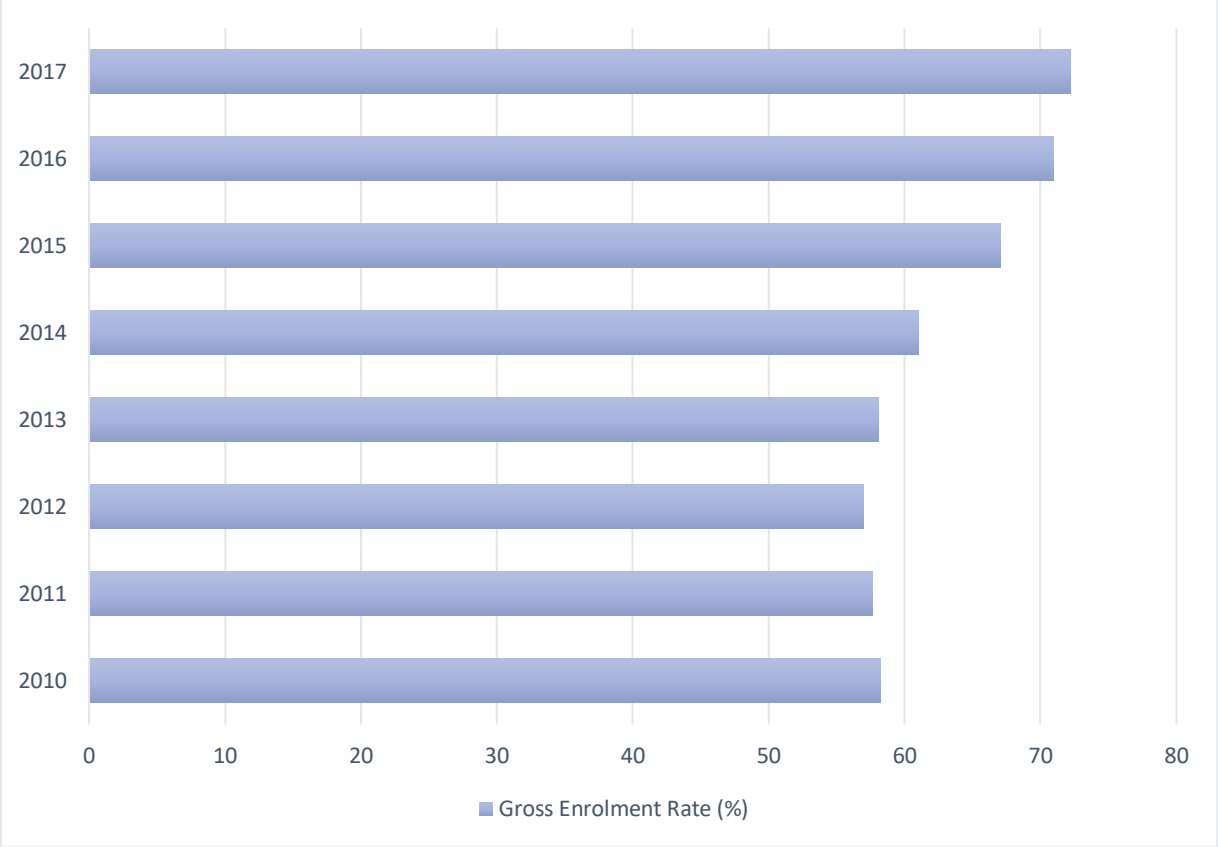


Figure 2.3: Gross School Enrolment, Secondary Education (2010-2017)

Source: Author's computation from WDI (2018)

Consequently, the educational system of Ghana has gone through major transformations with a general increase in enrolment across all levels of education, specifically for higher education, which experienced a 168% increase over seven years for the period 2010 to 2017. Future projections for employers in Ghana are looking better with an increasingly skilled labor force evolving. Despite the remarkable improvement in the education system and economic growth, there is the problem of skill mismatch which the country must look at critically in order to ensure

that it benefits from its potential talent pool. Figure 2.4 reports the gross tertiary enrolment rate for Ghana for the period 2010-2017.

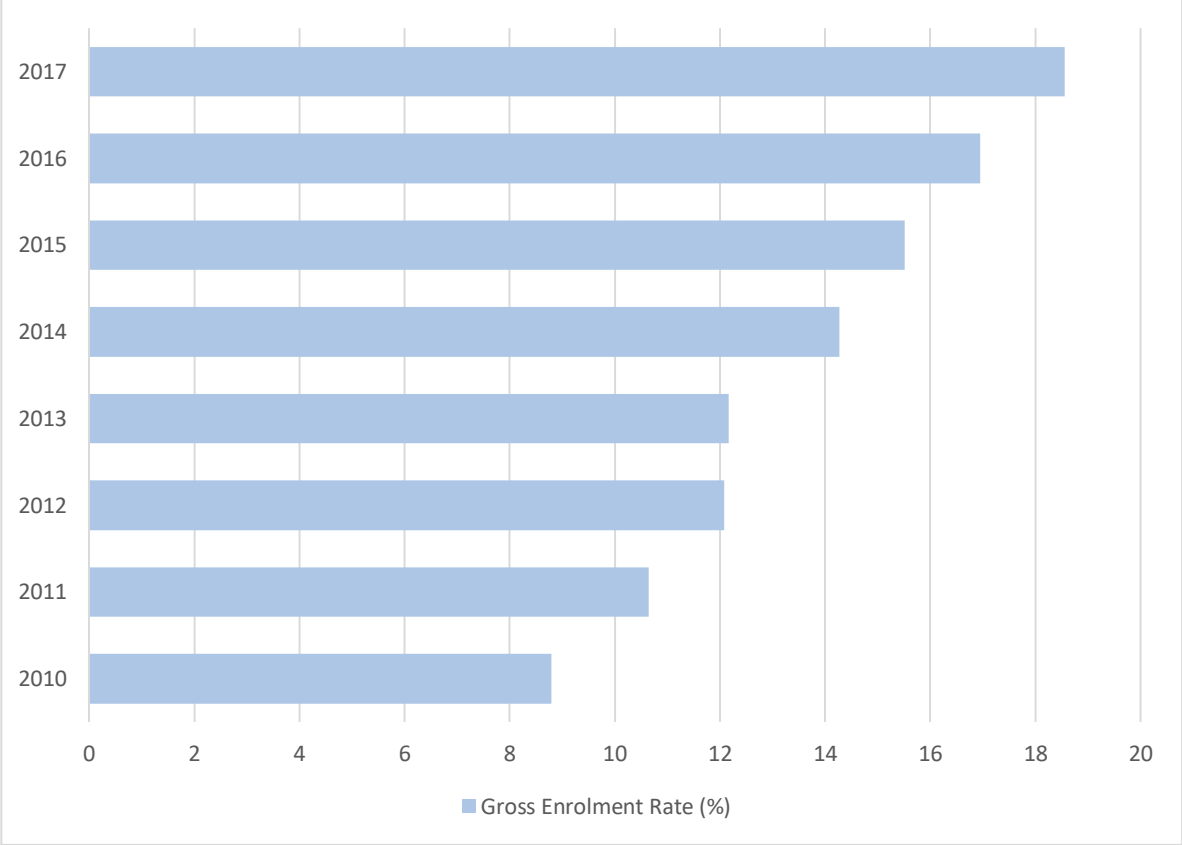


Figure 2.4: Gross School Enrolment, Tertiary Education (2010-2017)

Source: Author's computation from WDI (2018)

CHAPTER THREE
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

3.1 Introduction

The general aim of this chapter is to present the theoretical underpinning and the empirical evidence on human capital, R&D and firm export performance. The first section discusses the theoretical underpinning of firm export performance by focusing on the resource-based view (RBV) theory of the firm. It then presents the empirical studies on the effects and roles of human capital and R&D in firm export performance, the effects and roles of human capital and R&D in firm innovation advancement and finally on the effect of firm innovation on firm export performance. The review of literature is important in this context in developing a conceptual framework and research methodology.

3.2 Theoretical Underpinning

Over the years, export performance research has heavily relied on the resource-based view (RBV) theory of the firm as its conceptualization (see Francis & Collins-Dodd, 2000). The study therefore uses this insightful theory as the key theoretical framework to investigate the effects and roles of the resources and capabilities of firms in boosting their exports so they can become competitive in the global market (Barney, 1991).

The resource-based view (RBV) theory was put forward from the scholarly economic theory of Penrose (1959). She was among the foremost researchers to identify the significance of firm resource and the competitive position of firms. In 1959, she contended that the growth of a firm, both externally and internally is dependent on the way in which it uses its resources. She began by suggesting that a firm comprises ‘an inimitable bundle of resources (productive)’, and that these

resources can play an imperative role in improving the competitive position of the firm depending on the way they are exploited (Penrose, 1959). The RBV theory has been formalized by many researchers (see Wernerfelt, 1984; Barney, 1991; Teece et al., 1997). From the literature, different types of the framework of the RBV have been discussed, namely: the theory of resource exchange of the firm (Zacharakis, 1997), the theory of dynamic capability (Teece et al., 1997), the theory of resource dependency (Pfeffer & Salancik, 2003) and the theory of resource scarcity (Castrogiovanni et al., 2006). Most of these theories are built on the writings of Penrose (1959) and the framework of Barney (1991).

The resource-based view (RBV) theory propounds a theoretical underpinning that explains that the export activity of a firm is built on different facets of its capabilities and resources (Morgan et al., 2004). This theory views a firm as an entity with an inimitable bundle of tangible and intangible resources (i.e. managerial attributes, processes, assets, knowledge and capabilities) that enhances the efficiency and effectiveness of that firm (Wernerfelt, 1984; Barney, 1991). The resource-based view theory indicates that, the main drivers of the export performance of a firm are its internal organizational resources, which makes a firm unique and different from other firms. This makes it difficult for other firms to imitate its activities (Collis, 1991).

Furthermore, Wernerfelt (1984) emphasized that the resource of a firm represents anything (asset) tangible or intangible that can be regarded as the strength or weakness of that firm since they are tied up to its operations. These resources may include brand names, skilled employees, knowledge and technology, trade contracts, and plant and machinery. Consequently, other researchers (see Roth, 1995; Teece et al., 1997; Francis & Collins-Dodd, 2000) who support the resource-based view theory regard a resource as any given asset available to a firm that describes its strengths or weaknesses within a specified period (Collis, 1991). Consequently, it has been shown that the

success or failure of a firm can be attributed to how it can develop its capabilities in the market in which it operates given the specific resources available.

Also, Barney (1991) formalized the resource-based view theory by indicating that the heterogeneous nature of firms is because the resources and capabilities used in the production process vary across firms. Barney (1991) also opines that the resources and capabilities of firms contain diverse stocks of resources that possess characteristics like they being rare, immobile, non-imitable, valuable and non-substitutable. According to Barney (1991), based on the capabilities and resources available, firms can generate competitive advantage in both the domestic and international markets that they operate. The resources of a firm were then classified based on physical capital (plant and machinery, and land), human capital (education, formal training and the experience of workers) and capital (export planning and reporting systems).

Moreover, in international business, the resource-based view has recently become a widely-used theory with immense contributions from a lot of researchers (see Roth, 1995; Teece et al., 1997; Francis & Collins-Dodd, 2000) across the globe. According to Roth (1995) the conceptual framework of the resource-based view can be employed to conceptualize firms as entities that possess inimitable stocks of accumulated tangible and intangible resources. The tangible resources are categorized into two groups, the physical resources (plant, equipment and raw materials) and financial resources available to a firm, whilst the intangible resources may also include technology, reputation, human resources, training, culture and employee expertise (Roth, 1995). Roth (1995) also argued that the skills and knowledge (human capital) available to a firm can play a significant role in correcting inadequacies in the stock of resources, and can represent possible sources of competitive advantage for the internationalized firm.

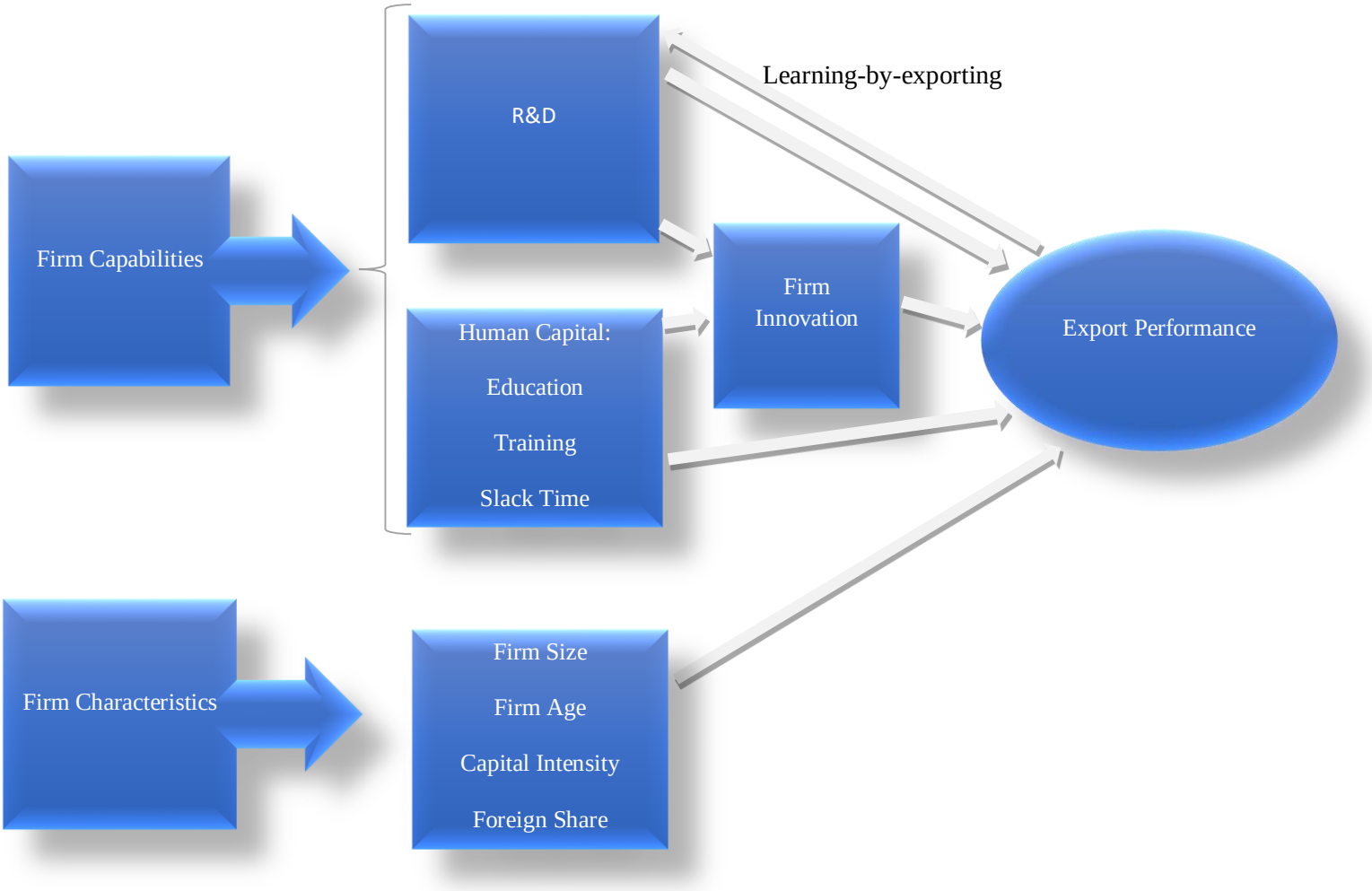
The study therefore employs the resource-based view theory as its key theoretical framework due to its wide use and acceptance by many researchers in investigating the effects and roles of firm capabilities and resources in boosting export growth (Roth, 1995; Francis & Collins-Dodd, 2000). Specifically, this vast literature has investigated the effects and roles of human capital, R&D, firm size, firm age, foreign affiliation, capital intensity and firm innovation in improving firm export performance (Zou & Stan, 1998).

3.2.1 Conceptual Framework

Drawing on the framework of the resource-based view, a comprehensive conceptual framework is established and shown in Figure 3.1. The literature on export performance indicates that, the key drivers of the export performance of a firm are most likely related to its capabilities (human capital, R&D and innovation). The literature has also identified other factors that might influence export, among which are the firm size, firm age, capital intensity and foreign affiliation. Recently, a more sophisticated measure of human capital, presented in the literature argues that the level of education of employees is not necessarily the main measure of the human capital of a firm (Nohria & Gulati, 1996). Human capital is then argued to include firm-level practices like formal training (see Knight & Yorke, 2003; Bastos et al., 2016; Blyde, 2016) and employees with slack time (see Bourgeois, 1981; Phan & Hill, 1995; Zhong, 2012). These practices within the firm help in developing the level of human capital and thereby boosting firm export performance.

Consequently, the variables discussed form the foundation of the firm export performance literature and therefore will be beneficial for the development of a conceptual framework for this research. The framework is illustrated in figure 3.1. This shows the drivers of firm export performance in Ghana using the resource-based view theory of the firm.

Figure 3.1: Conceptual Framework



Source: Author's construct from the Resource-Based View (RBV) theory of the firm.

The conceptual framework in Figure 3.1 illustrates the relationship between firm capabilities, characteristics and firm export performance. Firm capabilities (specifically, human capital and R&D) may affect firm export performance through the mediation of firm innovation. That is, a firm that conducts R&D or has a high stock of human capital may not necessary engage directly in exporting but can involve in innovation, which may probably influence exports. From the

literature, these variables have a strong but mixed relationships with firm export performance. However, a firm's export performance can have a positive influence on its capabilities (the most common being R&D) (Girma et al., 2008) - a terminology called the "learning-by-exporting effect." This effect has been confirmed by many researchers (see Aw et al., 2007; Girma et al., 2008; Harris & Moffat, 2012), who assert that firms that export are more likely to invest in R&D.

3.3 Empirical Literature Review

The effects and roles of R&D and human capital in enhancing firm export performance have gained a substantial attention in the literature for some time now. But the combined relationship of these factors in one study is dearth. Many studies have either of these (i.e. R&D or human capital) on firm export but not a combination of them on firm export. Due to this situation, the study reviews the literature on these different strands to build our conceptual model and methodology.

3.3.1 The Export-R&D Nexus

The association between R&D and firm export performance has been featured by a rising complementary in the globalization process and is therefore known to be very important to an economy: exporting as a representation of firm competitiveness while R&D is for productivity and growth. In the literature, export performance has been widely studied at the firm-level and most studies have stressed on the importance of R&D and technology since these factors encourage firms to involve in export activities. However, the empirical findings from these extant studies seem to be inconsistent. Specifically, most studies find a robustly positive relationship between R&D and export (see Ito & Pucik, 1993; Zhao et al., 1997; Smith et al., 2002; Aw et al., 2007;

Girma et al., 2008; Lin & Tang, 2013; Neves et al., 2016); while others find no significant association between R&D and export (see Lefebvre et al., 1998; Becchetti & Rossi, 2000). Also, most studies point to a bi-directional causality between R&D and export (see Zhao et al., 1997; Smith et al., 2002; Aw et al., 2007; Girma et al., 2008); while others find a uni-directional causality running from R&D to firm export (see Ito & Pucik, 1993).

For instance, Ito and Pucik (1993) analysed the effect of R&D on firm export. They examined this relationship in Japan. Based on their bivariate probit estimation technique, they examined whether R&D is a good predictor of firm export and whether firm export was a good predictor of R&D as well. They found a uni-directional causality running from R&D to firm export. Thus, R&D exerts a positive and statistically significant effect on firm export but no significant result was found on the effect of export on R&D. They concluded that, a firm that exports does not necessarily conduct R&D.

In contrast, Zhao et al. (1997) investigated the role of R&D in firm export performance in China, using a unique dataset comprising only manufacturing firms. The results from their logistic regression techniques and simultaneous analyses showed that the impact of R&D on firm export performance is significantly positive. Also, their findings confirm a significant causal relationship between firm export and R&D in their simultaneous test. They concluded that there is a bi-directional causality between R&D and export among these selected manufacturing firms in China, which is inconsistent with the findings of Ito and Pucik (1993) for firms in Japan.

Another strand of literature headed by Lefebvre et al. (1998) conducted a study on Canadian firms on the drivers of their export performance. Their results uncover that firm export performance is not affected by its R&D intensity. In contrast, they argued that, other technological variables such

as, the joint R&D projects with other firms and the proportion of employees with scientific and technical backgrounds exert positive and significant effects on firm export. The findings of Becchetti and Rossi (2000) confirm this. They studied this relationship on Italian firms. Their results reveal that the intensity of R&D neither increases the likelihood of a firm to export nor increases its share of exports in total sales, instead, other variables that are important in driving innovation (such as human capital and managerial expertise) are good predictors of firm export performance.

In Denmark, Smith et al. (2002) explored the effect of R&D on export participation of Danish firms. Firm export performance was modelled as the propensity of a firm to export. The issue of endogeneity between firm R&D and export was well established in the theoretical aspect of their study. They then formulated an empirical model to estimate those other factors that might affect firm export performance. It was shown that besides R&D, other important factors like wages and firm size are good predictors of firm export performance. Finally, they employed a bivariate probit estimation technique to tackle the issue of endogeneity between firm export and R&D and their results clearly confirmed the theoretical framework they put forward.

Furthermore, Aw et al. (2007) investigated the issue of productivity changes on the probability of a firm to export using a large sample of electronic companies in Taiwan. They employed a bivariate probit estimation technique in their methodology using structured equations: one with R&D as the dependent variable and the other with the decision to export by the firm. Their findings reveal a positive causal relationship between R&D and the likelihood of a firm to export. The study of Girma et al. (2008) confirms this relationship. They examined the causality and the relationship between R&D and export for Irish and UK firms. They replicated the model of simultaneous

equations by Aw et al. (2007). They also found positive causal relationships but differences existed among firms and countries.

Lin and Tang (2013), in the People‘s Republic of China, investigated how exporting affects R&D. They used data at the firm-level to model this relationship and adopted the model of Levinsohn and Petrin (2003), where the presence of endogeneity was accounted for. Their findings suggest that, exporters increase their spending on R&D activity by approximately 33%, increase their R&D intensity by approximately 5%, and are approximately 4% more likely to conduct R&D compared to non-exporters. Furthermore, they found firm export to have a minimal effect on R&D for those firms that were involved in the export of processed goods, especially, those in the electronics sectors that were foreign-owned.

Neves et al. (2016) examined whether in a small and liberalized economy in which exports trigger economic growth, R&D is the consequence or cause of firm export performance, and whether the interrelation between exports and R&D affects firm performance. They used a unique dataset that consist of all non-financial firms located in Portugal. They employed a bivariate probit estimation technique, which allowed for the estimation of two structured equations (exports and R&D). They found that there is a complementarity between exports and R&D, meaning that firms that conduct R&D are more likely to export, and those firms that export are also more likely to conduct R&D. They further established that export and R&D affect sales growth (firm performance) positively on the condition that both activities should occur simultaneously.

3.3.2 The Export-Human Capital Nexus

It has been established in the literature that investment in human capital drives the capability of firms in the development of the right methods of innovative activities and production, and plays a significant role in enhancing firm export performance. There has been inconclusive empirical evidence as to the right measure of the human capital of a firm. For decades, the main proxy of human capital has always been employee schooling in most studies (see Gråsjö, 2005; Teal et al., 2006; Munch & Skaksen, 2008; Wagner, 2011), but only infrequently with practices at the firm which may include giving slack time (see Bourgeois, 1981; Phan & Hill, 1995; Nohria & Gulati, 1996; Daniel et al.,2004; Zhong, 2012) and formal training (see Contractor & Mudambi, 2008; Bastos et al., 2016; Blyde, 2016) for workers to upgrade their skills and knowledge. However, the association between human capital and firm export performance from the extant literature has been shown to be strong and complex. To show these gaps in the literature, the following studies are reviewed:

Daniel et al. (2004) explored the relationship between human capital (employees with slack time) and firm export performance based on a meta-analysis from 66 studies. Their empirical findings reveal a positive and statistically significant relationship between slack time and export performance. They also established that those studies that controlled for industry-relative performance found a robustly positive slack–performance association compared to firms that do not control for this factor. However, this result is inconsistent with the findings of Bourgeois (1981) and Phan and Hill (1995) who opined that slack resources, such as idle hands, 'summons inefficiency demons'. They also assert that ''slack as inefficiency'' concept can promote self-serving managerial behaviors and satisficing, which hinder the performance of firms.

In addition, Gråsjö (2005) examined whether the accessibility to human capital can explain firm export. An empirical estimation of a knowledge production function was carried out both at the industrial sector and the aggregate-level, where exports were pegged above a certain price or value for Swedish municipalities from 1997 to 1999. The issue of geographical proximity was accounted for by using accessibilities to human capital as explanatory variables. Using quantile regressions as an estimation technique, it was shown that accessibility to human capital significantly has a positive relationship with firm export.

Also, Teal et al. (2006) modelled the causes of poor export performance at the micro-level using manufacturing firms from five selected countries in Africa - Ghana, Kenya, Tanzania, Nigeria and South Africa. They explored a large and long panel dimension dataset to examine the role human capital (employees with education), firm size and foreign ownership play in enhancing firm export performance in these selected countries. They established that, human capital (employees with education) and firm size are robust drivers of the decision to export by a manufacturing firm. Also, there was an evidence of a weak impact of foreign ownership on exports.

Furthermore, Contractor and Mudambi (2008) explored the role of investment in human capital on firm export performance using a rich dataset of 25 countries. Human capital was measured by ability of a firm to conduct formal training. It was shown that human capital (formal training) significantly has a positive impact on manufacturing and service exports in these selected countries. Also, their results indicate that human capital (formal training) is more superior in the export of manufacturing firms than in the export of service firms. Finally, it was found that the impact of human capital is more superior in emerging Asia than in developed countries, which is an imperative implication for policy makers and managers.

In Denmark, Munch and Skaksen (2008) studied the effects of wage employments, educational level of the employees (human capital) on firm export performance for the period 1995 to 2002. They found that firms with highly educated employees are more likely to produce quality and differentiated goods and maintain their reputation in the export market. Their empirical findings also revealed a positive and statistically significant relationship between employees with education and firm export performance, which intend impacts positively on the wages of the employees. The same result was found in Germany from the study of Wagner (2011). The effect of employees' level of education (human capital) on firm export performance was examined using a unique dataset representing a large panel of firms from the manufacturing industries of Germany. It was shown that, firm export performance and human capital are positively related in Germany.

Zhong (2012) explored the effect of employees with slack time on the performance (measured by export propensity) of mechanical manufacturing firms based on a rich dataset from the Henan Province in China. The empirical results revealed that mechanical manufacturing firms that grant employees time to develop new ideas are more likely to experience growth in exports. They concluded that promoting slack time is more beneficial in enhancing mechanical manufacturing firms' performance, and that more studies on the intervening factors influencing the slack–performance association are much needed for China.

Bastos et al. (2016) analysed whether formal training plays a significant role in influencing export participation of Brazilian manufacturing firms. They used a longitudinal firm-level data for manufacturing firms in Brazil. Their empirical results showed that firms whose workers receive technical upgrading (formal training) tend to participate in export activities. They also found that export participation increases the proportion of workers who receive formal training (technical upgrading). They concluded that there exists a complementarity between export and formal

training (skill upgrading). This confirms the findings of Blyde (2016) who studied this relationship on firms in Chile. Their matching difference-in-differences estimation results revealed that conducting formal training encourages firms to engage in export activities.

3.3.3 Human Capital, R&D and Innovation Nexus

Technological progress at the firm-level does not happen by chance but a consequence of goal-oriented expenditure on human capital and R&D. Firms make decisions about human capital, R&D and innovation. The advancement and dissemination of knowledge are good foundations to the growth of firms, whilst investment in human capital is an imperative input for the development of science and skills. Understanding the links between human capital, R&D and innovation at the firm-level remains limited since inconclusive results are found by many researchers.

For instance, Mahemba and Bruijn (2003), in their firm-level study on developing countries employed a logistic estimation technique to examine the impact of formal training on firm innovation performance. Their study focuses mainly on employees' years of schooling and formal training as the sole measures of human capital. They found that these factors are significant in explaining the innovation advancement in the region. They concluded that, human capital (employee's level of schooling and formal training) is important in driving firm-level innovation in developing countries.

In addition, d'Amore and Iorio (2009) tried to verify if human capital "embodied" in the workforce and R&D are good predictors of the innovation of firms. They also examined whether there is a link (i.e. linear or non-linear) or an interaction and of what sign between human capital (level of education) and R&D of firms. They used data from a survey collected from seven European countries for the period 2007 to 2009. They employed linear regression models, probit and logit

models as well as instrumental variables as statistical techniques. Their results showed that human capital and R&D affect innovation positively.

Moreover, Schneider et al. (2010) argued that the skills of workers (i.e. science and engineering skills, and managerial skills) are important sources of the innovative activities of firms. They explored the effects of formal education, work experience and actual occupation on manufacturing firms' innovation performance using a probit model. They used a firm-level data for Germany and found that firms (science-based industries and specialized suppliers) that have a high proportion of highly skilled workers involve in product innovation (not process innovation). They also found that at the aggregate firm-level, a high proportion of skilled workers has an insignificant effect on the likelihood of a firm to innovate.

Also, Gallié and Legros (2012) investigated the effect of technological capital and human capital on innovation. Technological capital and human capital were proxied by R&D expenditure and formal training of employees respectively. The relationship was explored using a count panel dataset to account for the issue of heterogeneity among selected firms in France. They found that R&D and formal training are positively related to innovation advancement. They argued that a more sophisticated firm-level approach should be employed to understand the association between human capital and innovation in this context. They also found that formal training initiatives by firms will help them with more innovative output.

McGuirk et al. (2013) employed a sophisticated measure of human capital (i.e. Innovative Human Capital) to evaluate its impact on the innovative output of small firms in Ireland. Three basic elements were captured in this new Innovative Human Capital measurement. They include; training, education and job satisfaction. They employed an augmented innovation production

function to investigate whether small firms that employed innovative human capital managers are more likely to engage in innovation activities. Their empirical findings suggest that Innovative Human Capital is important for small firms. Hence, this factor is crucial in determining the level of innovation among small firms in Ireland.

Finally, Sun and Ghosal (2017) explored innovation at the firm-level with a concentration on human capital using a rich dataset of firms in China (i.e. the metropolitan and provincial middle cities' datasets). They emphasized that both human capital and its interaction with R&D are positively related to firm innovation. Finally, they found that the impact of human capital on firm innovation are more profound in less developed areas. They concluded that human capital is an imperative factor for the adoption of technology and growth of firms.

3.3.4 Export-Innovation Nexus

Over the years, only a few empirical literature on innovation and firm export performance exist, and they are mostly centered on survey data with a comparatively small sample of firms. However, the main finding from these limited studies is that innovative firms are more likely to enter the export market. One of the earlier studies to explore this relationship was by Hirsch and Bijaoui (1985). They explored the effects of innovation on the likelihood of an Israeli firm to export. They found that firms that were involved in innovation activities were more likely to involve in export activities. They concluded that innovative initiatives by firms will help them with more exports. In UK, Wakelin (1998) examined the effect of innovation on the exports of firms with a concentration on firms that innovate and firms that do not innovate. Export performance was measured as the likelihood of a firm to export. Using probit regression techniques, their results showed that firms vary substantially based on their innovation status. Specifically, firms that do

not innovate were found to have a higher probability to export compared to innovative firms of the same size.

Furthermore, Roper and Love (2002) conducted a comparative survey at the plant-level to investigate whether there are substantial differences between the drivers of firm export performance at the manufacturing sectors of Germany and the UK. Innovation was found to have a positive impact on the probability of a manufacturing firm to export in both countries. They concluded that, innovation is a good predictor of firm export performance in both countries. Finally, significant variations were found between firms that innovate and firms that do not innovate in these two countries. Specifically, innovative firms in the UK were seen to be more efficient than that of Germany.

Moreover, Jose´ and Alegre (2007) investigated the effects of the size of a firm and innovation on firm export performance using selected firms in the French biotechnology industry. They argued that the size of a firm is not a good predictor of firm innovation or firm export performance. However, their finding indicates a significantly positive effect of innovation on firm export performance. Also, Cassiman et al. (2010) opined that the innovation decisions of the firm have a consequence on the positive relationship between firm export and productivity in the literature. They used a panel of manufacturing firms in Spain and showed that product innovation – and not process innovation –has a positive effect on productivity and enhances firms to engage in export activities. Also, Becker and Egger (2013) explored empirically how product and process innovations affect the propensity of a firm to export based on their panel dataset. Product innovation was defined as a significant factor that stimulates the entry of a firm into the export market, whilst process innovation aids in securing the position of a firm in the export market based

on the features of its product supply. They found that both types of innovation help in boosting the propensity of a firm to export, but product innovation was found to be relatively more important.

Finally, Rodil et al. (2016) argued that the R&D activity of the firm influences the relationship between innovation and firm export. They used a sample of 213 firms in Spain and showed that the interaction between innovation and R&D positively affects the probability of a firm to engage in export activities, whilst Liu et al. (2017) examined empirically how innovation influences the propensity of a firm to export with a concentration on the mediating and moderating roles of human capital (employees with higher education) based on a panel dataset for Chinese firms for the period 2006 to 2015. They found a positive causal relationship between innovation and human capital after addressing the problem of endogeneity. They also found that human capital exhibits a negative moderating effect on this relationship but no significant results was found for the mediating effect.

CHAPTER FOUR
METHODOLOGY AND DESCRIPTION OF DATA

4.1 Introduction

This chapter provides a detailed description of the research methodology employed in the study and elucidate how the study is carried out to accomplish the objectives stated in the introductory chapter. The chapter explains how the research objectives are accomplished through a methodological framework adopted for the study. Specifically, this chapter discusses the econometric techniques employed, variable description and data source.

4.2 Model Specification

To achieve the research objectives, the study makes use of robust empirical estimation techniques in this regard. Specifically, all the objectives are achieved by providing a descriptive analysis and econometrically assessing these relationships using robust estimation techniques for all firms (pooled sample), and for manufacturing and service firms (sub-samples).

Now, concentrating on these two research objectives, this study adopts the model of Van Dijk (2002), which was used to analyse the drivers of firm export performance for manufacturing firms in Indonasia and has been replicated by Dueñas-Caparas (2006) to assess the factors that determine firm export performance in the Philippines. We specify the export decision of a firm as a function of R&D, human capital, innovation, firm characteristics and industry dummies. The dependent variable is a binary variable which takes the value "1" if firm 'i' is engaged in export activity and zero otherwise. We assume a latent continuous endogenous variable, $EXPORT_i^*$ and hence, we

model $EXPORT_i^*$ using a natural regression model which is specified in the index functional form as:

$$EXPORT_i^* = \alpha + R\&D_i\beta + HC_i\gamma + INNOV_i\theta + ITR_i\mu + FC_i\delta + IND_i\sigma + \varepsilon_i \quad (1)$$

Where, $EXPORT_i^*$ is the unobserved variable that symbolizes the i^{th} firm's engagement in export activity, $R\&D_i$ denotes research and development related to firm 'i', HC_i represents human capital (i.e. schooling, slack time and training) related to firm 'i', $INNOV_i$ shows whether firm 'i' innovates or not, ITR_i represents the interactions of innovation with R&D and human capital, FC_i denotes the set of firm characteristics related to firm 'i', IND_i denotes the industry type (manufacturing versus services) related to firm 'i', $\beta, \gamma, \theta, \mu, \delta$ and σ are vectors of parameters of exogenous variables, α denotes the intercept terms, and ε_i is the vector that denotes the stochastic error term.

Based on the dichotomous nature of our dependent variable, a probit regression estimation technique is employed to explore how the independent variables influence the probability of a firm to export as:

$$Pr(EXPORT_i = 1|\, X_i) = Pr(EXPORT_i = 1|R\&D_i, HC_i, INNOV_i, ITR_i, FC_i, IND_i) \quad (2)$$

Where, $EXPORT_i$ is the endogenous variable and X_i denotes different set of exogenous variables that capture R&D, human capital, innovation, firm characteristics and the industry type of the firm. The estimated model of the factors inducing the decision of a firm to export is specified as:

$$Pr(EXPORT_i = 1|\, X_i) = \Phi(\alpha + R\&D_i\beta + HC_i\gamma + INNOV_i\theta + ITR_i\mu + FC_i\delta + IND_i\sigma) \quad (3)$$

Where, Φ is a cumulative standard normal distribution function. The model is first estimated using all firms (full sample), followed by separate estimations for manufacturing and service firms (sub-samples). EXPORT is the endogenous variable that measures whether a firm is engaged in export activity or not. The set of predictor variables include R&D, which is a dichotomous variable that denotes whether a firm conducts research or not; human capital is measured by employee schooling (EMPSCH), which is a continuous variable that measures the total number of educated employees, slack time (EMPSLAC) is a dichotomous variable that shows whether a firm gives slack time or not, formal training (FORTRN) is a dichotomous variable that shows whether a firm trains its employees or not; innovation (INNOV) is a dichotomous variable that shows whether a firm innovates or not; interaction (ITR) represents the interactions R&D*INNOV and EMSCH*INNOV. The firm characteristics variables (FC) include firm size (FMSIZE), which is a continuous variable denoting the size of a firm, firm age (FMAGE) is a continuous variable that denotes the age of a firm, foreign share (FORSHARE) is a dichotomous variable showing whether a firm has a foreign share or not, capital intensity (CAPINT) is a continuous variable showing the capital intensity of a firm, and industry (IND) represents an industry dummy which takes the value '1' if a given firm is a manufacturing firm and '0' if it is a service firm.

Equation (2) will be re-specified for the manufacturing and service firms (sub-samples). Although the emphasis of this study is on the aggregate firm-level in Ghana, we consider it appropriate to disaggregate the firms into manufacturing and services for the opportunity of having some comparison models.

4.3 Method of Analysis

In reality, firms are faced with two decisions in exports (whether to export or not) simultaneously. Since the dependent variable (export) is dichotomous, a probit analysis is applied to show how the independent variables interact to affect the export decision of firms.

4.4 Description and Source of Data

This section of the study provides a detailed discussion of the variables (both dependent and independent variables). It also, presents thorough descriptive analysis of the variables (both dependent and independent) employed in the study sample as well as the source of data.

4.4.1 Description of Variables

The key variables employed to explore the effects and roles of human capital and R&D in enhancing firm export performance are employee schooling (EMPSCH), employee slack time (EMPSLAC), formal training (FORTRN), research and development (R&D), export (EXPORT) and innovation (INNOV). Also, to develop our empirical analysis, a lot of control variables have been used. The variables we controlled for are known to be factors that determine firm export performance and have therefore been used by other researchers including Dueñas-Caparas, (2006), in his study in the Philippines. They include, firm size (FMSIZE), firm age (FMAGE), foreign share (FORSHARE), capital intensity (CAPINT) and the industry dummy (IND).

- **Export (EXPORT)**

To obtain the export outcome of a firm, we employed self-reported measurement of export that were established from the Ghana 2013 Enterprise Survey, the Ghana 2013 Innovation Follow-up Survey and the Ghana 2013 Innovative Capability Survey. Specifically, to measure whether firms

export or not we employed two consecutive questions. Firms were asked *"what percentage of sales goes to direct exports? what percentage of sales goes to indirect exports?".* A three-year period was chosen. A percentage greater than '0' for the sum of the two answers to the questions means that a firm exports and were coded with a '1' and all other firms with a '0'. The unobserved variable is therefore a dichotomous variable which takes on two values, '1' if a firm is engaged in export activity and '0' otherwise.

- **Employee Schooling (EMPSCH)**

Employees' level of education was measure by asking firms the question, "*What percentage of your full-time workers has completed their high school?*" The variable is therefore within the range 0 to 100 by design. The educational level of employees from the literature is expected to influence firm export performance positively (See Teal et al., 2006).

- **Formal Training (FORTRN)**

To ascertain the availability of formal training practices within the firm a question was asked, "*In the last fiscal year did your company offer formal training programs to your full-time permanent employees?*" firms that answered 'yes' pertaining to this question were given the value '1' whilst the rest with the value '0 '. Formal training from the literature is expected to influence firm export performance positively (see Blyde, 2016).

- **Employee Slack Time (EMPSLAC)**

The firm practice of granting employees enough slack time out of their normal routines to create new ideas was measured by asking "*During the last three years, did your establishment give*

employees time to work on new ideas?" firms that answered 'yes' to this question were given the value '1' whilst the rest with the value '0 '. Employee slack time from the literature is expected to influence firm export performance positively (see Daniel et al., 2004).

- **Research and Development (R&D)**

This is a binary variable which takes on two values, '1' if a firm conducts R&D and '0' if it conducts no R&D. From the literature firms that conduct R&D activities have a higher likelihood to export than those firms that do not conduct R&D. Spending on R&D by a firm is expected to improve its skills and knowledge base and enable them to survive the pressures from both foreign and domestic competitions (Aw et al., 2007).

- **Innovation (INNOV)**

Innovation is measured by employing two consecutive questions. Firms were asked "*Did you introduce new or significantly improved products or services to the market in the last three years?*" "Was this new or significantly improved product or service also new to your main market?". Firms answering 'yes' pertaining to these two questions were given the value "1" whilst the rest with the value "0". Firm innovation from the literature is expected to influence firm export performance positively **(**see Becker & Egger, 2013).

- **R&DINNOV**

This variable takes care of the interaction between the R&D variable as defined earlier and the firm innovation dummy. This spells out the mediating effect of firm innovation on the association between R&D and firm export performance in this study. According to Harris and Moffat (2012),

innovating firms that spend on R&D have a higher chance of exporting than firms that do not. The innovation dummy defined, takes the value "1" if a firm is involved in innovation and "0" if he does not innovate. This interaction term from the literature is expected to influence firm export performance positively**.**

- **EMPSCHINNOV**

This represents the interaction between employees' education and the innovation dummy. This spells out the mediating effect of firm innovation on the association between firm export performance and human capital in this study. Wagner (2000) argued that the interaction of education with innovation has a positive impact on firm export provided they are combined in right proportions. This interaction term from the literature is expected is expected to influence firm export performance positively**.**

- **Firm Size (FMSIZE)**

The effect of firm size on the export performance of a firm is empirically considered to be positive. That is, for a firm to compete globally, it must be big (Teal et al., 2006). In contrast, some studies have found a negative effect of the size of a firm on export performance. This can be attributed to the existence of a non-linear relationship existing between firm export and firm size. That is, after a certain limit (threshold), firm size affects firm export performance negatively. Firm size in this study is modelled as the total number of full time permanent workers within a firm. Therefore, firm size from the literature is expected to influence firm export performance either positively or negatively.

- **Firm Age (FMAGE)**

This denotes the total number of years a given firm has stayed in business. This is ascertained by subtracting the year a given firm started full operation from the year the survey was conducted (2013). The age variable from the literature is shown to have a mixed effect on firm export. As the firm matures, it provides itself with a better opportunity to compete fully in the export market through firm capabilities that are built from the accumulation of knowledge stock. However, some old firms may become rigid through these capabilities and younger firms may take advantage on them by being flexible, proactive and aggressive to participate effectively in the export market. Firm age from the literature can either affect firm export performance positively or negatively (see Wagner, 2015).

- **Foreign Share in domestic firms (FORSHARE)**

The foreign share variable is a dichotomous variable that takes on two values, '1' if the foreign equity participation of a firm is more than 0% and the value "0" if the foreign equity participation is exactly 0%. Foreign participation of firms in developing economies is known to be a good source of technology and knowledge. A higher proportion of foreign equity from the literature is expected to affect firm export performance positively (Teal et al., 2006).

- **Capital Intensity (CAPINT)**

The capital intensity of a firms is defined as the stock of capital available to a firm, where the stock of capital represents the total value of plant and machinery, and land and building. From the literature, it is expected to influence firm export performance in a positive direction given that the

technology and knowledge available to domestic firms are dependent on the plant and machineries used in the production process (Van Dijk, 2002).

- **Industry dummies (IND)**

An industry dummy variable is included and accounts for the variations that may exist between firms in different industries (services being the reference category). This is because the service sector is known to be home-based, whilst the manufacturing sector is mostly regarded to be more export-oriented. Hence, it is imperative to control for industry type in our analysis.

4.4.2 Descriptive Analysis

A brief discussion of the basic statistical properties of the variables (export, employee schooling, slack time, formal training, R&D, innovation, firm size, age, capital intensity, foreign share and industry type) used in the model is presented in this section. The mean, standard deviation, minimum and maximum values are the summary statistics examined for the firms in the sample.

The descriptive analysis of the variables used in our model of export performance is depicted in Table 4.1. It is recorded that approximately 20% of all firms export with maximum and minimum values of 1 and 0 respectively. This is quite a reasonable percentage since firms in Ghana hardly engage in export activities. R&D recorded an average of about 22% with maximum and minimum values of 1 and 0 respectively. The low investment in research and development can be ascribed to the low significance that firms in Ghana attach to technological innovation promotion. INNOV recorded an average of about 52% with maximum and minimum values of 1 and 0 respectively. Also, EMPSCH averaged about 67% with maximum and minimum values of 100 and 0 respectively. Moreover, FORTRN averaged about 40%, while EMPSLAC averaged about 39%.

Table 4.1 Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
EXPORT-dummy	0.2	0.4002781	0	1
R&D-dummy	0.2217573	0.4157187	0	1
EMPSCH-continuous	66.61119	33.88305	0	100
EMPSLAC-dummy	0.3908206	0.4882739	0	1
FORTRN-dummy	0.3986014	0.4899531	0	1
INNOV-dummy	0.5164835	0.5004161	0	1
FMSIZE-continuous	32.72145	72.20062	5	620
FMAGE-continuous	15.11831	11.70826	1	104
FORSHARE-dummy	0.1641168	0.3706394	0	1
CAPINT-continuous	233626.5	970673.9	300	1.01E+07
IND-dummy	0.5236111	0.4997894	0	1

Source: Author's computation from the data

Furthermore, approximately 52% of manufacturing firms are engaged in export, compared to service firms. This high percentage is because traditionally, most service firms are known to concentrate more on the domestic market (home-based). The average number of employees and age of the firms are 33 workers and 15 years respectively. Finally, approximately 16% of the firms are foreign owed and the capital intensity is 233,626.5 Ghana cedis.

4.4.3 Data Source

Data for the study is sourced from the Ghana 2013 Enterprise Survey (ES), the Ghana 2013 Innovation Follow-up Survey (IFS) and the Ghana 2013 Manufacturing Innovation Capability Survey (ICS). The three datasets are merged to enable a richer investigation of the links between firm innovation, firm capabilities, and the performance and competitiveness of firms in Ghana.

The ES is carried out by the World Bank and is a survey at the firm-level that representes a sample of the country's service and manufacturing firms. The survey includes a wide range of topics such as firm performance, competition, infrastructure, access to finance, to mention but a few. The ES was administered in Ghana in 2007 and 2013. We use the 2013 data which covers 720 service and manufacturing firms.

The IFS is a follow up survey to the ES and returns to firms that were already visited and interviewed during the ES to collect firm-level data mainly on innovation and activities related to innovation. This module is administered to a subset of 549 manufacturing and service firms.

The ICS is a partnership between the Tilburg University and the Enterprise Analysis Unit (DECEA) of the Development Economics Group of the World Bank. The ICS is a follow–up to and complement the 2013 Ghana IFS undertaken by the World Bank. The ICS aims at primarily studying the innovation activities and the innovation capabilities of manufacturing firms. The ICS covers only manufacturing firms. The sample size is 201 firms. These firms were all part of the Ghana 2013 ES and the IFS.

4.5 Empirical Estimation Issues and the Choice of Estimation Technique

Most studies that have examined the drivers of export performance of firms employ the Ordinary Least Squares (OLS), one-stage econometric estimation approach, or the two-step econometric estimation approach for their estimations. However, there are some criticisms that are raised against these approaches (Dueñas-Caparas, 2006). Firm export performance, where firm export is defined as, 'export as a proportion of total Sales', by definition ranges from zero (0) to one (1), which renders the OLS procedure inappropriate for its estimation. Some studies also employ an alternative approach called the two-step approach, where firm export performance is modelled in two stages. A given firm decides to export or not in the first stage. The model then analyses the proportion of sales that goes to export if the firm really exports in the second stage (Sterlacchini, 1999). The drawback of this approach is that a firm that is profit oriented may fail to make any distinction between these two stages and deciding simultaneously as to whether to export and how much to export.

The next approach is the one-stage approach which is used to analyse export participation (using one equation) by employing the tobit model to investigate firm behaviour using both exporters and non-exporters (Van Dijk, 2002). However, a major drawback of this method is the failure of the tobit model to identify dichotomous dependent variables that ranges from zero (0) to one (1).

Due to the limitations of the models mentioned above, the study empirically investigates the drivers of firm export performance using a probit regression technique. The study estimates a full sample model (all firms) as well as two sub-sample (manufacturing and services firms) models to examine how the various covariates may differ across sectors. More importantly, the possibility of some of the explanatory variables being endogenous is an issue that must be addressed in our

estimation. The issue of endogeneity may arise from three main sources: simultaneity, measurement error and misspecification.

With reference to Aw et al. (2007) and Girma et al. (2008), we suspect that R&D is endogenous given that firm export may affect R&D (learning-by-exporting effect) and R&D in turn also affecting firm export. Bias estimates of the regression parameters may arise if we fail to account for endogeneity in our empirical estimations. An instrumental variable (IV) probit estimation technique could be used to account for the endogeneity problem that may be present in our model based on the nature of our dependent variable (whether a firm export's or not). But the problem of getting the right instruments and ensuring at the same time that the other variables in the model are strictly exogenous is a major challenge in using the IV estimation method. However, the possible endogenous variable (R&D) is a dummy, thus, the study employs the bivariate probit regression technique to address this endogeneity problem in the empirical relationship (see Aw et al., 2007; Girma et al., 2008). This model simultaneously estimates two structural equations and follows with a test on the hypothesis that the error terms are correlated. If indeed they are correlated, then there is evidence of endogeneity in the model.

Now, concentrating on the test for endogeneity between R&D and export, we adopt the models of Aw et al. (2007) and Girma et al. (2008) to construct the R&D and firm export decision interdependently using a bivariate probit model in this context. Hence, the bivariate probit model can be modelled as:

$$EXPORT_i = \beta M_i + \delta R\&D_i + \varepsilon_i$$

$$R\&D_i = \gamma N_i + \mu_i \qquad (4)$$

$$E(\varepsilon_i) = E(\mu_i) = 0;\ Var(\varepsilon_i) = Var(\mu_i) = 1;\ Cov(\varepsilon_i, \mu_i) = \rho$$

This model is identified if there is at least one variable in N that is not found in M. Rho (ρ) signifies the extent to which the error terms of the structural equations are correlated. The independent variables employed in the estimations are the same for both R&D and export activities of a firm since they are all significant in explaining these two activities (Neves et al., 2016).

Finally, the study carries out two estimation techniques- simple probit and bivariate probit estimations. The probit regression is used to model the effects of the components of human capital (employee schooling, formal training and employee slack time) on export performance, while the bivariate probit regression is used to model the effects of both human capital and R&D on export performance. The coefficient estimates of the probit and the bivariate probit model are reported since there are interaction terms in our model. This is based on the recommendation by Ai and Norton (2003), Norton et al. (2004) and Greene (2010). We consider a nonlinear model (probit model) of the form:

$$E[y|x_1x_2,Z] = prob\,(y = 1|x_1x_2,Z) = \Phi(\beta_1x_1 + \beta_2x_2 + \beta_{12}x_1x_2 + \delta Z) = \Phi(.) \qquad (5)$$

Where, Φ is the cumulative standard normal distribution function. Given that, x_1 and x_2 are continuous variables, then the interaction effect is the cross derivative of the expectation of y,

$$\frac{\partial^2\Phi(.)}{\partial x_1\partial x_2} = \beta_{12}\Phi'(.) + (\beta_1 + \beta_{12}x_2)(\beta_2 + \beta_{12}x_1)\Phi''(.) \qquad (6)$$

However, Ai and Norton (2003) stressed that most researchers instead calculate the marginal effect of the interaction term as:

$$\frac{\partial\Phi(.)}{\partial x_1\partial x_2} = \beta_{12}\Phi'(.) \qquad (7)$$

and interpret it as the interaction effect. But Eq. (6) indicates clearly that the interaction effect in the model is not equal to $\beta_{12}\Phi'(.)$. Also, Ai and Norton (2003) asserted that the partial effect (a unit change) of the variable of interest is more complex in nonlinear models than in linear models.

They further stressed on the view that interaction effect in a regression model cannot be calculated merely by looking at the sign or statistical significance of the coefficient of the interaction term when the model is nonlinear, but through the evaluation of cross differences (derivatives). Hence, the sign of β_{12} does not always show the sign of the interaction term. Finally, they opined that unlike the interaction effects in linear models, the interaction effect in nonlinear models is conditional on the explanatory variables. Therefore, the study employs the cross differences (derivatives) approach (the "inteff" command after probit) specified by Ai and Norton (2003) to estimate the correct interaction effects (correct sign and statistical significance) within a probit regression model.

CHAPTER FIVE
DATA ANALYSIS AND DISCUSSION OF RESULTS

5.1 Introduction

This chapter presents a thorough discussion of the issues concerning the bivariate probit model estimation techniques specified in the fourth chapter. Our analysis begins by presenting the correlation between export and the independent variables used in this study and then discussing the results from the test for endogeneity between R&D and export in the model. Finally, this chapter provides a comprehensive discussion of the results from both the simple probit estimation and the bivariate probit estimation.

5.2 Correlation Matrix and Test for Endogeneity

In this section of the study, we give a brief discussion of the correlation between the variables used in the model and then proceed to test for the presence of endogeneity in our model. Specifically, the correlation between all the variables used in the study as well as the test for endogeneity are presented in Tables 5.1 and 5.2 respectively.

Firstly, the correlation between the dependent variable (export) and the explanatory variables (employee schooling, formal training, employee slack time, R&D, innovation, firm size, firm age, capital intensity and foreign share) used in this study are shown in Table 5.1. From Table 5.1, the association between our dependent variable (EXPORT) and the independent variables met the expectation of this study. Generally, the observed correlation between all the variables in this study is basically low (below 0.50). This implies that, the variables selected for the study are not highly correlated with each other, which is a sign of a fit model to be estimated.

Table 5.1: Correlation Matrix for the Variables

	EXPORT	R&D	EMPSCH	EMPSLAC	FORTRN	FMSIZE	FMAGE	FORSHARE	CAPINT	INNOV
EXPORT	1.00									
R&D	0.06	1.00								
EMPSCH	0.16	0.13	1.00							
EMPSLAC	0.04	0.45	0.02	1.00						
FORTRN	0.10	0.30	0.04	0.32	1.00					
FMSIZE	0.38	0.21	0.02	0.11	0.20	1.00				
FMAGE	-0.17	0.10	0.08	0.01	0.05	0.32	1.00			
FORSHARE	0.23	0.06	0.14	-0.02	0.00	0.26	0.17	1.00		
CAPINT	0.09	0.08	0.06	0.08	0.01	0.51	0.39	0.21	1.00	
INNOV	0.05	0.25	0.07	0.28	0.02	0.12	-0.06	0.02	0.06	1.00

Source: Author's computation from the data

Also, showing whether R&D is endogenous or not, we specify a bivariate probit regression model that tests for the possible endogeneity that may exist between R&D and firm export. Rho (ρ) measures the extent to which the error terms in the two structural equations are correlated. If the errors are correlated it implies that, ρ is significantly different from zero and hence, there exist endogeneity. Negative values of ρ signify that the unobserved variables impact the outcome variables in different directions while positive values of ρ signify that the unobserved variables impact the outcome variables in the same direction.

Table 5.2 provides the results of the endogeneity test between firm export and R&D both in the full sample (all firms) and the manufacturing and service sub-samples. From Table 5.2, the estimated value of ρ is significantly different from zero in both the full sample and the manufacturing and service sub-samples. We therefore find evidence that exports have a significant effect on R&D of firms in Ghana. The examination of the effect of R&D on firm export and vice

versa brings about the issue of complementarity between these two activities. According to Aw et al. (2007), R&D and firm export decisions are interdependent and they both enhance the performance of firms. It is shown that failing to account for the problem of endogeneity in the firm-level export model, the researcher faces the risk of producing spurious regression estimations. Therefore, it is necessary to control for endogeneity when estimating our models.

Table 5.2: Results of Endogeneity Test between R&D and Export (Based on the Bivariate Probit Model)

	Full sample (All firms)		Sub-sample (Manufacturing firms)		Sub-sample (Service firms)	
Correlations between disturbance terms	Coefficient	Linearized SE	Coefficient	Linearized SE	Coefficient	Linearized SE
Rho (ρ)	0.1101807**	0.0944016	0.2793266**	0.1223014	0.2642036*	0.1799782
Observations	259		142		117	

Where, ***p<0.01 **p<0.5 *p<0.1

Source: Author's computation from the data

5.3 Empirical Analysis

We estimated our model using robust econometric estimation techniques. A simple probit regression model as well as a bivariate probit regression model are estimated for the various components of human capital and the pooled independent variables respectively. This is done to check for the robustness of the regression coefficients. Table 5.3 presents the coefficient estimates of the components of human capital within a probit regression model for all firms, whilst Tables 5.4, 5.5 and 5.6 present the coefficient estimates of R&D and human capital within a bivariate probit regression model for all firms in the model, and for manufacturing and services respectively.

We adopt the specification by Ai and Norton (2003), Norton et al. (2004) and Greene (2010) by reporting the coefficients estimates since there are interaction terms in our regression models. According to Ai and Norton (2003), the partial effect (a unit change) of the variable of interest is more complex in nonlinear models than in linear models, and that merely looking at the sign and statistical significance of the interaction term's coefficient can be contradictory or misleading. Therefore, the study employs the cross differences (derivatives) method (the "inteff"command after probit) to obtain the correct interaction effects. Moreover, the regression analyses were conducted with reference to industry dummies and disaggregated into sectors (manufacturing and services) to account for possible heterogeneity that may exist among sectors, industries or firms. This means that the same firm capability or characteristic may exert different effects on firm export depending on which industry the firm belongs.

Firstly, Table 5.3 presents the coefficient estimates of the simple probit regression for the effects of the components of human capital (formal training, employee slack time and employee schooling) on export. From Table 5.3, Model 1 through Model 3 present the effects of each of the components of human capital with the control variables on export. Model 4 presents the combined effects of all the components of human capital on export without the control variables, whilst in Model 5 control variables are added. Also, in model 6 we augment model 4 with the interaction term- EMSCHINNOV, while in model 7 further controls are added.

In addition, Tables 5.4, 5.5 and 5.6 present the coefficient estimates of the bivariate probit regressions for the combined effects of human capital (formal training, employee slack time and employee schooling) and R&D on export. Based on Table 5.4, Model 1 denotes the baseline model that includes only the independent variables. Model 2 adds the effects of the control variables. Models 3 and 4 add the effects of the interaction terms- R&D and innovation (R&DINNOV); and

human capital and innovation (EMSCHINNOV) respectively. Model 5 presents the combined effect of all the variables including the interaction terms and the controls. Also, from Table 5.5 and 5.6, we replicate our regressions in Table 5.4 by disaggregating the firms into manufacturing and service firms respectively, which are portrayed in Model 1 through Model 5 from each of the tables (Table 5.5 and 5.6) respectively.

Consequently, the models employed performed well as most of the regressors had their expected signs and highly significant as well. For the manufacturing firms (see Table 5.5), the coefficient of the interaction effect of education and innovation (EMPSCHINNOV) is found to be insignificant on export. However, interpreting the interaction effects directly can lead to misleading results, hence, we will interpret the interaction effects separately for all firms and the disaggregated firms (manufacturing and service firms) based on the cross difference (derivative) method. To make the discussion of our results easier to follow we start by discussing the results from Table 5.3 followed by Tables 5.4, 5.5 and 5.6 respectively.

5.3.1 Effects of the Components of Human Capital on Exports (All Firms)

Generally, the reported coefficient estimates in Table 5.3 show that, human capital (formal training, employee slack time and employee schooling) significantly affects export performance positively. As anticipated, there exist faster export growth among firms that have a well-developed human capital. Model 1 through Model 3, using the simple probit regression, show that formal training, employee slack time and employee schooling respectively, exert positive and statistically significant effects on export. The combine impacts of these variables are still positive and statistically significant except formal training, which is statistically insignificant, albeit positive, in Model 4. In model 5, we augment Model 4 with the control variables (firm age, firm size, capital

foreign share, capital intensity and innovation) and the effect of human capital (employee schooling, slack time and formal training) is still positive and significant. Also, Model 6 adds the interaction term- employee schooling and innovation (EMPSCHINNOV), while in Model 7 further controls are added, but the effects of the components of human capital are still positive and statistically significant. The interaction term is positive and statistically significant as well. Furthermore, we use the cross difference (derivative) method to compute the correct effects of the interaction term within the probit regression in Model 6, following Ai and Norton (2003) (see Table 5.3.1 and Figures 1 and 2). From Table 5.3.1 and the corresponding graphs (Figures 1 and 2) the interaction term is positive but its statistical significance differ by observation in the sample. The concave line drawn on the graphs indicates the incorrect marginal effect.

The first key result we can see from the probit coefficient estimates is that, firm-level practices such as, giving workers slack time and formal training, have positive and significant coefficients across all models, indicating a positive effect of firm-level practices on export performance, whilst the number of highly educated employees has a marginally significant, albeit positive, effect on the probability of a firm to export. Also, the size of the effects of the firm-level practices (slack time and formal training) is more profound than that of employee schooling. This implies that, the number of highly educated employees is a relatively unimportant determinant of firm export, and that a firm that gives slack time and conduct formal training as a way of boosting its human capital, will tend to have more exports. This confirms the findings of extant studies. Specifically, Teal et al. (2006) and Munch and Skaksen (2008) concluded that those firm-level practices that enhance human capital have positive effects on export using data at the firm-level from selected countries in Africa and Denmark respectively. Their results show that all things being equal, when the level of human capital increases, export would also increase.

Very interestingly, we find from the probit coefficient estimates (Table 5.3) and the cross differences (Table 5.3.1 and Figures 1 and 2) that innovation positively mediate the association between human capital (employee schooling) and export performance. Specifically, for a lot of observations with a probability value of exporting higher than 0.2, the interaction effect is positive, otherwise negative (see Figure 1). The empirical findings of this study on the positive mediating effect of firm innovation is consistent with the study of Wagner (2000) on German firms, who concluded that, it is important to know that combining employee schooling and innovation increases the probability of a firm to export. An essential component of firm capability is the ability of a firm to involve in innovative activities. This innovation will itself directly trigger potential behavior change in terms of inducing firms to engage in activities that will lead to export growth, thus, regarded as a potential mediator or mechanism through which the effect of human capital is felt within the firm. This means that human capital (education) on its own cannot lead to more firm export in Ghana except through innovation. Thus, to achieve firm growth in terms of exports, firms should improve innovation by properly managing the skills and knowledge of employees.

However, based on the results from the cross difference approach the statistical significance of the interaction term is observed to differ by observation (i.e. signicant for some obversations and insignificant for others) (see Figure 2). This implies that, we cannot draw a general conclusion on the statistical significance of the interaction effect in our model. Also, it is shown that some of our control variables have positive and significant effects on export performance. Specifically, there is higher export performance among manufacturing firms, larger firms and firms that have a foreign affiliation. This confirms the findings of Van Dijk (2002), who argued that manufacturing firms, large firms and foreign affiliated firms are more likely to engage in export activities in Indonesia.

Table 5.3: Probit Estimates of the Effects of the Components of Human Capital on Exports (All Firms)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	All Firms						
Variables	Probit EXPORT	Probit EXPORT	Probit EXPORT	Probit EXPORT	Probit EXPORT	Probit EXPORT	Probit EXPORT
Independent Variables:							
EMPSCH	0.056**			0.056***	0.057**	0.084**	0.096**
	(0.025)			(0.017)	(0.024)	(0.035)	(0.046)
EMPSLAC		0.088**		0.072**	0.111***	0.107***	0.138**
		(0.044)		(0.064)	(0.094)	(0.071)	(0.113)
FORTRN			0.085*	0.156	0.093**	0.097**	0.125**
			(0.053)	(0.123)	(0.055)	(0.166)	(0.111)
INNOV						0.119**	0.088*
						(0.099)	(0.078)
FMSIZE	0.137***	0.180***	0.163***		0.177***		0.101**
	(0.092)	(0.089)	(0.090)		(0.096)		(0.072)
FMAGE	-0.113	-0.108	-0.117		-0.120		-0.105
	(0.100)	(0.098)	(0.099)		(0.100)		(0.128)
FORSHARE	0.084***	0.121***	0.137***		0.134***		0.293*
	(0.080)	(0.106)	(0.112)		(0.113)		(0.231)
CAPINT	0.016	0.036	0.037		0.017		0.023
	(0.051)	(0.047)	(0.047)		(0.051)		(0.072)
IND	0.335**	0.317**	0.315**		0.343**		0.641***
	(0.145)	(0.135)	(0.138)		(0.147)		(0.210)
Interaction term:							
EMPSCHINNOV						0.047**	0.052**
						(0.038)	(0.043)
Constant	-2.824***	-2.580***	-2.592***	-1.286***	-2.818***	-1.510***	-2.971***
	(0.481)	(0.447)	(0.449)	(0.140)	(0.480)	(0.285)	(0.658)
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	521	547	544	674	519	339	260

Robust standard errors in parenthesis, ***p<0.01, **p<0.05, p<0.1
Source: Author's computation from the data

Table 5.3.1 Interaction effect between education and innovation in model 6 (All firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.009482	0.0004359	0.00783	0.012935
Standard error	0.0017646	0.0008974	0.0001241	0.0029816
z-ratio	5.367224	0.1765549	-0.270329	5.4762898

Figure 1

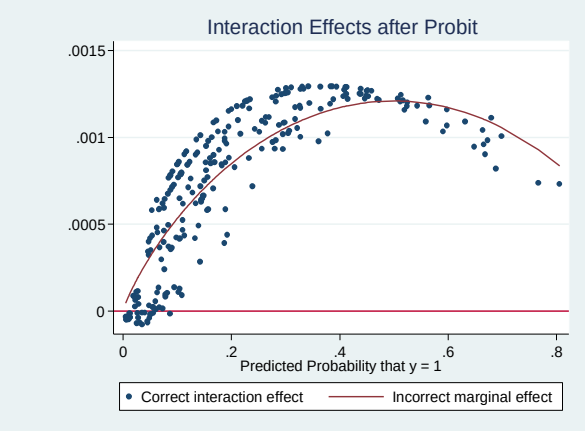
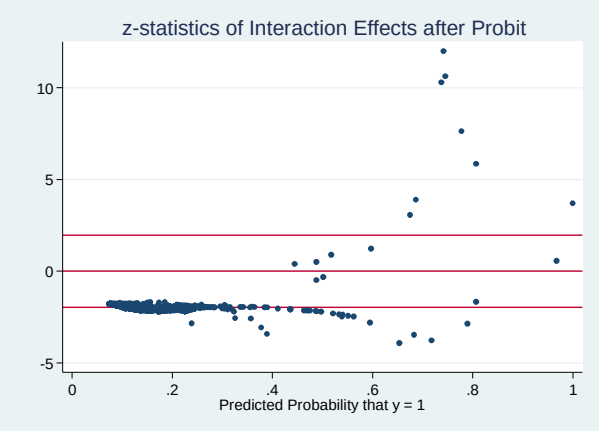


Figure 2



5.3.2 Effects of R&D and Human Capital on Exports (All firms)

The reported results in Table 5.4 overall suggest that, human capital (formal training, slack time and employee schooling) and R&D exert positive and statistically significant effects on export performance. The baseline model (model 1), using the bivariate probit regression, indicates that the effects of human capital and R&D are significantly positive. The effects are still significantly positive even when we add the control variables (firm age, firm size, foreign affiliation, capital intensity and the industry dummy). The baseline model is augmented with the interactions terms-R&D and innovation (R&DINNOV); and human capital and innovation (EMPSCHINNOV) respectively in Model 3. The human capital and R&D, and the interaction terms are observed to exert positive and statistically significant effects on exports. In addition, further control variables (firm size, firm age, capital foreign share, capital intensity and innovation) are added in Model 5.

The effects of human capital, R&D and the interaction terms continue to exert positive and statistically significant effects on exports. Moreover, we replicate models 3 and 4 using a probit regression and the cross derivatives approach (the "inteff"command after probit) to compute the correct interaction effects (see Ai & Norton, 2003; Greene 2010) (see Tables 5.4.1 and 5.4.2 and the graphs that follow). From Tables 5.4.1 and 5.4.2 and the graphs, it is seen that the interaction effects are positive but their statistical significance differ widely by observation.

Generally, the R&D variable is robust with the expected positive sign in all estimations. The results of this variable confirm the findings of Aw et al. (2007) and Girma et al. (2008) in their study on Taiwan and British firms respectively. The basic explanation that may be given for the positive and statistical significant effect of R&D is that, the variable is mainly regarded as partly a technology variable and may take into consideration the incremental advancements in the methods that the firm or industry is more likely to experience (see Aw et al., 2007). According to Van Dijk (2002), R&D is generally low in developing countries, which is mostly based on the adaptive nature of technical change. In the Ghanaian setting, a good explanation to this phenomenon is that, approximately 22% of firms in Ghana perform R&D (see ES, ICS and IFS survey data, 2013) given the financial constraints they currently face. This is a bit impressive in our setting and may account for the positive effect it has on firm export decision. Also, it has been observed that most local firms in Ghana obtain their knowledge and technology from the importation of capital goods and services and from suppliers of services and materials (Buatsi, 2002). Spending on R&D would probably enhance the export participation of firms given the limited financial resources in Ghana.

In addition, the effect of employee schooling (EMPSCH) was apparent from the estimation results. This variable is found to be statistically significant with the expected positive sign in all the estimations. This establishes the fact that, a firm with a higher share of employees with at least a

secondary school education is more likely to export than a firm that does not. This confirms the results from Teal et al. (2006) who analyzed the drivers of export performance of firms in Sub-Saharan Africa and found a positive relationship between education and exports. Employees with higher levels of education within a firm are expected to be creative and process information faster than employees without education, and hence, impacts positively on exports (see Munch & Skaksen, 2008). The coefficient estimates show that an increase in the education of an employee increases the probability of a firm to export. However, the impact is very small. Even though we find evidence to support this, we conclude that the level of education of an employee is a relatively unimportant driver of firm export performance in Ghana.

Moreover, the employee slack time variable (EMSLAC), is robustly significant and with the expected positive sign in all estimations. This means that, a firm that grants employees some time to develop new ideas is more likely to have higher exports than a firm that does not. This is because the provision of employee slack time by a firm can be an informal way of R&D activities when resources are limited. This is true for a developing country like Ghana since our resources are limited. According to Daniel et al. (2004), slack time enables employees to exploit their own ideas and grants them some level of freedom in their work that promotes creativity and hence, innovation and export improvement. They therefore concluded that slack time is related to more exports. This implies that, a firm in Ghana that provides slack time to employees will increase its probability to be innovative and perhaps participate in exporting.

Furthermore, the variable formal training (FORTRN), is statistically significant with the expected positive sign. This implies that, firms that give formal training to employees are more likely to have higher exports, compared to firms that do not. Formal training has been known to be a form

of training that is geared towards supplementing the educational levels of employees (Bastos et al., 2016). This result confirms the findings of Bastos et al. (2016).

More importantly, the positive effects of the interactions terms- R&D and innovation; and education and innovation- on exports are confirmed by the results in Tables 5.4.1 and 5.4.2 and Figures 3 and 5. For all observations (in both cases) the interaction terms are positive, not negative (see Figures 3 and 5). This in line with the findings of Wagner (2012), Harris and Moffat (2012) and Rodil et al. (2016) for Dutch, British, and Spanish firms respectively. This shows that innovative firms that conduct R&D or employ more educated workers are more likely to engage in export activities. However, a clear conclusion cannot be drawn since the statistical significance of these interaction terms is observed to differ by observation (i.e. significant for some observations and insignificant for others) (see Figures 4 and 6) from the cross difference after probit regression computation.

In the light of the results from the control variables, the expected signs are confirmed except the firm age variable. To begin with, from the bivariate probit estimates, the firm size (FMSIZE) variable is positive and highly significant in all the estimations. Thus, large firms are more likely enter the export market compared to small firms in Ghana (Teal et al., 2006). This result conforms to the work of Teal et al. (2006). In addition, the foreign share variable (FORSHARE) exerts positive and significant effect on firm export performance. Also, the capital intensity variable (CAPINT) exerts an expected positive and significant effect on firm export performance. Finally, the industry dummy variable (IND) is positive and statistically significant in our estimations. It is mostly argued that service firms are home-based while the manufacturing firms are expected to be more export-oriented. Therefore, manufacturing firms are more likely to export, compared to service firms in Ghana.

Table 5.4: Bivariate Probit Estimates of the Effects of R&D and Human Capital on Exports (All Firms)

	Model 1	Model 2	Model 3	Model 4	Model 5
	Full Sample (All Firms)				
VARIABLES	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)
Independent Variables:					
R&D	0.152*	0.245**	0.174**	0.318**	0.275**
	(0.115)	(0.163)	(0.156)	(0.271)	(0.149)
EMPSCH	0.036**	0.064***	0.087**	0.096***	0.098**
	(0.022)	(0.014)	(0.043)	(0.034)	(0.015)
EMPSLAC	0.204**	0.218***	0.104***	0.236**	0.117***
	(0.130)	(0.202)	(0.069)	(0.174)	(0.102)
FORTRN	0.173**	0.150***	0.142**	0.246**	0.149***
	(0.125)	(0.102)	(0.135)	(0.164)	(0.102)
INNOV			0.252**	0.184*	0.173*
			(0.219)	(0.127)	(0.158)
FMSIZE		0.295**			0.297**
		(0.126)			(0.129)
FMAGE		-0.118			-0.119
		(0.129)			(0.130)
FORSHARE		0.274			0.127*
		(0.234)			(0.114)
CAPINT		0.032			0.139**
		(0.072)			(0.074)
IND		0.120***			0.169**
		(0.105)			(0.110)
Interaction terms:					
R&DINNOV			0.047**		0.051*
			(0.018)		(0.022)
EMPSCHINNOV				0.050**	0.093**
				(0.016)	(0.027)
Constant	-1.931***	-2.978***	-2.180***	-1.503***	-2.843***
	(0.174)	(0.678)	(0.428)	(0.279)	(0.689)
Rho (ρ)					0.110**
					(0.094)
Prob>Chi2	0.000	0.000	0.000	0.000	0.000
Observations	671	259	338	338	259

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Source: Author's computation from data

Table 5.4.1 Estimated interaction effect between R&D and innovation in model 3 (All firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.007266	0.003743	0.003043	0.0093374
Standard error	0.0012039	0.0006482	0.0001538	0.0023396
z-ratio	2.2678610	0.0808037	1.1976808	3.7475622

Figure 3

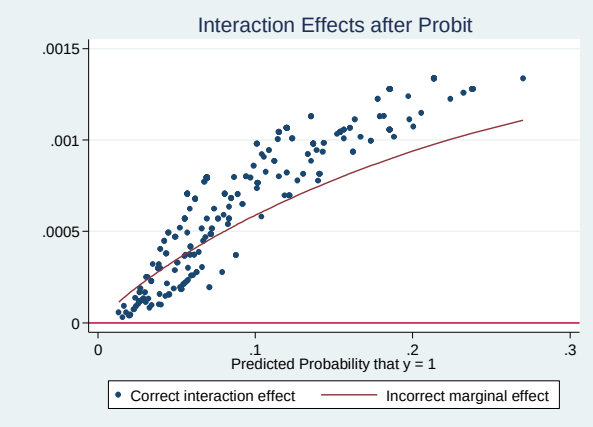


Figure 4

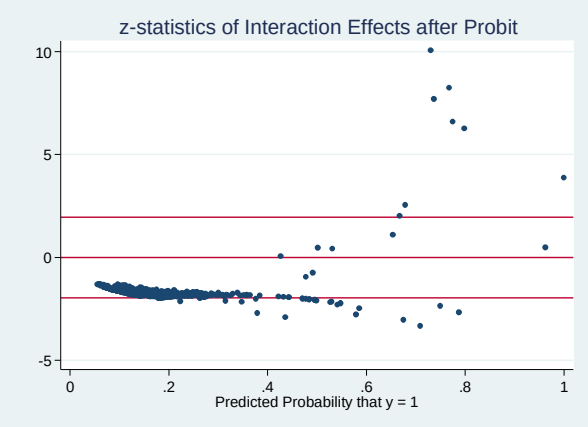


Table 5.4.2 Interaction effect between education and innovation in model 4 (All firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.006720	0.0062110	0.001772	0.0073460
Standard error	0.0012093	0.0006328	0.000198	0.0023411
z-ratio	5.5569338	0.5332835	1.756896	6.5212511

Figure 5

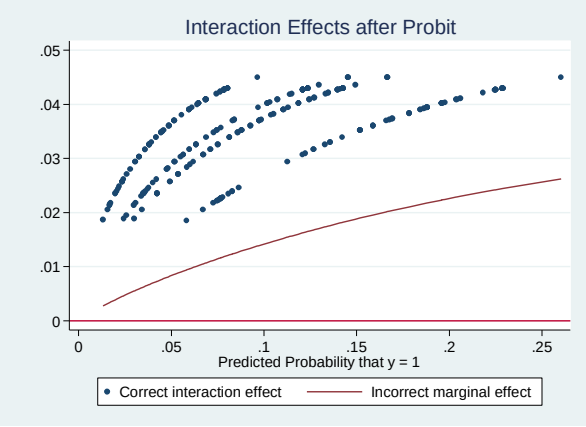
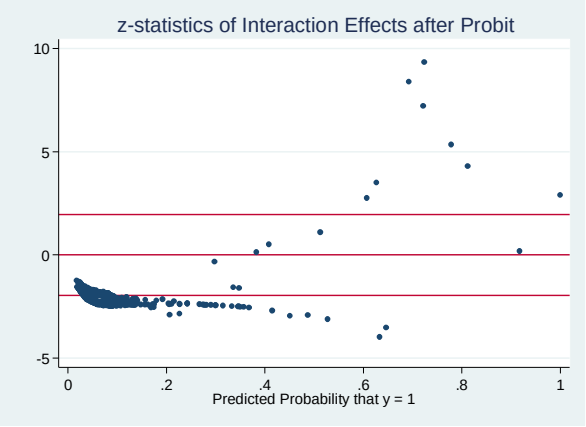


Figure 6



5.3.3 Effects of R&D and Human Capital on Exports (Manufacturing and Services)

Tables 5.5 and 5.6 present the results of the sub-samples (manufacturing and service firms). The overall results from the bivariate probit coefficients estimates indicate positive and significant effects of human capital (employee schooling, slack time and formal training) and R&D on firm export performance. These results undoubtedly indicate that these variables are good in explaining the export participation of a firm in Ghana. Specifically, from Tables 5.5 and 5.6, we replicate the models in Table 5.4 using a firm disaggregated models for manufacturing and service firms respectively, and the effect of human capital, R&D and the interaction terms (except the interaction between employees schooling and innovation in the manufacturing sector) is positive and statistically significant on our dependent variable (export).

Juxtaposing the existing literature with our findings signify that, the non-significance of the combination of human capital (educated employees) and innovation in enhancing export performance may be due to the lower levels of education of most employees in the manufacturing sector (see Teal, 1999; Sarpong & Wolf, 2008). Therefore, interacting human capital with innovation may produce insignificant effects on export. However, these results can be misleading or inconsistent, hence, we calculate the correct interaction effects using the cross difference (derivative) approach. The results from the cross differences after probit, suggest that the interaction terms - human capital and innovation (EMPSCHINNOV); and R&D and innovation (R&DINNOV)-affect export performance positively. This is based on Tables 5.5.1 and 5.5.2 for manufacturing and Tables 5.6.1 and 5.6.2 for services, and their corresponding graphs. Also, the statistical significance of the interaction terms differ by observation (i.e. insignificant for some observations) (see the Figures 8, 10 for manufacturing and Figures 12 and 14 for services).

Therefore, an all-inclusive conclusion cannot be drawn on the significance and the signs of the interaction terms in our manufacturing and service models.

Table 5.5: Bivariate Probit Estimates of the Effects of R&D and Human Capital on Exports (Manufacturing)

	Model 1	Model 2	Model 3	Model 4	Model 5
	Sub-Sample (Manufacturing firms)				
VARIABLES	Biprobit EXPORT	Biprobit EXPORT	Biprobit EXPORT	Biprobit EXPORT	Biprobit EXPORT
Independent Variables:					
R&D	0.427**	0.407**	0.196**	0.209**	0.258***
	(0.378)	(0.362)	(0.179)	(0.116)	(0.129)
EMPSCH	0.095**	0.076*	0.040**	0.053*	0.093**
	(0.022)	(0.046)	(0.013)	(0.025)	(0.059)
EMPSLAC	0.289***	0.261**	0.143**	0.177**	0.213***
	(0.211)	(0.220)	(0.078)	(0.095)	(0.134)
FORTRN	0.148*	0.225**	0.244**	0.131*	0.113**
	(0.101)	(0.179)	(0.214)	(0.119)	(0.099)
INNOV			0.147**	0.107**	0.152**
			(0.116)	(0.039)	(0.089)
FMSIZE		0.297**			0.280**
		(0.159)			(0.171)
FMAGE		-0.089			-0.081
		(0.162)			(0.156)
FORSHARE		0.572**			0.177*
		(0.291)			(0.096)
CAPINT		0.123*			0.130*
		(0.080)			(0.081)
Interaction terms:					
R&DINNOV			0.097**		0.082**
			(0.052)		(0.064)
EMPSCHINNOV				0.074	0.048
				(0.081)	(0.017)
Constant	-1.354***	-1.196***	-1.277***	-1.405***	-1.196***
	(0.189)	(0.804)	(0.291)	(0.371)	(0.878)
Rho (ρ)					0.279**
					(0.122)
Prob>Chi2	0.000	0.000	0.000	0.000	0.000
Observations	349	142	183	183	142

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation from the data

Table 5.5.1 Interaction effect between R&D and innovation in model 3 (Manufacturing firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.002695	0.0011925	0.0011006	0.0034795
Standard error	0.0009429	0.0002747	0.0005442	0.002084
z-ratio	2.855265	0.8923571	1.10669	3.718657

Figure 7

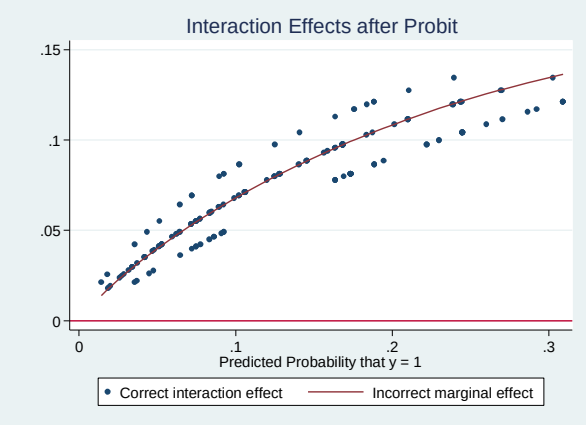


Figure 8

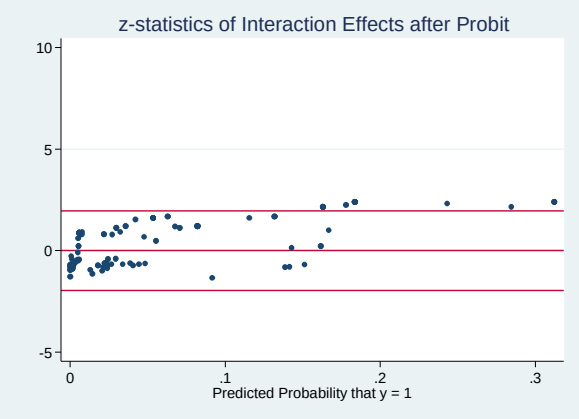


Table 5.5.2 Interaction effect between education and innovation in model 4 (Manufacturing firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.0515143	0.0140117	0.0228384	0.0697432
Standard error	0.1019217	0.0329435	0.0396146	0.1507532
z-ratio	0.5057117	0.0329078	0.4626319	0.5765152

Figure 9

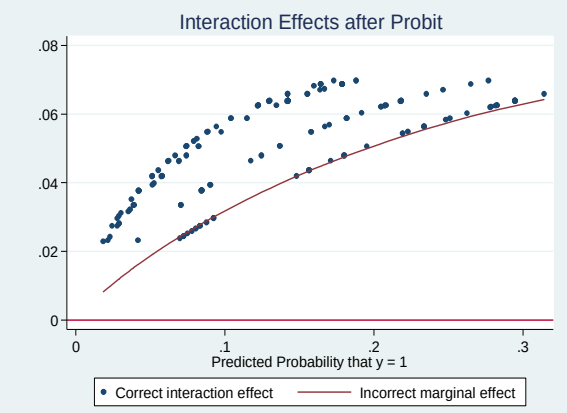


Figure 10

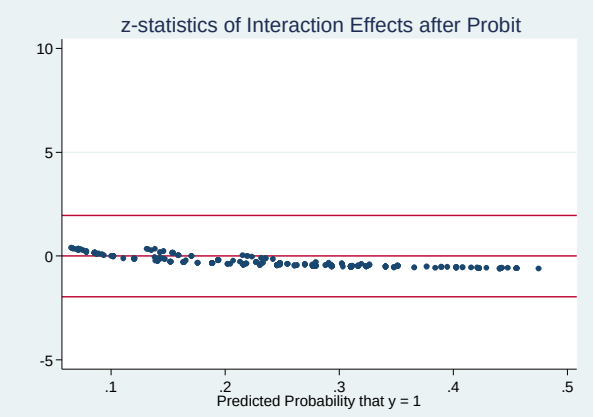


Table 5.6: Bivariate Probit Estimates of the Effects of R&D and Human Capital on Exports (Services)

	Model 1	Model 2	Model 3	Model 4	Model 5
	Sub-Sample (Service Firms)				
VARIABLES	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)	Biprobit (EXPORT)
Independent Variables:					
R&D	0.096*	0.118**	0.069*	0.056**	0..138**
	(0.045)	(0.055)	(0.023)	(0.037)	(0.114)
EMPSCH	0.059***	0.071**	0.046**	0.021***	0.049**
	(0.033)	(0.061)	(0.018)	(0.016)	(0.035)
EMPSLAC	0.119**	0.234**	0.149**	0.185**	0.176**
	(0.073)	(0.178)	(0.125)	(0.144)	(0.150)
FORTRN	0.164**	0.113**	0.242**	0.130*	0.118**
	(0.123)	(0.101)	(0.187	(0.105)	(0.111)
INNOV			0.061*	0.103**	0.092*
			(0.011)	(0.071)	(0.081)
FMSIZE		0.217**			0.126***
		(0.198)			(0.104)
FMAGE		-0.131			-0.118
		(0.270)			(0.267)
FORSHARE		0.122*			0.087**
		(0.064)			(0.039)
CAPINT		0.087**			0.056*
		(0.029)			(0.013)
Interaction terms:					
R&DINNOV			0.063**		0.105**
			(0.036)		(0.059)
EMPSCHINNOV				0.074**	0.097**
				(0.029)	(0.012)
Constant	-1.477***	-5.529***	-2.849***	-2.982***	-5.419***
	(0.307)	(1.325)	(0.513)	(0.746)	(1.392)
Rho (ρ)					0.264*
					(0.180)
Prob>Chi2	0.000	0.000	0.000	0.000	0.000
Observations	322	117	155	155	117

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation from the data

Table 5.6.1 Interaction effect between R&D and innovation in model 3 (Service firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.0028775	0.0012842	-0.0064838	0.0044637
Standard error	0.0009263	0.0002934	0.0005669	0.002174
z-ratio	3.1064449	1.042319	1.752313	5.582067

Figure 11

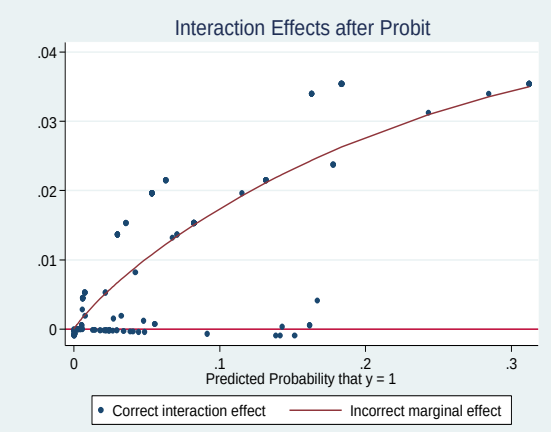


Figure 12

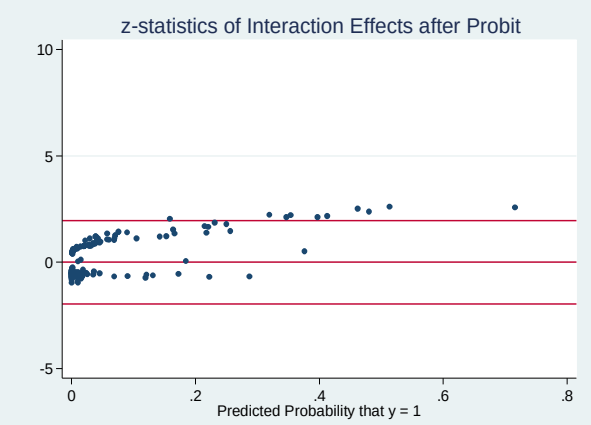


Table 5.6.2 Interaction effect between education and innovation in model 4 (Service firms)

Variable	Mean	Std. Dev.	Min.	Max.
Interaction effect	0.016563	0.004297	0.0044691	0.0213694
Standard error	0.007947	0.032608	0.0119366	0.1160906
z-ratio	2.0841827	0.111889	0.1179269	0.4737453

Figure 13

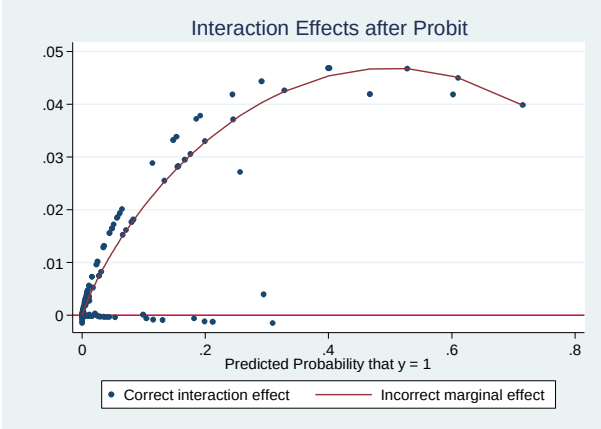
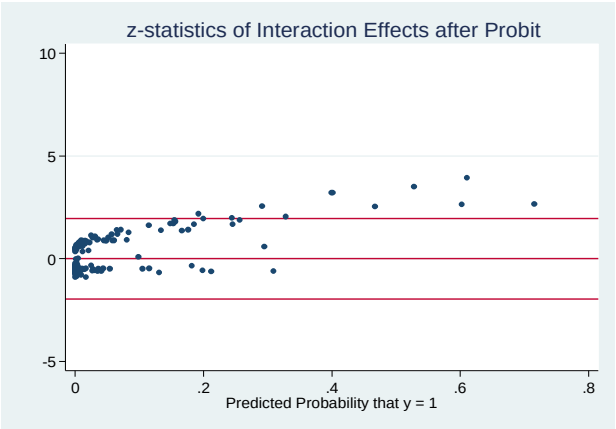


Figure 14



Finally, based on the results of the control variables in Tables 5.5 and 5.6, firm size, foreign affiliation and capital intensity have positive effects on the probability of a manufacturing or service firm to engage in export activity, while firm age is insignificant. Simply put, manufacturing or service firms that are large, foreign owned and have sophisticated capital are more likely to export, compared to firms that are small, domestic owned and are capital deficient.

CHAPTER SIX
CONCLUSIONS, POLICY RECOMMENDATIONS AND LIMITATIONS

6.1 Introduction

This chapter provides the summary and conclusion of the study. The first section discusses the summary of the study and the conclusions. Policy implications and recommendations that would be relevant for policy makers are presented in the next section. The final section presents the limitations of the study.

6.2 Summary and Conclusion

The main objective of this study is to explore the effects and roles of human capital and R&D on export, and to investigate the mediating role of innovation on the relationship between R&D, human capital (educated employees) and export of firms in Ghana. This is to ensure export growth and competitiveness of firms in the global market. A theoretical model (RBV) on exports, human capital and R&D was developed, followed by an empirical literature review to ascertain the effects of these variables on firm export performance. The study also tested for the presence of endogeneity between R&D and exports in the model, were it was shown to be present. Consequently, a simple probit regression and bivariate probit regression techniques were used in the empirical estimation to accomplish the set objectives of the research. Specifically, the simple probit regression was used to model the effects of the components of human capital (employee schooling, formal training and employee slack time) on export performance, whereas the bivariate probit regression was used to examine the effects of both R&D and human capital on export performance. These regression techniques are preferred to other techniques because it is ideal for

the estimation of a model that has a discrete dependent variable (whether a firm exports or not). Also, the study employed the cross-difference approach to model the correct estimates of the interaction terms in the model, following the recommendation by Ai and Norton, (2003).

The study used employee schooling, formal training and employee slack time as measures of human capital. We also controlled for firm characteristics (i.e. firm age, firm size, foreign share, capital intensity) that determine firm export performance. The study used a unique dataset that combines the Ghana 2013 Enterprise Survey, the Ghana 2013 Innovation Follow-up Survey and the Ghana 2013 Innovative Capability Survey. The classification of sectors stressed the significance of the variations in sectors in investigating the effects of firm capabilities and characteristics on firm export performance. The key findings of the study are presented as follows:

First, the effect of human capital, which is measured by employee schooling, formal training and employee slack time, is similar across all sectors. That is, they are positive and statistically significant on firm export performance. However, the effect of employee schooling is very small. Even though we find evidence to support this, we conclude that the level of education of an employee is a relatively unimportant driver of firm export performance in Ghana. This signifies the importance of employee slack time and formal training in influencing export performance of firms in Ghana, which should be given much attention if we aim at improving the productivity and performance of firms in the global market.

In addition, we find the R&D variable to have a positive and robustly significant effect on export performance in all the estimations. The effect of this variable on export is quite impressive since we expected a small impact for a country like Ghana, where R&D is mainly regarded to be

generally low. This is because firms in Ghana hardly undertake R&D, which is mostly based on the adaptive nature of technical change.

Furthermore, the results from the simple probit and bivariate probit coefficient estimates suggest that the interactions- employee schooling and innovation; and R&D and innovation- have positive effects on exports for the full sample and the firm disaggregated sample of manufacturing and service firms' models (see Wagner, 2000; Harris & Moffat, 2012). However, when their cross differences are computed as recommended by Ai and Norton (2003), the positive effects of the interaction terms are confirmed, but their statiscal significance differ widely by observation (in both cases). These results stress on the variations in the roles of human capital and R&D in innovation and export advancement among firms in Ghana. We therefore opine that the low stock of educated employees especially in the manufacturing sector and the low patronage of R&D by firms in Ghana may be the possible reason for the variation in the statistical significance of the interactions terms in our model (see Teal, 1999; Sarpong & Wolf, 2008).

Finally, the findings suggest that firm size, foreign affiliation and capital intensity have significantly positive effects on the probability of a firm to export, while firm age is found to be insignificant. This means that, firms in Ghana that are large, have foreign shares and use sophisticated capital are more likely to participate in export activities. Thus, if firm growth is to be improved through export, these factors cannot and should not be overlooked. Also, the results suggest that manufacturing firms are more likely to participate in export activities, compared to service firms in Ghana.

6.3 Policy Implications

The findings from our study have some significant implications for policy makers and firms' management. Our empirical estimation shows that the firm-level practices-employee formal training and employees with slack time tend to have greater effects on firm export performance in Ghana than the traditional factor-employee schooling. This indicates that policymakers, involved in promoting firm export, should give more attention to employee slack time and formal training in their policy initiatives. Employees should be well trained and given more time to develop their own ideas since this is mostly an informal way of conducting R&D in developing countries (Ghana), where resources are limited. Introducing subsidies or tax advantages may be conducive for firms that are involved in this practice. Kenya for instance has introduced policies geared towards promoting in-house activities that boost the R&D of firms. The study therefore points out those policy initiatives geared towards promoting employee slack time and formal training may be more favorable for firm-level export growth in Ghana than policies that concentrate on the education of employees.

Also, there is a complementarity between firm export and R&D of firms in Ghana from the findings of the study. The importance of conducting R&D by firms has long been shown in the literature even though some studies may say otherwise. To make R&D more efficient in enhancing export in Ghana policy makers should provide full support for firms to undertake this activity. As it is observed in Ghana, the financial support given to firms by the government to carry out R&D activities is either non-existence or woefully inadequate. Mahmoud (2010) argued that the highest funding from national funding agencies on R&D expenditure was only 6% while other government authorities including the Municipal and District Assemblies provided less than 2% of R&D expenditure to firms in Ghana. This leads us to a recommendation that, government needs to

establish an R&D fund that will help to boost innovation, productivity and the performance of firms in both the local and international market.

6.4 Limitations of the study

The study measures both employee slack time and formal training as dummy (discrete) variables, which fails to give a comprehensive information on these variables. Studies that will be conducted in the future could use information such as money and time spent on the practices of the firm if more information is available, to gain a more comprehensive understanding. Also, we are only made to understand whether a firm conducts formal training for its workers in each year or not but we are not told to which workers or whether those employees would stay with the firm after the training. This could also have an impact on the results. Furthermore, we are only made to understand whether a firm spends on formal R&D or not but not the exact expenditure spent on this activity. This could also influence the results.

Moreover, more specific information on human resources has been included in some studies, which cannot be found in our database. In the future, data collection could add other important variables associated with human resources, namely opportunities (information sharing and job design) and motivation incentives (bonuses). Finally, the scope of the study is limited to R&D, human capital and firm export performance at the specific country-level (Ghana). Therefore, the study fails to explore these relationships in detail at the cross country-level. Due to the significance of this subject matter further research can be conducted at the cross country-level in Africa.

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