UNIVERSITY OF CAPE COAST

DETERMINANTS OF INNOVATION AMONG MICRO, SMALL AND MEDIUM SCALE ENTERPRISES IN THE GHANAIAN APPAREL INDUSTRY

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BY

BENEDICT AFFUL JR

THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, FACULTY OF SOCIAL SCIENCES, UNIVERSITY OF CAPE COAST IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF MASTER OF PHILOSOPHY DEGREE IN ECONOMICS

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature ……. Date…….……

Name:……...

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature…….. Date ……...

Name:…….

Co-Supervisor's Signature…….. Date ……..

Name:……

ABSTRACT

The ability to innovate technology represents the highest degree of development of an industrial society. However, there has not been much research focused on innovation of a firm, especially in the apparel manufacturing industries in Ghana.

The purpose of this study is to investigate the determinants of innovation within the context of the apparel industry, using cross sectional data collected on fifty apparel firms selected from the Accra Metropolis in the Greater Accra region of Ghana. In order to understand the learning of innovation at the firm level, the evolutionary framework was adopted. Also, a logistic model was used in the analysis of the innovation behaviour of the fifty respondent firms.

The results revealed that age of a firm positively influences process innovation but negatively influences product innovation. The result revealed that the share of export in sales and the experience of entrepreneur are positively related to product and process innovation but training duration was positively related to innovation. On the other hand, the results indicated that the firm size, extent of local ownership, training duration, and lack of financial resources did not have significant effects on product and process innovation.

In order to aid the innovation activity by firms, explicit policy framework should be adopted. The elements of the policy framework are: introduction of national apprenticeship and starting of firm scheme; annual awards or sponsorships; industrial leave for upgrade courses from higher institutions or industrial attachment in other countries; and increase the awareness on AGOA.

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DEDICATION

I dedicate this thesis to my late grand father Samuel Kortei Boye and my beloved wife Gifty Esinam Afful.

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LIST OF ACRONYMS

AGI	Association of Ghana Industries
AGOA	African Growth and Opportunities Act
ATL	Akosombo Textile Limited
BAC	Business Advisory Centres
CDF	Cumulative Distribution Frequency
CIDA	Canadian International Development Agency
EC	European Commission
ECOWAS	Economic Community of West African States
EPZs	Export Processing Zones
EU	European Union
FAL	Final Act of Lagos
FDI	Foreign Direct Investments
GAFD	Ghana Association of Fashion Designers
GIPC	Ghana Investment Promotion Centre
GNTDA	Ghana National Tailors and Dressmakers Association
GRATIS	Ghana Regional Appropriate Technology Services
GOG	Government of Ghana
GSP	Generalized System of Preferences
GSS	Ghana Statistical Service
GTP	Ghana Textile Product
GTMC	Ghana Textile Manufacturing Company
ILO	International Labour Organization
IPR	International Property Right
ITTU	Intermediate Technology Transfer Units
LDCs	Least Developed Countries
LPM	Linear Probability Model

MES	Ministry of Environment and Science
MIST	Ministry of Industries, Science and Technology
MOTI	Ministry of Trade and Industry
NBSSI	National Board for Small – Scale Industries
NDC	National Democratic Congress
NPP	New Patriotic Party
NRC	National Research Council
OECD	Organisation for Economic Co-Operation and Development
OLS	Ordinary Least Squares
OR	Odds Ratio
R&D	Research and Development
RTTC	Regional Technology Transfer Centre
SME	Small and Medium Enterprise
SSA	Sub-Saharan Africa
UNIDO	United Nations Industrial Development Organization

CHAPTER ONE

INTRODUCTION

Introduction

This chapter entails a comprehensive introduction to the research undertaken. Among the topics discussed in the chapter are: background to the study, problem statement, objectives of the study, and statement of hypothesis. The chapter also highlights on significance of the study, scope of the study, and organization of the study.

Background to the study

Many researchers, including Schumpeter (1934), Bozeman, Crow and Link (1984), Lucas, Gibbs and Keen (1988), Ahuja and Lampert (2001), Corrocher and Zirulia (2004), and many others attest to the fact that successful innovation tends to provide several advantages to innovating firms in particular and the country as a whole. Economic growth, employment, creation of value, wealth creation, competitiveness and high corporate performance among others, are the advantages that a firm and the nation get from innovation. In all, it is generally believed that innovation holds the key to prosperity for firms, industries and developing countries.

Due to the important role innovation plays in nation building, it has attracted the attention of many, including the World Bank. In view of this, many researchers, policy-makers, governments, firms, industries and other big institutions all over the world try to promote innovation at all levels. The growing interest in the subject stems from three drivers. The first is the intensification of the globalization process. Spurred by the revolution in telecommunications, this revolution manifests itself, among other things, by the importance of trade within the global economy. The second driver is the intensive ongoing technological change stimulated by tremendous scientific advances made in the foundations of life, matter, energy and time. The third and final driver is the recognition that, it is necessary to go back to basics after experiencing the limits of traditional economic policies.

Privatization, liberalization, and deregulation policies have clearly demonstrated their limits for promoting sustainable growth in the developing world. Similarly, policies focusing on modernization, in the sense of building infrastructure and institutions with a more interventionist government, have not yielded the expected fruits. Thus, there has been a tendency to look for an alternative engine of economic development that is technology, its creation and diffusion.

Broadly speaking, social scientists (especially economists), have stressed the market or demand side of the process, whilst natural scientists and engineers have tended to stress more strongly the research and technical side, at the neglect of the market (Nemet, 2006). These one-sided approaches may be selected briefly

as ‘demand-pull’ and ‘science-push’ theories of innovation (Nemet, 2006). In the economic literature on innovation, there are different branches of economics (industrial economics, institutional economics, evolutionary economics, and international trade) that explain the source(s) of innovation.

In addition, several researchers have looked at the determinants of innovation in the manufacturing sector. For instance, Lee (2003) analyzed the determinants of innovation in the Malaysian manufacturing sector (food processing, apparel and textiles, wood work, etc) using firm level data. For all the variables included in the model, age of firm, firm size, share of export in sales, and types of ownership were found to be important determinants of the innovations in Malaysia. Wignaraja (2008) also examined the links between ownership, innovation and exporting in electronics firms in three late industrializing East Asian countries (China, Thailand and the Philippines), drawing on recent developments in applied international trade and innovation and learning. He found that higher levels of skills, managers’ education and capital also matter as well as accumulated experience of entrepreneur by firms emerges as a more robust indicator of innovation.

However, studies of technological upgrading in developing countries have long argued for a need to recognize the importance of national capabilities and policies, but also to understand technological capabilities at the firm level (Kim, 1980; Dahlman, Rose-Larson & Westpal, 1987; Lall, 1992). Meanwhile, there is considerable experience accumulated in the field of innovation policy in

developed/OECD countries, much of which is not directly applicable to developing countries because of the nature of the challenges the latter are facing.

After gaining independence in 1957, Ghana has put in place many policies, structures, and institutions to encourage the development of science and technology. In February 1959, the Research Act of 1958 (No. 21) was enacted and this led to the eventual establishment of the National Research Council (NRC). In September 1979, the then Ministry of Industries, Science and Technology (MIST) was established. In the quest for development, Ghana took part in the Lagos Plan of Action for the Economic Development of Africa (1980 – 2000) and the Final Act of Lagos (FAL) 1980. In April 2006, the Ministry for Science and Technology was changed to Ministry of Environment and Science (MES). The recent economic and social development documents; namely, the Ghana Vision 2020 by the NDC and the revised Ghana Growth and Poverty Reduction Strategy I & II respectively, identify the need to apply modern science and technology in the country's development efforts towards a middle income economy by 2015 by the NPP.

Ghana's development strategy aims at achieving an effective economic growth. Its success depends largely on the development of the private sector, which consists mainly of small and medium scale industries. According to Steel and Webster (1991), micro, small and medium enterprises (MSMEs) contribute about 85% of manufacturing employment and account for about 92% of business. Due to the important role played by the small and medium scale industries, governments of Ghana have provided means (National Board for Small Scale

Industries, Ghana Regional Appropriate Technology Service, President's Special Initiative among others) to help develop these industries.

In addition, the US government passed the African Growth and Opportunities Act (AGOA), under which Ghana is one of the 34 Sub-Saharan countries. The main aim of AGOA was to help the sub-region to transform its economic landscape by providing new trading opportunities, creating new jobs, and increase foreign exchange. The programme was intended to develop internationally competitive exporting firms in the apparel and textile sector, targeting American and European markets. For the apparel manufacturing firms to take advantage of the opportunities offered by AGOA, the firms ought to be innovative to be able to compete favourably in the international markets. There is the need therefore to think about the determinants of innovation among MSMEs in the Ghanaian apparel industry.

Statement of the problem

The ability to innovate technology seems to represent the highest degree of development of an industrial society (Halty-Carrere, 1979). However, Wolf (2007) found that most African countries are under-developed because the capacity to innovate is quite low in those countries, both in the private and in the public sectors. Lall, Navaretti, Teitel and Wignaraja (1994) also found that 'R&D effort' (which is also used loosely to include direct efforts towards innovation) in Ghana relevant to manufacturing industry is minuscule and for this matter, innovation is low.

In Ghana, the apparel industry plays a significant role in the Ghanaian economy because of its potential to earn foreign exchange, create employment, reduce poverty, and contribute to growth and development. Currently, the apparel firms can be found in every corner of the country (especially the urban centres) producing all kinds of products for both local and international markets. These firms are basically MSMEs engaged in the manufacturing of apparel.

The surfacing of AGOA has offered good opportunities for all apparel industries to expand their production hence increase employment. Producing apparel to meet the standards of AGOA or to take advantage of the opportunities offered by AGOA, the firms ought to be innovative to be able to compete favourably in the international markets. Therefore, the determinants of innovation in the apparel industry ought to be looked at.

Although a considerable amount of literature exist on the determinants of innovation in SMEs in Ghana (Quashiegah, 2003; Abor, 2005), none of them delve into the above specific issue. The study seeks to fill this gap by answering the question: What are the determinants of innovation among MSMEs in the Ghanaian apparel industry? The challenge, of this study, is to estimate the determinants of innovation in the Ghanaian apparel industry.

Objectives of the study

Main objective

The overall objective of this study is to analyze the determinants of innovation among MSMEs in the apparel industry in Accra metropolis.

Specific objectives

The specific objectives of the study are to:

1. Determine the effect of firm's size on innovation.
2. Determine the effect of the owner(s) experience on innovation.
3. Investigate whether the share of exports in sales can stimulate firm's innovation.

Statement of hypothesis

The following hypotheses were tested:

H_0: Firm size has no significant effect on firm's innovation.

H_1: Firm size has a significant effect on firm's innovation

H_0: The owner's experience has no significant effect on firm's innovation.

H_1: The owner's experience has a significant effect on firm's innovation

H_0: The share of exports in sales does not significantly influence firm's innovation.

H_1: The share of exports in sales significantly influences firm's innovation

Significance of the study

This study seeks to investigate, empirically, the main determinants of innovation among MSMEs in the Ghanaian apparel industry. The outcomes of the study will be useful to entrepreneurs, and other stakeholders in the apparel industry.

This study applied econometric techniques on a survey data collected by the researcher from Ghana to analyze the determinants of innovation among MSMEs in the Ghanaian apparel industry. Because the analysis is rigorously based on existing theories of innovation, the study will improve our understanding of the factors that influence innovation in developing countries like Ghana.

The study could also help policy makers formulate consistent policies and also make policy recommendations that will attract innovation in the apparel industry and go a long way of curtailing import bills, improve the country's balance of payment state and also ensure economic growth.

Furthermore, no earlier related study on Ghana, such as Lall et al. (1994), Quashiegah (2003), and Abor (2005), delves deep into the above specific issue. The specific issue of showing the economic determinants of innovations in the Ghanaian apparel industry has not been tackled in research works in Ghana. In this regard, the research is of academic relevance.

Lastly, the research will serve as a source of reference to later researchers who want to do further studies or research on innovation in Ghana in relation to apparel industry and also other sectors of the economy.

Scope of the study

The study investigates the determinants of innovation among MSMEs in the Ghanaian apparel industry. The apparel industry is very complex due to the several economic activities in the sector. However, a standard categorization of economic activities is useful so that entities can be grouped according to the

activity they carry out. Indeed, there are many classifications regarding what is included in the apparel industry. Based on the Ghana Standard Industrial Classification (GSS, 2006) and other empirical studies, the apparel industry includes:

a. Manufacture of wearing apparel, dressing and dyeing of fur:
    1. Manufacturing of wearing apparel by cutting and sewing fabrics, leather, etc., for:
        i. Hats and caps, shirts, suits, trousers, blouses, brassieres, night-wears, etc.;
        ii. Gloves, robes and dressing gowns, rain coats and other water proofed outer garments, belts;
        iii. Handkerchiefs, academic caps and gowns.
    2. Dressing and dyeing of fur, manufacture of articles of fur: i.e. dressing and dyeing of fur skins and hides with hair on.
b. Tanning and dressing of leather, manufacture of luggage, handbags, saddler, harness and footwear:
    1. Tanning and dressing of leather:
        - Production of tanned leather, manufacture of composition leather.
    2. The manufacture of luggage, handbags and the likes, saddler and harness:
        - Luggage, handbags and the like, cigarette and key cases and coin purses;
        - Non-metal watch straps, driving belts, packing;
        - Pocket books etc.

3. Manufacture of footwear:
    - Manufacture of footwear of any material, including moulding;
    - Manufacture of parts of footwear like uppers, inner, outer, soles, heels.

Owing to limited resources and time available, this study concentrated on GSS Industrial Classification code 1810 (Manufacturing of wearing apparel by cutting and sewing fabrics, leather, etc) only. The study, therefore, covers firms in the industrial production of hats and caps, shirts, suits, trousers, blouses, gloves, dressing gowns, academic caps and gowns, etc, and is located in the Accra Metropolis. The data gathered were used to analyze the determinants of incremental innovation among MSMEs in the Ghanaian apparel industry.

Organization of the study

The remaining chapters of the study report are organized as follows: Chapter two provides a review of related literature, which includes overview of the Ghanaian apparel industry, the theoretical and empirical literature on innovation. Chapter three specifies the model used to estimate the innovation function and the methodology adopted for the study. Chapter four presents the results and discussion of the determinants of innovation among MSMEs in the Ghanaian apparel industry. Finally, the summary, conclusion and policy recommendations as well as areas for study in the future are discussed in chapter five.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This chapter presents the review of related literature for the study. The literature review is divided into three sections. The first section deals with the overview of the manufacturing sub-sector in Ghana. The second section looks at the theoretical literature on innovation activities and sources of innovation. The third section presents the review of empirical studies on innovation.

Overview of the manufacturing sub-sector in Ghana

During the Nkrumah era, Ghana's industrialisation efforts were driven by Import-Substitution Industrialisation (ISI) strategy based on the ownership of manufacturing firms producing a wide variety of goods. The implementation of this model was influenced by Nkrumah's aspiration to achieve economic independence as a response to the balance of payment problems at the time.

Although some manufacturing establishments had been established in the early 1900's, the development of manufacturing establishments could be described largely as a post-war phenomenon (Baah–Nuakoh, 1997). Manufacturing in the pre-reform era could be considered within the economic

policy structure. The economic policy structure has been described as characterized by "implicit inconsistencies, incoherencies and reversals", partly reflecting the ideological differences and political ambitions of the diverse regimes (Baah–Nuakoh, 1997, p.2).

However, the fundamental characteristics of manufacturing production since independence then can be described as: dominance of small-scale production units; production of mainly non-durable consumer goods; production mainly for the domestic market; weak inter-sectoral linkages; low domestic resource utilization; and exhibiting technical dualism (for more insight see Baah–Nuakoh, 1997).

Performance of the manufacturing sector

The acceptance of the ERP in April 1983 necessitated an industrial policy shift from an inward-looking public sector strategy to an outward-oriented private sector strategy. The core policy objectives have been to develop the international competition of especially local resource-based firms, increase employment generation of small and medium firms and to ensure ecological balance.

The implementation of the ERP made positive impacts on the manufacturing sub-sector, as indicated in the Table. Output grew at rate of 14.5% between 1984 and 1987, compared with the rate of – 1.1% between 1971 and 1979, but was not sustained as it registered a growth rate of 2.6% between 1988 and 1995 (Asante, Nixson & Tsikata, 2000). The mean growth rates for both the manufacturing and industrial sectors were significantly higher for the post-ERP

period than for the pre-ERP period (Asante et al., 2000). According to Asante et al. (2000), the sub-sectors that recorded a remarkable output increase in the post – adjustment period were beverages, sawmill and wood products, cement, textile and garment, iron and steel industries.

Table 1: The growth rates of real GDP, industry and manufacturing and their shares in real GDP

Period	Growth rate (%)			Shares (%) in Real GDP	
	Real GDP	Industry	Manu	Industry	Manu
2005	5.8	7.7	5.0	25.1	8.9
2006	6.2	9.5	4.2	25.8	8.8
2007	6.3	7.4	- 2.3	25.7	8.1
2008	7.3	8.1	4.5	25.6	7.9
2009	4.1	1.6	- 1.3	24.9	7.5
Average (1971 – 83)	- 0.8	- 4.3	- 4.5	17.3	11.2
Average (1984 – 95)	5.0	7.0	6.6	13.9	8.7
Average(1996 – 00)	4.4	4.4	4.6	16.7	8.5
Average (2001 – 04)	4.9	4.4	4.4	24.8	8.8
Average (2005 – 09)	5.9	6.1	2.0	25.4	8.2

Source: ISSER, 2007, 2008, 2009

Manufacturing performance in 1996 fell sharply to 9% of output, a level comparable to the Sub-Saharan African average, but behind South Africa and Zimbabwe (UNCTAD, 2003). While there are slight indications of robustness in the Ghanaian economy, the sector continues to mark low contribution to the national output.

The manufacturing sub-sector experienced the worst performance, shrinking from 4.2% in 2006 to – 2.3% in 2007 (ISSER, 2007). The sub-sector's share of GDP declined from 8.8% in 2006 to 8.0% in 2007 (ISSER, 2007). Contraction in the manufacturing sub-sector is accredited primarily to energy crisis and increase in petroleum prices. Other factors that contributed to dismal performance include the influx of cheap imported goods, unavailability and low quality of raw materials, unavailability and high cost of credit, low domestic demand and lack of market access (ISSER, 2007).

Due to the stable supply of power in 2008, the sub-sector bounced back with a growth rate of 4.5% from -2.3% in 2007(ISSER, 2008). The growth rate is partly attributed to the 50.6% growth in the food processing and beverages sub-sector index, which had been on a continuous upward trend since 1999. The positive growth rate in 2008 was not sustained as it registered – 1.3% in 2009 (ISSER, 2009). The high prices of crude oil during most of 2009 counted for this downturn of the manufacturing sector. Due to the fact that the increase in the crude oil price affected the manufacturing sector both directly and indirectly. This increased their cost of production and led to reduction in employment and hence output.

Ghana's apparel industry

According to Ghana Investment Promotion Centre (GIPC, 2008), Ghana enjoys a long tradition of custom-made clothing. The traditional apparel styles associated with Ghana include the *kaba* (fitted top), *slit* (fitted long skirt), *boubou* (loose, embroidered garment), *kaftan*, and *fugu*. In addition to this, contemporary designers also manufacture western-style trouser suits, skirts, shirts, coats, and jackets, often incorporating indigenous African designs.

The traditional and western-style apparel is mostly produced from local wax, batik, tie-dye and screen printed fabrics as well as imported cottons, linens, and silks. Some artisans in Ghana produce internationally renowned hand woven ceremonial Kente cloth and batakari material. It is however estimated that about 90 percent of the cotton apparel produced in Ghana is sold locally (GIPC, 2008).

Due to the increase in the population growth of Ghana, there has been a significant increase in the demand for ready-to-wear apparel made, apart from the custom-made clothing Ghanaians are accustomed to. This has led to the importation of clothing. It is estimated that, about US $180 to 200 million is used to import used clothing into Ghana every year (GIPC, 2008). The imports of new and used clothing arrive in Ghana mainly from China, Thailand, Indonesia, Hong Kong, India, Pakistan, Bangladesh, USA and UK (GIPC, 2008).

Ghanaian apparel exports have also received a boost from preferential trading agreements. Ghana has enjoyed duty free manufactured exports to European Union markets under the Generalized System of Preferences (GSP) Multi-Fibre agreements of textile quotas until 2005. In addition, the US recently

passed the African Growth and Opportunities Act (AGOA), under which Ghana is one of 34 sub-Saharan countries (GIPC, 2008). AGOA gives preferential trade treatment for reforming developing countries. This preferential treatment provides for duty-free and quota-free treatment for certain products imported from eligible SSA countries. According to Quartey (2006), the provision covers textiles and apparel and practically, extends to over 6,500 products entering the U.S. market from SSA.

Significance of Ghanaian textile and apparel industry

The exports of textile and apparel have been the most important source of foreign exchange and revenue to textile and apparel manufacturing firms. In 2000, Ghana qualified for AGOA and exports of Ghanaian textile and apparel to the US market amounted to $550,000 in 2002, $4.5 million in 2003 and $7.4 million in 2004 which shows an increase in textiles revenue (Quartey, 2006). On the other hand, imports of US textile and apparel were $8.87 million, $12.73million and $11.48 million respectively over the same period (Quartey, 2006). The main export destination for made-in–Ghana textiles as at 2004 includes EU countries (55%), U.SA (25%), ECOWAS (15%), and the remaining 5% percent exported to other countries mostly Southern and Eastern African states (Quartey, 2006).

Even though Ghanaian manufacturers of textiles and apparel generally agree that the market for exports is huge, they have stipulation about operating in some of these markets mainly within the ECOWAS sub-region due to trade barriers. Some of the trade barriers include: transit tax collected at Benin,

extortion by Nigerian authorities, the imposition of 20% duty by Cote d'Ivoire (contrary to ECOWAS regulations), and the risk of currency devaluation (Quartey, 2006). According to Quartey (2006), poor packaging of some manufacturers/exporters also serves as a barrier to exports to markets such as the EU and the United States of America. Also, poor finishing of products (quality), technical barriers, and inability of some manufacturers to meet export orders on schedule, among others (Quartey, 2006).

Micro and small enterprises in Ghana

It is not easy to define small-scale industries or small enterprises and micro enterprises. According to the Bolton Report (1971), small firms are present in virtually every industry and the characteristics they share as small firms are sometimes not present as apparent because of the differences arising from the contrasting conditions of the different industries. There is also extreme variation regarding the efficiency, methods of operation, the nature of the market served, and the size of the resources employed. Thus, a manufacturing business employing up to 200 people has very little in common with a small shop owned and run by a married couple. The report proposes that a small firm has three essential characteristics which are: Management by its owner(s) in a personalized way; relatively small share of the market in economic terms; Independent in the sense that it does not form part of a larger enterprise and its ownership is relatively free from outside control in its principal decision.

European Union (EU) (1995) definition of the "Small and Medium Enterprise" (SME) comprises the following: micro enterprise employs less than 10 persons; small enterprise employs 10 to 99 persons; and medium enterprise employs 100 to 499 persons.

In Ghana, this difficult in the definition of small-scale industries can be seen in the variation of definitions of it among Boards and Bodies. According to the Ghana statistical Board; it is an enterprise that employs twenty-nine (29) or fewer workers. According to the National Board for Small Scale Industries (NBSSI), an apex body established by Act 434 of 1981 for promoting small-scale industries, defined it as an enterprise whose employment capacity is 29 persons or less and with assets in terms of machinery, equipment and tools or investment capital not exceeding the cedi equivalent of $100,000.

The important role played by SMEs has increasingly realized over the past years. SMEs contribute to: the basis of industrialization; employment; optimal use of resources and considerable multiplier effects on the economy.

The small scale industry sector provides a stepping stone for businesses to grow along the path to become lager industries. As pointed out by Parker, Riopelle, and Steel (1992) nations do not have larger industries to begin with, it is some of the existing small scale firms that grow into large industries. The process of industrialization normally begins with the rapid growth of small scale industries, for which some expand to medium and large scale firms while the rest survive the market niche where they remain competitive with large scale firms. The small scale firms can also endanger industrialization rooted in indigenous

entrepreneurship due to low technological capacity (Afful, 2002). Bruton (1998) also noted that if the small scale firms are implemented successfully, they would develop both entrepreneurial and managerial skills that are needed as a basis for local investment in large scale firms. Indeed, small scale industry is the backbone of the large scale industries.

In times of economic downturn, small scale firms served as a critical source of primary and secondary employments as well as income for a large majority of the working population. According to Steel and Webster (1992), small scale firms provide roughly 90 percent of manufacturing employment.

Small scale sector provides the large scale sector with goods and services at very low prices, which makes high profits possible of the large scale sector. Employees of the large scale sector also obtain cheap goods and services from the small scale firms. Hence, the small scale sector help keep the prices of labour power low, and contributes to an increase in surplus value and the accumulation of capital in the industry.

Institutions

Due to the lower number of large scale and medium scale industries in Ghana; increasing population growth, the government deems it fit to have established institutions such as the National Board for Small Scale (NBSSI), the Ghana Regional Appropriate Technology Service (GRATIS) Foundations and many others to provide assistance to micro and small scale firms.

National Board for Small Scale Industries (NBSSI)

The National Board for Small Scale Industries (NBSSI) is the apex governmental institution responsible for the development of Micro and Small Scale Enterprises in Ghana. It was established in 1981 by an Act of parliament, Act 433, to oversee the growth of small industries in the country. NBSSI has four main divisions, namely: Policy Planning, Monitoring and Evaluation; Entrepreneurship Development; Investment and Credit; and Administration.

The main objectives of NBSSI are to: contribute to the creation of enabling environment for small-scale enterprise development; contribute to the development of an enterprise culture in Ghana; provide non-financial support for small-scale business development; facilitate access to credit for small-scale enterprises; and promote MSEs sectoral associations.

The activities of NBSSI are implemented through Business Advisory Centres (BAC) and Credit Units located in the regions and districts. The BAC promotes activities directed at entrepreneurship development, which include: facilitating the improvement of the environment for small-scale business creation and growth; providing tailor-made entrepreneurial, managerial and technical training; provision of advisory, counselling and extension services; and promoting group formation and strengthening MSEs associations.

The Credit Unit aims at creating an enabling environment for MSEs to operate in. NBSSI manages the credit schemes of small-scale enterprises as a revolving fund. Such loans would be accessed through personal guarantee and

bear reasonable interest rates. The maturity period is one year. The Credit Unit also facilitates MSEs access to bank credit and other financial institutions.

It could be viewed from the above that, the NBSSI is mostly involved in the direct provision of services through Business Advisory Centres and Credit Units, and is rarely engaged in strengthening the private sector.

Based on the national initiative to accelerate craft development, NBSSI has already started establishing an Art and Craft Village to promote the sub-sector. Accordingly the construction of working and marketing places for about 700 handicrafts men, engaged in various handicrafts activities in a locality called Aburi, has been started (GOG, 2008). In addition, NBSSI is also supporting these craftsmen by giving them appropriate training, arranging for them, experience sharing visits, searching better markets for their products, and organizing them for better working conditions.

Ghana Regional Appropriate Technology Services (GRATIS)

GRATIS was established in 1987 by the then Ministry of Industries, Science and Technology with funding from the Canadian International Development Agency (CIDA) and the European Commission (EC). As a strategy of meeting its objective, Intermediate Technology Transfer Units (ITTU) now regional technology transfer centre (RTTC) was opened in nine regions of Ghana.

The GRATIS was established to offer technical and managerial support through training to small and medium-scale enterprises. The training programme can be categorized into engineering and non-engineering training programmes.

The non-engineering training programmes include: garment printing, masonry, carpentry, soap making and food preservation; rural enterprise scheme; entrepreneurial and basic management training. The training programmes take two forms: training apprenticeship; and professional skills upgrading which involve short-term duration of engineering, master craftsmen, graduates from universities and technical vocational institutes for industrial attachments.

GRATIS also provides soft loans as working capital to clients, give equipment on hire/purchase, turn-key packages, and advice clients on the coordination of the disbursement and utilization of funds in their business.

Theoretical literature

This section seeks to review the different branches of the economic literature on innovation

Evolutionary Economics

According to Nelson and Winter (1982), evolutionary economics represents an exit from neoclassical theories and assumptions (bound rationality, with incomplete information and no foresight, where actors are not independent and not optimatizing their utility but rather adopting a "satisfying" behaviour). It attempts to clarify the innovation process by integrating the related micro- (firm-level) and macro-evidence (Nelson & Winter, 1982). It is rooted in the Schumpeterian vision of the economic world as a series of disequilibria, however seeing innovation as an endogenous process rather than as exogenous force acting

on the economic system (Léger & Swaminathan, 2006). The environment in which the firm operates must also be engaged into account, which is especially considered in the literature on systems of innovation (Lundvall, 1992; Edquist 1997).

In evolutionary economics, the concept of diversity is very important to the explanation of inter-industry and inter-country differences (Nelson, 1993). Considering the innovation system as a whole, allows explaining a significant portion of inter-country differences in innovative performance (Nelson, 1993; Kim & Nelson, 2000; Freeman, 2002; Hu & Mathews, 2005), which pleads for the addition of such factors in the analysis of innovation.

Another important concept in evolutionary economics is continuity. Through the execution of routines or day-to-day activities, a learning process takes place: "learning-by-doing" and "learning-by-using" add to the development of implicit knowledge that is difficult to transmit (Ruttan, 2001). There are great controversies surrounding the effect of continuity and innovation. On the one hand, the knowledge accumulated is instrumental for the absorption and use of inter-firm spillovers (Ruttan, 2001). On the other hand, Nelson and Winter (2002) argued that, the knowledge accumulated from routine activities cause resistance to change, and hence can slow innovation or adoption in the medium- and long-run.

One can also differentiate between two types of innovations: the cumulative innovation stimulated by the need for improvements that has been recognized through day-to-day activities; and the discrete innovation, independent development that often indicates the commencement of a new technological

paradigm (Dosi & Nelson, 1994; Klevorick & Levin, 1995). In the occurrence of both types of innovations, knowledge and information are inputs to different extents (Dosi & Nelson, 1994; Klevorick & Levin, 1995). But, these differences arise the need for different policies, for example, IPR would hinder technological progress when used to protect cumulative innovations, while they would be advantageous to society for independent innovations (Léger & Swaminathan, 2006).

From the theory, it can be concluded that the basic assumptions of evolutionary economics reflect more sufficiently the processes and environment characterizing innovation. The adhesiveness of knowledge, and the costs related to knowledge transfer are theoretically better represented when distinguishing between knowledge and information and taking them as related (Léger & Swaminathan, 2006). In all, diversity, continuity, and IPR explain a significant proportion of inter-industry and inter-firm differences in innovation.

Industrial economics

Smith (1937) identifies innovation as requiring the investment of money and as an essential economic activity suggest gains. Schumpeter (1942) also explained the role of economic agents (inventor and entrepreneur) in technical advance. He defined entrepreneur as one who sees how to fulfil currently unsatisfied needs or perceives a more efficient means of doing what is already being done and receives profits as a result (Kamien & Schwartz, 1982). According to Schumpeter (1942), technological innovation is referred to as

'creative destruction' whereby monopolies are formed in the interim due to the 'catching up' of newcomers. In the case of a perfectly competitive market, the profits which came as a result of innovation would be immediately reduced to normal levels due to imitation by other firms (Schumpeter, 1942). Hence perfect competition cannot exist along with entrepreneurship (Schumpeter, 1942).

Schumpeter (1942), however, said that larger firms have a significant advantage with respect to innovation. As shown by some researchers (Scherer, 1965; Cohen & Klepper, 1996), an industrial organization of large monopolistic firm offers decisive welfare advantages and larger firms are able to develop market reputation, achieve economies of scale, diversify, etc. The more widely spread the reputation and name of a firm, the higher the chances of full exploitation of its research efforts (Nelson, 1959). On the other hand, Schmookler (1972) contented that after a certain 'large' size, the efficiency of innovative activity varies negatively with firm size. An additional reason for the lack of innovation by large firms might be the 'scarcity of ideas' model (Varian, 2004). Ideas developed from the existing technological base and scarcity means that just one inventor caters for the market with his or her idea (Léger & Swaminathan, 2006). They further argued that disclosure of the ideas increases the probability that the succeeding idea would come from a competitor.

Innovation is believed to be extremely competitive and small firms are in a better position to completely take advantage of it, due to their focus on new innovative technologies (Hicks & Buchanan, 2003). Small firms have been revealed to be more resourceful in the use of capital and labour resources than

large firms (Acs & Audretsch, 1991). Nevertheless, both small and large firms exhibit advantages and disadvantages, the right firm size could depend on the type of industry (Léger & Swaminathan, 2006).

Though Schumpeter (1942) did speak about the innovation process, he did not explicitly explain how innovations come about nor did he consider whether there could be too much destruction. An investigation in the allocation of resources for innovation was given by Arrow (1962). Innovative competition creates privileged levels of uncertainty as competition can come from any industry (Arrow, 1962). Arrow (1962) was the first to differentiate between invention and risk-bearing. In doing so, he threw light on a principal and agent problem. Invention is carried out by the agent and he or she may or may not wish to bear any risk (Léger & Swaminathan, 2006). If the agent chooses not to, he or she immediately accepts the fee for his or her service and the investors (principal) then bear most of or all the risk (Arrow, 1962). Given the features of knowledge-incomplete appropriability, a free enterprise economy is likely to under invest in invention and research (Léger & Swaminathan, 2006). Léger and Swaminathan (2006) claim that the under investment will be bigger for more fundamental research.

There are two solutions to this problem: turning to the free forces of the market, and government intervention, mainly in financing fundamental research (Léger & Swaminathan, 2006). It should be noted that Schumpeter (1942) and Arrow (1962) recognize that monopoly power tends to hold back innovative growth because of its complacence in the market share. This leads Hellwig and

Irmen (2001) to conclude that the motivation to innovate is greater in the perfectly competitive market than monopolistic market.

According to Mansfield (1977), government intervention can be utilized in the case where an inventor is unfulfilled with the incentives given to invest in R&D, and hence refrains from inventing, though society may gain from it. However, government innovative undertakings have not been predominantly successful and few western governments are caught up in the actual development and marketing of innovations (Kamien & Schwartz, 1982). This was refuted by Scotchmer (2004) who claims that a considerable amount of the innovation taking place is the outcome of government development and mixed innovative efforts from both the public and private sectors of the economy.

From a cumulative innovation perspective, transitory market power and the associated reduction in diffusion of information could block subsequent innovation (Hall, 2004). Often innovations come from diverse industries and offer further learning opportunities and responses to unfulfilled demand (Léger & Swaminathan, 2006). Cohen and Levinthal (1989) argue that as an industry becomes more competitive, the private loss associated with the public good character of R&D spillovers diminishes relative to the private gain of being able to exploit competitor's spillovers. Competition tends to be most brutal when firms are on the same level (Tirole, 1993). When development costs are high, imitation is a probable firm strategy (Léger & Swaminathan, 2006). Owing to this, resources are allocated towards those innovative activities which are not easy to

be imitated (Shrieves, 1978). In LDCs, imitation may be new preferred strategy as it enables learning through reverse engineering (Lall, 2003).

In industrial economics, two important determinants of innovation were identified market structure and firm size. With regard to market structure and innovation, there are three views; positive and negative correlations between monopoly power and innovation (Scherer, 1967; Levin, Cohen & Mowery, 1987), perfect competition is the more appropriate market structure to create incentives for innovation (Boldrin & Levine, 2003), and finally, sequential innovation occurs best in a monopolistic competitive structure due to the 'customer's love for variety (Dixit & Stiglitz 1977). According to Tirole (1993), there is learning within a firm based on R&D activity, past experience, lead time reputation, and learning within an industry. The learning within an industry is limited to firms that are alike in size and development (Tirole, 1993). Innovation can thus, be viewed as an outcome of firm size, the industry it belongs to, market demand and structure and the associated spillovers and diffusion that takes place within the industry (Léger & Swaminathan, 2006).

Institutional economics

In institutional economics, externalities are considered to be an important characteristic of innovation. Property rights are defined to be internalizing externalities, and they also ensure that the benefits from an invention are concentrated with the innovator, which provides further incentives for additional innovation (Demsetz, 1967). North (1990) claims that, with any property rights

structure transaction costs are positive which implies that rights are never perfectly specified and enforced.

Coase (1960) put forward that, when transactions are costly, institutions matter a lot. Societies build up informal institutions, such as culture and norms, as well as formal institutions, to lessen the significance of transaction costs (Williamson, 2000). Formal institutions significant to innovation are International Property Right (IPR) and the related legal organizations necessary for their enforcement, which are part of the institutional environment (Léger & Swaminathan, 2006). Léger and Swaminathan (2006) argued that information that is not afforded legal protection cannot be sold on the market, in order to sell the information, the inventor must disclose it – but then has nothing left to sell, because of imitation.

The environment in which these rights exist is crucial: First and foremost, it determines the quality of the rights and hence the extent to which they reduce transaction costs and correct for the public-good market failure (Williamson, 2000). On the other hand, in a world of incomplete contracts and transaction costs, Pagano and Rossi (2004) explain the existence of self-reinforcing interactions between property rights and technology. Countries tend to acquire abilities because they have International Property Right (IPR) and tend to obtain IPR because they have abilities – some countries may be trapped in equilibrium where they do not acquire IPR because they do not have particular abilities, and they do not acquire these abilities because they do not have IPR (Léger & Swaminathan, 2006).

The relationship between IPR and innovation has been a crucial task for policy makers to use due to the conflicting results from developed and developing nations. For instance in OECD countries, IPR would play a significant role in supporting innovation (Furman, Porter & Stern, 2002; Alfranca & Huffman, 2003). Similar results were obtained when the framework was applied to developing and industrialized countries (Lerderman & Maloney, 2003). Hu and Mathews (2005) on the other hand, expanded the Furman et al. (2002) framework and applied it to five East Asian countries, and did not find IPR to be a significant factor explaining innovation. Similarly, comparing the determinants of innovation for LDCs and industrialized countries shows that, while IPR have an inverse and non-significant impact on innovation in the former, the effect is positive and significant for the latter (Higino, 2005).

From the theory, researcher (Williamson, 2000; Pagano & Rossi, 2004) has been able to explain that transaction costs, informal and formal institutions play a significant role in determining innovation. They also found that transaction costs negatively affect the incentive effects of IPR. Similarly, it is essential to take into account in studying innovation. The role of formal and informal institutions, one such institution IPR, is however not clear theoretically, and empirical evidence is mixed, especially for LDCs (Léger & Swaminathan, 2006). More empirical evidence on such institutions in LDCs could help purify the theory and support the development of more suitable innovation and industrial policies in these countries.

International trade

In the literature (Grossman & Helpman, 1990; Grossman & Helpman, 1991; Grossman & Helpman, 1994) interactions between trade and innovation received increasing attention due to the growing importance of trade liberalization and economic integration. In these literatures, the principles of growth theory have been transposed to the two-country case, taking into account the differences in factor endowments and prices between the trading partners (Léger & Swaminathan, 2006). They argued that, the determinants of innovation under international trade are similar to the ones in the different branches of economics, e.g. endowments and factor prices, market structure and competition, and other demand pull factors. This section however, focuses on the problems of trade as a cross-country channel of information.

On the one hand, intended information transfer occurs, through technology transfer and therefore IPR are needed to define and protect the object of the transaction, and serve as additional sources of revenue for the patent-holder (Léger & Swaminathan, 2006). On the other hand, unintended transfer takes place through spillovers, either from foreign direct investments (FDI) or trade flows (Léger & Swaminathan, 2006). Coe and Helpman (1995) found that total factor productivity in industrialized countries to be positively affected by foreign R&D, more so for more open countries but less so for G7 countries, the most innovative ones.

In addition, certain models believe the existence of a freely accessible global stock of information to which countries can turn to find suitable solutions

to their problems (Grossman & Helpman, 1991). On the contrary, other models assume entirely endogenous technological change, implying that a country's technological position is related only to its own innovations (Romer, 1990).

It is now obvious that, intended and unintended technology transfers significantly affect the performance of domestic innovation, but again, country characteristics (the level of domestic absorptive capacity) have to be taken into account (Léger & Swaminathan, 2006). More empirical evidence on experiences in LDCs could help refine the innovation theory and support the development of more appropriate innovation and industrial policies in these countries (Léger & Swaminathan, 2006).

The sources of innovation

A lot of explanations had already been given to the determinants of innovation but, a reasonable explanation of innovative performance would have to take into account the fundamentally 'two-faced' nature of innovation. On the one hand, innovation involves the identification of a potential market for a new product or process, and an endeavour to satisfy this market. On the other hand, it involves technical knowledge which may be normally accessible, but may also integrate the results of original research activity. In the innovation literature, there are many attempts to build a theory predominantly on one or other of these two aspects. Broadly speaking, social scientists (especially economists), have stressed the market or demand side of the process, whilst natural scientists and engineers have tended to stress more strongly the research and technical side to the neglect

of market (Nemet, 2006). These one-sided approaches may be designated briefly as 'demand-pull' and 'science-push' theories of innovation (Nemet, 2006).

Demand side (Demand – pull)

Shifts in relative factor prices (Hicks, 1932), geographic discrepancy in demand (Griliches, 1957), as well as the recognition of "latent demand" (Schmookler, 1966) and prospective new markets (Vernon, 1966) all affect the extent of the payoff for successful investments in innovation (Nemet, 2006). Demand "steers" firms to work on certain problems (Rosenberg, 1969). Changes in market demand can therefore create opportunities for firms to invest in innovation to satisfy unmet wants or needs (Nemet, 2006).

The demand-pull argument has suffered severe criticisms on three grounds. First and foremost, demand explains incremental technological change far better than it does discontinuous change, so it fails to explain for the most important innovations (Mowery & Rosenberg, 1979). Secondly, the definition of "demand" in empirical studies has been contradictory and overall, was considered too broad a concept to be useful (Mowery & Rosenberg, 1979; Scherer, 1982). Finally, the arguments' assumptions regarding firm capabilities, expressing doubt about (1) how far firms might vary from existing "routines" in order to satisfy unmet human needs or wants, (2) the degree to which firms in general have access to a large enough accumulated techniques to address the glut of needs that could be expected to surface, and (3) how efficiently firms can recognize "revealed needs" from an almost infinite set of likely human needs (Nemet, 2006).

Research and technical side (Science and technology push)

Bush (1945) articulated a significant version of the science and technology argument in what became known as the "post-war paradigm," and later as the "linear model." He later developed a model of technology transfer rooted in a succession of knowledge from basic science to applied research to product development to commercial products. Dosi (1982) attributed this line of argument to: "the increasing importance of science in the innovation process, increasing complexity which necessitated a long-term view, apparently strong correlations between R&D and innovative output, and the inherent uncertainty of the innovation process".

Rosenberg (1974) claims that, the existence of practical "technological opportunities" plays a role in determining the rate and direction of innovation, and these may rely on advancement of science and technology in each industry. "Capabilities push" however, emphasized changes in a firm's ability to follow meticulous technology paths (Freeman, 1974). This means that firms must invest in scientific knowledge to develop their "capacity to absorb" knowledge and utilize opportunities emerging from the state-of-the-art elsewhere (Rosenberg, 1990).

The science and technology-push argument has suffered severe criticisms on three grounds. One critique of the argument is that the emphasis on a uni-directional succession within the stages of the innovation process was incompatible with successive work that highlights feedbacks, interactions, and networks (Freeman, 1974; Freeman & Louca, 2001). Another is that the linear

aspect of the model defended the "sequential" nature of science and technology, even if feedbacks are acknowledged to be strong (Rothwell, 2002). Finally, it ignores prices and other changes in economic conditions that affect the profitability of innovations (Nemet, 2006).

Following the significant responses to both arguments, weaker versions of each were used to support the claim that both demand, and science and technical side factors are essential to explain innovation (Nemet, 2006). According to Freeman (1974), successful innovations should show the ability to connect, or "couple" a technical opportunity with a market opportunity.

Economic implications of the types of innovation

In any case, the sources of innovation are able to produce two types of innovations (process and product/service) which have clear economic implications. On the one hand, a product innovation corresponds to the creation of a new production function (Kamien & Schwartz, 1982), which includes the likelihood to discriminate an existing product (Beath, Katsoulacos, & Ulph, 1987; Vickers, 1986). On the other hand, a process innovation can be viewed as an outward shift of an existing supply function, which corresponds to lower variable costs in the production of an existing product or service, and is therefore a productivity increase (Beath, Katsoulacos, & Ulph, 1995; Dasgupta & Stiglitz, 1980).

Economic theory suggests that, all things being equal, both the formation of a new supply function and the outward shift of an existing supply function can

lead to higher output levels and thus revenue growth (Koellinger, 2008). Thus, both product and process innovations can lead to economic growth of the innovator, independent of the firm's ability to suitable private profits from the investment that caused the innovation (Hannan & McDowell, 1990; Sutton, 1991).

Possible 'early mover' advantages will be limited or even reversed if the technologies on which the innovations are based demonstrate either falling prices or rapid technological improvements over time (Beath et al., 1995). In addition, the basic problem for the innovator is, however, to protect its process or product innovation from imitation by rivals. If all competitors use the same improved process and produce the same product, no single firm in the market will be able to do better than its rivals, including the firm that first brought the innovation to the market (Teece, 2006). The faster an innovation is copied by other firms, the less time the innovating firm has to reap extra payoffs from the investment in the innovation (Koellinger, 2008). The game-theoretic literature indicates that firms that are able to outpace their direct competitors in technological development will arrest market shares and profits from their rivals, and even the competitors out of business (Koellinger, 2008).

Definitions and orientation

An Innovation is a new or significantly improved product introduced to the market or the introduction of a new or significantly improved process introduced in an organization. A new product is a product whose technological

uniqueness or intended uses vary significantly from those of previously produced products. An improved product is an existing product whose performance has been significantly improved. Innovation is, however, based on the results of new technological developments, new combinations of existing technology or employment of other knowledge acquired by the company. The innovation should be new to the firm but might not necessarily be new to the market. Also, changes of a solely aesthetic nature and purely selling of innovations wholly produced and developed by companies was included in the definition of the innovation. The two types of innovation have been defined by Lee (2003) as follows:

Product innovation is a good or service which is either new or significantly improved with respect to its basic uniqueness, technical specifications, incorporated software or other immaterial components, and intended uses.

Process innovation includes new or significantly improved production technology and methods of delivering products. The outcome should be significant with respect to the level of output, quality of products, costs of production and distribution. The innovation should be new to the company; the company may not necessarily be the first to introduce the process.

According to Gallouj and Weinstein (1997), conceptualization of innovation helps to identify several types of innovation, stemming from different mechanisms. In particular, innovations come in many different forms ranging from incremental or evolutionary innovations, radical or revolutionary or

breakthrough innovations, improvement innovation, ad hoc innovation, re-combinative innovation, to formalization innovation.

Incremental innovations consist of minor improvements or plain adjustments to existing products or technology. In this case, the structure of the system remains unchanged. This type of innovation may also generate the improvement of final characteristics, as well as the reduction in production costs. Their individual impact on the economic system is usually limited. Radical innovations on the other hand are generally considered as being a risky departure away from existing practice (Hage, 1980). Radical innovations show key characteristics that are inherently different from existing products or technologies. Radical innovation often lies at the heart of sustained wealth creation for both the individual firm as well as for the society as a whole (Schumpeter, 1975; Ahuja & Lampert, 2001). Re-combinative innovations require the combination of different final and technical characteristics. They may also involve the creation of a new product by combining the characteristics of two or more existing products, or the creation of new products by splitting up an existing product, separating various characteristics and turning certain elements into autonomous products. Ad hoc innovations are given by social, interactive constructions of a solution for particular problems posed by specific customers, and they often imply that firms and clients cooperate by sharing their knowledge and experience on the specific issue. Improvement innovations refer to the process of improving selected characteristics without changing the overall planning of the system. Finally,

formalization innovations refer to the process of putting the service characteristics in “order”, by specifying them and making them concrete.

Technological advancement however, refers to new or improved goods and services and new improved production or distribution processes. Technological advance occurs only in the very long-run, because in the short-run technology and plant and equipment are fixed. In contrast, the very long-run is a period in which firms can introduce entirely new products. Technological advance is a three-step process of invention, innovation, and diffusion (McConnell & Brue, 1999).

Empirical literature

In this study, it is important to note that the determinants of innovations are sector specific, although some determinants may be the same across regions. The factors that have been found to influence innovation include industry characteristics, firm characteristics and institutional factors. In this sub-section, we provide a review of some empirical studies of the determinants of innovations.

Lall et al. (1994) used case study and panel data surveys to analyse the acquisition of technological capabilities in textiles and garments, food processing, woodworking and metalworking industries in Ghana. They made use of the cluster analysis technique based on the limited number of imperfect quantitative indicators, therefore proved an incomplete picture of the technological development process in a firm. Lall et al. (1994) found statistically significant differences between the relatively technologically competent firms and other

firms. They also indicated the importance of understanding what enabled some firms to be technologically more competent than others.

Baldwin and Sabourin (1999) examine the factors contributing to innovative activity in the Canadian food processing sector using the logistic model. It was found that business practices, R&D, and size effects are significantly related to the probability that a firm is innovative. Their study also found that increasing firm size and decreasing market competition would lead to more innovation. Size is positively related to the probability of innovation. They found that foreign controlled plants in the food processing sector are more likely to introduce an innovation. Nationality of ownership was positive and highly significant even after engineering practices are taken into account.

Eaton and Kortum (1999) developed a model of endogenous innovation with international diffusion, using patenting abroad from the 5 research economies (USA, Japan, Germany, UK, and France) as a proxy for diffusion. Their results show that international diffusion of ideas is important: Countries adopt between 50% and 75% of ideas generated abroad, with the USA deriving most of its growth from its local innovation, and the USA and Japan generating most of the growth in other countries of the sample. It is however believed that national characteristics affect the performance of innovation, and are likely to affect the benefits a country can obtain from international technology diffusion.

Lee (2003) analyzed the determinants of innovation in the Malaysian manufacturing sector using logit model. The probability to innovate was used as the dependent variable; the explanatory variables included age of firm, extent of

local ownership, firm size measured by total employees, the percentage of sales derived from exports, four types of ownership, type of industry as the determinants of the innovations in Malaysia. Evidence from this study shows that propensity to innovate is positively related to firm size, market concentration and negatively correlated to the age of the firm and the share of exports in sales but the influence of industry's technology level is inconclusive. The findings also indicate that the extent of local vs. foreign ownership is not an important determinant of innovation.

Corrocher and Zirulia (2004) analyzed the innovation and Schumpeterian competition in the mobile communications service industry. This study was done on the mobile communications service industry in Italy. The rationale for their studies was that the existence of exogenous and endogenous switching costs makes price competition not much attractive to firms and drives them towards a process of Schumpeterian competition in the market. In their analysis, they proposed a system of firms' innovative strategies that is based upon the installed base of customers (firm size) and the stage of industry evolution. These factors identify firms' capabilities and market incentives to innovate in order to compete in the market. In this framework, demand affects firms' choices in two ways. First, the ability of designing different tariff plans is related to the level of information firms have on users' needs and behaviour: relatively large firms are more able to segment the market than small firms. Second, the incentives to introduce innovations depend upon the level of market saturation: as market grows, firms concentrate more and more on their existing users.

Mohnen and Röller (2005) consider the obstacles to innovation as indications of failures or weaknesses in the corresponding innovation policies. They examine whether innovation policies are complements or substitutes in the sense of reinforcing their negative effect on innovation behaviour and innovation output. They conclude that the two phases of innovation, i.e. the probability of becoming an innovator and the intensity of innovation, are subject to different constraints. The evidence seems to suggest that substitutability among policies is more often the norm as far as the intensity of innovation is concerned and complementarily as far as making firms innovative is concerned. When it comes to turn non-innovators into innovators, it is important to remove a bunch of obstacles at the same time.

Dachs and Ebersberger (2007) tried to find out if foreign ownership influences the innovative behaviour and performance of enterprises using kernel-based matching approach as a non-parametric test. After controlling for size, sectoral affiliation, export intensity and other variables that influence innovative behaviour they found that the impact of foreign ownership on innovation input and outcome is not significant in most variables. Membership in a multinational enterprise group, however, significantly helps to overcome different obstacles in the innovation process, such as the lack of financial resources, the lack of technological and market information or organizational problems. The nationality of the parent enterprise does not matter for innovative behaviour and performance except in the case of Anglo-Saxon-owned enterprises.

Maria, Joao and Mario (2007) studied the barriers to innovation that influence the innovation capability of Portuguese industrial firms using logistic regression model. It was found that firms which innovate are those that have more perception of the barriers to innovation. However it was also observed through the logistic regression model that some of the relations established between the barriers to innovation and the entrepreneurial innovative capacity are not statistically significant. The results reveal that the majority of the variables associated with the barriers to innovation present a negative signal. The results provide insights that high innovation costs, lack of financing sources, lack of customers' responsiveness to new products have a negative and significant effect on the innovation propensity.

Wignaraja (2008) examined the links between ownership, innovation and exporting in electronics firms in three late industrializing East Asian countries (China, Thailand and the Philippines) drawing on recent developments in applied international trade and innovation and learning. Probit model was used in this study. The econometric results confirm the importance of foreign ownership and innovation in increasing the probability of exporting in electronics firms. Higher levels of skills, managers' education, capital and experience accumulated. Furthermore, a technology index composed of technical functions performed by firms emerges as a more robust indicator of innovation than the R&D to sales ratio.

Summary

In this chapter, we looked at the overview of manufacturing sector in Ghana as well as theoretical and empirical literature on innovation. The literature was reviewed to identify the key variables for the analysis of determinants of innovation.

Also, it was identified in the literature that firms and industrial characteristics influence the ability to innovate. It was noted from the empirical literature that discrete choice models are widely used by researchers to analyse determinants of innovation. Among the discrete choice models reviewed, logit model was employed to study determinants of innovation.

CHAPTER THREE

METHODOLOGY

Introduction

The purpose of this chapter is to explain the methodology used in investigating the determinants of innovation. It describes, the study area, study design, population, sampling of respondents, sources and type of data collection and the research instrument used. It also discusses the econometric model, estimation technique, research variables and their operationlisation, estimation procedure and estimation method.

The Study Area

Accra is the capital and largest city of Ghana, with the population of the city estimated at 3,963,264 as of 2011. Accra is also the capital of the Greater Accra Region and of the Accra Metropolitan District. Accra is fasten to a larger metropolitan area called the Greater Accra Metropolitan Area (GAMA), which include: Accra Metropolitan, Tema Metropolitan, Ga East Municipal, Ga West Municipal, Ga South Municipal, Ledzokuku-Krowor Municipal, Ashaiman Municipal and Adenta Municipal. The crossroads of the Lafa stream and Mallam junction serves as the western border, while the Nautical College forms the

eastern border of the city. The Great Hall of the University of Ghana forms Accra's northern border, while the Gulf of Guinea forms the southern border. Due to its size, Accra is divided into 11 sub-metropolitan areas: Ablekuma Central, Ablekuma North, Ablekuma South, Ashiedu Keteke, Ayawaso Central, Ayawaso East, Ayawaso West Wuogon, La, Okaikoi North, Okaikoi South, and Osu Klottey.

Accra is Ghana's cultural and tourist heart, which includes monuments, museums, a wide variety of hotels, nightclubs, and other attractions. Accra hosts the National Museum, National Theatre, National Cultural Centre, Du Bois Centre houses, Kwame Nkrumah Mausoleum, Usher Fort and James Fort, Osu Castle, Accra International Conference Centre, Labadi Beach Hotel, La Palm Royal Beach Hotel, Golden Tulip Hotel, Novotel Hotel, Hotel Wangara, Hotel Shangri-La and Erata Hotel. Other sites wealth noting are Golden Jubilee House, Accra Centre for National Culture, the Ohene Djan Stadium, the Independence Square, the Parliament of Ghana, and the Ghana-India Kofi Annan Centre of Excellence in ICT.

Accra's economy consists of the primary sector (farming, fishing, mining and quarrying), the secondary sector (manufacturing, electricity, gas, water, and construction), and the tertiary sector (wholesale trade, retail trade, hotel, restaurant, transportation, storage, communication, financial intermediation, real estate service, public administration, education, health and other social services). The city's largest economic sector is the tertiary sector and employs about 531,670 people. The primary sector being the smallest economic sector of Accra

employs 91,556 persons. The primary economic activities are predominantly fishing and urban agriculture, with fishing accounting for 77.8% of the total labour employed. Fishing operations are outstanding at the Jamestown, La, Teshie, Nungua and Chorkor fishing shores. The economically active population of Accra is sketchy to be 823,327. However, the daily incursion of people from towns outside the city makes this figure higher than approximated on most days.

The area for the study, however, covered the Accra metropolis of the Greater Accra Region. It was chosen as the area of study, because most of the apparel firms found in this area produce for the domestic market and also for export. It is one of the cities where apparel firms flourish well.

Research Design

This study adopted the survey research design to analyse the determinants of innovation in Ghanaian apparel industry in the Accra metropolis in the Greater Accra Region. The main strength of the survey approach is that it can be used for both descriptive and exploratory purposes and allows for direct contact between the researcher and the respondents in the process of collecting data for a study (Singleton, Straits & Straits, 1993). Another advantage of this approach is that it can be used to obtain detailed and precise information about large heterogeneous population.

Conversely, the main weakness of survey design as compared to other designs, relates to the possibility of respondents not giving out true nature of events or state of affairs. This is due to the fact that in survey design, the

researcher relies on reports of behaviour rather than observation of behaviour. According to Singleton et al (1993), the consequence of this is that, measurement errors are produced by respondents' lack of truthfulness, misunderstanding of questions, and inability to recall past event accurately and by the instability of their opinions and attitudes.

Population

The target population for the study comprised all the industrial tailoring and seamstress firms in the Accra Metropolis in the Greater Accra Region. The study, therefore, covers MSMEs in the industrial production of hats and caps, shirts, suits, trousers, blouses, gloves, dressing gowns, academic caps and gowns, etc, (i.e. GSS Industrial Classification code 1810: manufacturing of wearing apparel by cutting and sewing fabrics, leather, etc) and are located in the Accra Metropolis. In the beginning, lists of apparel MSMEs were obtained from the Association of Ghana Industries (AGI), Ghana Statistical Service (GSS), Ghana National Tailors and Dressmakers Association (GNTDA), and Ghana Association of Fashion Designers (GAFD). Through that a total population of 115 industrial tailoring and seamstress MSMEs were identified in the Accra metropolis.

The industrial tailoring and seamstress was chosen because they are more likely to innovate than the customer-specification tailoring and seamstress. Also, the industrial tailoring and seamstress firms were chosen because they do mass production for the domestic market and are in a better position to take advantage of AGOA to expand the industry by increasing employment, increasing output,

and increasing foreign exchange among others. This will go along way to revamp the textile industry.

Sample size and Sampling techniques

A sample survey was considered instead of census because complete coverage of the population does not offer any advantage over the sample. Samples can also provide accurate information within a relatively fewer resources (finance, time, and labour), and may be more efficient than the census. But samples are not selected haphazardly; they are chosen in a systematically random way, so that chance or the operation of probability can be utilized.

According to Yamane (1973), a random sample can be selected from a population by using the formula below:

$$n = \frac{N}{1 + Ne^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (a)$$

Where, n is sample, N is population, e^2 is probability of error.

The sample size for the study can be calculated according to the recommendation as: $n = \frac{115}{1+115(0.05)^2} = 89.32$

With N = 115, e = 5% (95 percent confidence). Hence, the sample size for the study was 89 MSMEs in the apparel industry. The sample of 89 MSMEs was chosen because they are good representation of the total population and can provide accurate information.

However, the selection of the 89 MSMEs was done using the Simple Random Sampling Technique. Here, the firms were serially numbered and the

random function on the scientific calculator was applied to select 89 firms from the total number. The essence of using simple random sampling technique was to allow for equal chance of representativeness.

Source and type of data collection

The data used for the study were mainly primary data. Cross-sectional data were collected through a field survey of industrial tailoring and seamstress MSMEs in the study population who were selected to form the study sample. Information were collected on innovation, innovation activities, the effects of innovation, training, human resource, age of the firm, ownership, employment, exports, and experience of the entrepreneur. This source and type of data collection was used because there is no survey in Ghana which has ever covered innovation and at the same time the other variables in the industrial tailoring and seamstress MSMEs in the Ghanaian apparel industry.

Research instrument

The main research instrument used in the data collection for this study was a self-report questionnaire that asked managers to provide response to the questions posed on their various fields. The questionnaire was designed to match with the objectives and conceptual framework of the study.

The questionnaires were administered personally by the researcher and the respondents supplied brief answers to the questions posed. This has been referred to as the personal interview questionnaire (Kumekpor, 1999). Both the open-

ended and the close-ended types of questions were asked. The open-ended questions allowed free responses from the respondents in their own words. The close-ended on the other hand, called for short check mark (list) responses. Here, the respondents were asked to mark or tick a Yes or No or rank alternative responses provided based on how he or she knows about the issue. The choice of the research instrument was based on the fact that i) it can be self-administered or presented in an interview format, ii) it was expected that most of the respondents may not understand the concept of innovation, iii) it was also expected that some of the respondents will be illiterate, and iv) it is less expensive and less cumbersome to administer. The instrument was given to the research supervisors to validate the contents and after administed solely by the student researcher.

To facilitate an in-depth understanding of innovation capabilities of these firms, observations were also made to obtain information on other relevant technology issues which are observable. The observed information was used to support some of the results obtained.

Field work

To ensure validity and reliability of the research instrument, a pilot test was done. In order not to jeopardize the population of the study area, the pilot test was conducted in the Tema Metropolis using ten MSMEs in the apparel industry.

The pilot test revealed the need to incorporate adequate skip patterns into the questionnaire design, as well as clarify certain questions to enable them elicit the appropriate responses. After the pilot test, all the needed corrections or

adjustments were made and the final questionnaires and interview guides were printed and reproduced for the main survey.

The main survey started on 6th July 2009. With the help of firms' addresses and telephone numbers, the researcher was able to locate some of the firms in the sample. The questionnaires were sent directly by the researcher to these located firms. The questionnaires were explained in English or Ga or Twi (depending on the choice of the respondent) to each respondent. In certain cases, the researcher filled up the questionnaires based on answers of respondents who were illiterates. This was done to ensure that correct responses were collected for effective use. The researcher took note of the address, phone number, physical location and the name of firms where questionnaires were left behind. In all, 60 questionnaires were administrated. The fieldwork took a maximum of 3 months.

Field challenges

The main challenge encountered was "research fatigue" as the previous surveys (by other researchers) were unproductive and time-wasting because the respondents argued that those surveys were not able to improve their situation. The researcher was rejected by as many as 11 respondents who declined to help. Some of the statements they made were; "nothing will come from this", "come back next week", "there is embargo on research", "we are tired of always answering so many questions and we do not get any thing out of that".

Another problem encountered was the absence of the entrepreneurs whose apparel industries were chosen. The researcher had to travel between two to five

times before the entrepreneur, were met. Upon all these, some of the entrepreneurs declined to help, some took the questionnaire and booked for another day, some even filled to the middle and stopped. In one particular firm, the researcher had to visit five times and on each visit, a new questionnaire was left because the previous one was missing.

The firms appeared to be suspicious of the purpose of the study. It was difficult to tell why the suspicion, but some firms gave the following reasons: Fear of competition by other companies, companies with tax problem or problem with the government, and fear of grading or assessing them financially. It took the researcher several hours to convince the respondents.

Due to poor addresses and wrong telephone numbers, the researcher could not find 18 firms. Most firms had been closed down, some had relocated and it was very difficult to find their new location.

These challenges were encountered because of the improper organisation of the apparel industry in particular and the manufacturing industry as a whole. However, in the mix of all these challenges, the data collection process progressed smoothly and successfully.

Data management

The responses in the retrieved questionnaires were edited or cleaned. The researcher checked entries to ensure consistency across and within instruments before leaving premises of the firm. This was to ensure that all response had been provided. In the evenings, the researcher went through the questionnaires again

and with the help of STATA (computer software), the field data were inputted base on the coding and further cleaning was made. The essence of these activities was to make sure that the field data were subject to appropriate statistical analysis.

Model specification

To examine the determinants of innovation in the Ghanaian apparel industry, we employ a discrete and limited dependent variable model used by Lee (2003). This model predicts that age of firms, extent of local ownership, firm size, and the share of exports in sales to determine innovation in the apparel industry in Accra Metropolis. In addition, we include other variables like lack of financial resource, training and experience of entrepreneur which are also proven by other researchers as determinants of innovation. These variables can also be thought of as determinants of innovation in the apparel industry.

Theoretical econometric model

The propensity to innovate is modelled as:

$$y_i = X_i\beta + \mu_i \qquad 1$$

However, in a binary outcome model, the dependent variable y_i takes one of these two values:

$$y_i = \begin{cases} 1 & if\ firm\ i\ \ innovates \\ 0 & otherwise \end{cases} \qquad 2$$

X_i is a vector of exogenous explanatory variables.

μ_i is a stochastic error term.

β is a vector of parameters

The logit model is systematically specified below: Beginning from a Linear Probability Model (LPM):

$$P_i\ (y = 1/X) = P\ (y = 1/X_1 + X_2 + \ldots + X_K) \qquad 3$$

$\boldsymbol{P_i}$ is the probability that a firm will innovate

$\boldsymbol{X_1, X_2 \ldots X_k}$ denote explanatory variables.

$\boldsymbol{y = 1}$ means the event does occur (the firm innovates)

$\boldsymbol{y = 0}$ means the event does not occur (the firm has not innovated)

The LPM above assumes that $P_i\left(y = 1|X\right)$ increases linearly with $\boldsymbol{X}$ i.e. the marginal or incremental effect of X remain constant throughout. This seems impracticable since most economic variables tend to be nonlinearly related. Moreover, since $E\left(y = 1|X\right)$ in linear probability models measures the conditional probability of an event occurring given $\boldsymbol{X}$, it must necessarily lie between 1 and 0. Although this is true apriori, there is nothing in the procedure that guarantees that $\boldsymbol{\hat{y}_i}$, the estimators of the estimated probabilities, $E\left(y|x\right)$ will necessarily fulfil this restriction, and this is the real problem with OLS estimation of the LPM. The more common and practical procedure is to model the probabilities by some distribution function other than the cumulative normal. The logit model which uses Cumulative Distribution Frequency (CDF) to model regressions where the response variable is dichotomous, does not only guarantee that the estimated probabilities fall between the logical limits 0 and 1 but also ensures that the relationship between $\boldsymbol{P_i}$ and $\boldsymbol{X_i}$ is nonlinear.

Then the logistic model specifies that the probability of a firm innovating is given by:

$$P_i\left(y = 1 \middle| X_i\right) = \frac{\exp^{(x\beta)}}{1 + \exp^{(x\beta)}} \qquad 4$$

Where $_x\boldsymbol{\beta}$ is $\boldsymbol{\beta_1 X} + \ldots + \boldsymbol{\beta_k X_k}$

Equation (4) implies that the probability of a firm not innovating ($\boldsymbol{1-P_i}$) can be written as

$$1 - Pi = \frac{1}{1 + \exp^{x\beta}} \qquad 5$$

We can, therefore, write

$$\frac{P_i}{1 - P_i} = \frac{\exp^{(x\beta)}}{1 + \exp^{(x\beta)}}\left(\frac{1 + \exp^{x\beta}}{1}\right) = \exp^{x\beta} \qquad 6$$

$\frac{Pi}{1 - Pi}$ is simply the **odds ratio (OR)** in favour of innovating firms – the ratio of the probability that a firm will innovate to the probability that a firm will not innovate. The odds ratio is equal to $exp(x\beta)$.This shows the probability of a firm innovating for a given value of an explanatory variable, holding all other explanatory variables in the model constant. When both the dependent variable(Y) and the explanatory variable(X) are dichotomous, the odds ratio is the probability that Y is 1 when X is 1 *compared* to the probability that Y is 1 when X is 0.

Taking the natural log of equation (6) gives the Logit Model as specified below:

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right) = Z_i = \beta_1 + \beta_2 X_i + \mu_i \qquad 7$$

Since the maximum likelihood is used; the estimated standard errors are asymptotic. The standard normal (Z statistic) is used, instead of the t statistic, to evaluate the statistical significance of the coefficient. The reason is that if the sample size is large enough, the t distribution converges to the normal distribution. If $\boldsymbol{L_i}$, the logit, is positive, it means that when the value of the regressor (s) increases, the odds that the regressand equals 1 (meaning that some event of interest occurs) increases. If $\boldsymbol{L_i}$ is negative, it means that the odd that the regressand equals 1 decrease as the value of X increases (Greene, 2000).

Empirical model

From the theoretical and empirical literature review, three separate regression models will be estimated. This is due to the fact that, in both process and product innovation the "subject approach" (which is based on firm's own assessment) was used rather than the "object approach" (which is based on expert opinion or technical literature survey), and innovation was considered from the firm's point of reference, not that of the industry or other firms in the world. Also, the procedure has been used in a number of studies, which is consistent and has provided satisfactory results. In our model, we postulate that the probability of innovating is influenced by the following factors: Age of firms (AGEF), Extent of local ownership (ELOWN), Firm size measured by total employees (FSIZE), Share of export in sales (EXPORT), training (TR), lack of financial resources (LFR), and experience of the entrepreneur (EXE).

The full regression equations are as shown below:

Product innovation only (IN_{pdt}):

$$IN_{pdt} = \beta_0 + \beta_1 lnAGEF + \beta_2 ELOWN + \beta_3 FSIZE + \beta_4 EXPORT + \beta_5 TR + \beta_6 LFR + \beta_7 EXE + \mu \quad 8$$

Process innovation only (IN_{prs}):

$$IN_{prs} = \beta_0 + \beta_1 lnAGEF + \beta_2 ELOWN + \beta_3 FSIZE + \beta_4 EXPORT + \beta_5 TR + \beta_6 LFR + \beta_7 EXE + \mu \quad 9$$

Innovation (IN_{Any}):

$$IN_{Any} = \beta_0 + \beta_1 lnAGEF + \beta_2 ELOWN + \beta_3 FSIZE + \beta_4 EXPORT + \beta_5 TR + \beta_6 LFR + \beta_7 EXE + \mu \quad 10$$

A priori restrictions: the expected signs of the explanatory variables are in the table below:

Table 2: Expected signs of the explanatory variables

Variable	Expected sign
Age of firms	+
Extent of local ownership	_
Firm size	+ / -
Share of export in sales	+
Training	+
Lack of financial resource	_
Experience of entrepreneur	+

Research variables and their operationalisation

Dependent variable:

Innovation: the innovation variable is built on the firm's assessment of innovation at the firm level with special attention on incremental innovation. The firms are asked if they have introduced new or improved products or processes in the market or the firm. For a firm to the considered as an innovating firm, the product or process or the marketing and organization strategy should be new to the firm but not necessarily the market. Innovation is defined in three different ways in this study. Three types of innovation are considered—product innovation only, process innovation only, and any form of innovation in the past four (4) months. The first binary variable takes a value of one if a firm has produced at least one product-only innovation and zero if it has produced no innovation within the past four (4) months. The second binary variable contrasts process-only innovators against non-innovators, while the third contrasts innovators against non-innovators.

Explanatory variables:

Differences in innovative capabilities are considered to be partly related to differences in individual firm and industry characteristics. Therefore, innovation is postulated here to be a function of firm-specific characteristics.

Age of firm: This is natural logarithm of the number of years since the firm had begun operations in the country. On the one hand, older firms tend to have more accumulated knowledge and other resources to capitalize on, but on the

other hand, newly established firms, and therefore younger firms, should appear to be more innovative because they by principle need to introduce a new product when they launch their business. It will be interesting to see, which of these effects dominate the results.

Extent of local ownership: Theory shows that the extent of local vs. foreign ownership can influence the level of innovation. The extent of local ownership is measured by the share of the company owned by local individuals. On the contrary, Lee (2003), and Dachs and Ebersberger (2007) findings also indicate that the extent of local vs. foreign ownership is not an important determinant of innovation.

Firm size: The firms are grouped into various categories according to the size of each firm. The size is measured by the number of employees in each firm. Theory predicts that exposure to firm size influences firm's effort to innovative. On the one hand, Lee (2003) argued that firm size is positively related to innovation. On the other hand, Schmookler (1972) claimed that after a certain 'large' size, the efficiency of creative activity varies inversely with firm size.

Share of export in sales: Theory predicts that exposure to export markets makes firms innovative. However, developing countries export based on low-cost strategies. Hence, it will be interesting to observe the relation between export-intensity and innovation.

Lack of financial resource: Financial resources play an important role in every business activity. In innovation economics however, lack of financial resource has been recognized as one of the biggest barriers to innovation effort in

a firm. According to Maria et al (2007), and Dachs and Ebersberger (2007), lack of financial resource has a negative effect on the innovation propensity.

Experience of an entrepreneur: This has gained a lot of attention in literature on innovation (Bell, Scott-Kemmis & Satyrakwit, 1982). However, its impact and direction on innovation of a firm have raised a lot of controversies in both the theoretical and empirical literature. It will be interesting to see which of these effects dominate the results. Owing to this, experience of an entrepreneur was measured as the number of years the entrepreneur has been working after training.

Training duration: This is captured as the number of times a worker is trained, per year. Continuous upgrading of skills is essential to leverage a qualified work force to adapt to the demands of market and remain innovative. Hage and Aiken (1967) show that knowledge depth, as measured by the extent of professional training, is positively correlated with innovation. Swan and Newell (1995), for example, show that on-the-job training is positively associated with innovation. Later studies, by Du and Girma (2007) did a similar thing and found that training is positively related to innovation.

Estimation procedure

The dependent variables are qualitative in nature and so there is some estimation problems associated with the use of the standard regression technique. Applying Ordinary Least Squares to a qualitative dependent variable will result in inconsistent standard error estimates, inefficient estimates, and the test of

significance for estimated coefficient are inapplicable, hence imprecise predictions. In accordance with our objectives and the nature of the dependent variables, the estimation procedure used follows closely the estimation procedures described in Lee (2003) for estimating determinants of Innovation in the Malaysian Manufacturing Sector. Before discussing the estimation procedures, it is useful to discuss the nature of the outcome variables and the explanatory variables considered in the study.

Several outcome variables are considered in the study, namely: (a) product innovation only; (b) process innovation only; (c) any type of innovation. All of these variables are qualitative / binary such as (a) at least one product-only innovation or no product innovation; (b) process-only innovators against non-innovators; (c) any form of innovators against non-innovators. Their values are captured by the help of dummies such as 1 and 0. The variable is given 1 if at least one of those innovations can be seen in the firm and 0 if there is no such innovation. Each of these different types of dependent variable requires the same estimation methodology but differently estimated.

The independent variables used in the study are similar to those used in existing literature (e.g. Lee, 2003; Corrocher & Zirulia, 2004; Mohnen & Röller. 2005; Maria et al., 2007; Wignaraja, 2008 stated in the literature review and the variables operationalisation). These include firm-specific and industry-specific characteristics. Firm-specific variables include age of firm, extent of local ownership, firm size measured by total employees, share of export in sales,

qualified personnel, training, experience of the entrepreneur, information search, lack of financial resources and types of ownership.

Estimation method

The general estimation methodology can be labelled as logistic cumulative probability function approach. The logistic regression allows prediction of a discrete outcome from a set of explanatory variables that may be dichotomous, discrete, continuous, or mix (Tabachnick & Fidell, 1998). This approach has no reservation about the nature or distribution of the explanatory variables used. Estimating a model with a logistic regression gives an efficient result and also very easy to interpret. The odds ratios are also estimated easily by the logistic regression for interpretations.

Given the logistic regression function in (8), (9) and (10) then;

$P_i = prob(y_i = 1)$ refer to probability of a firm undertaking innovation, and

$P_i = prob(y_i = 0)$ refer to probability of a firm not undertaking innovation.

The maximum-likelihood estimation procedure has desirable asymptotic properties and must be used to check whether all the parameters are normal. It was realized that all the parameters were consistent and efficient asymptotically so the z was applicable. The p-value was also reported.

Beside all these tests, there are other tests to check the robustness of the results. Some of these tests are specification link test, Hosmer – Lemeshow chi-squared test, and Pseudo – R^2 or Mc Fadden's likelihood ratio index. Pseudo – R^2

test was performed after every model estimated. The test interpretations were also considered in our analysis.

Diagnostic test

Two diagnostic tests were preformed to ensure that the results are reliable and far from wrong conclusions.

Heteroscedasticity is primarily common in cross-sectional data such as the one used in this study. The reason is that, in cross-sectional data, we generally deal with members of a population at a given point in time, such as innovative and non-innovative apparel firms. These firms may be of different levels of income, size, and technology. In other words, there may be what we call scale effect. The presence of heteroscedasticity can be detected by performing any of these tests: Goldfield-Quandt test, Breunsch-Pagan test, Spearman's rank correlation test, Glejser test, Park test, and White test. However, most econometric software packages have some of these tests incorporated in them and able to detect heteroscedasticity in data. Using SPSS and STATA, heteroscedasticity test was carried out and the results indicated that there was no problem of heteroscedasticity in our data.

Multicollinearity test was also performed to find out if the independent variables included in the estimation are not related. It can be detected using the variance inflation factor or correlation matrix. However, most econometric software packages have some of these tests incorporated in them and able to detect multicollinearity in data. Using SPSS and STATA, multicollinearity test

was carried out and the results indicated that there was no problem of multicollinearity in our data and that; all variables could be included in the model.

Method of data analyses

Having managed the data properly, specify the econometric model to be used, test for multicollinearity and other diagnostic tests, the next step was estimation and analysis. To organize and analyse the data, the Statistical Product and Service Solution (SPSS) and STATA were employed. The data were used to run the econometric model to get the estimates of the parameters. The results of the study have been presented in the form of tables, percentages and frequencies to help establish the relationships among the variables and hence test hypotheses.

Summary

This chapter discussed the methodology for the study. The survey research design was adopted for the study. Primary data were collected through survey of MSMEs in the apparel industry in Accra. The data collection started with a pilot survey. The study employed questionnaire instrument for data collection. The study adopted the analytical framework developed by Lee (2003) for the analysis of the determinants of innovation of SMEs in the apparel industry in Accra. Since innovation is dichotomous, the logit model was employed to estimate the determinants of innovation model.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

The purpose of this chapter is to discuss the empirical evidence on innovations in the selected apparel firms in Ghana. This chapter however, addresses the following: Response rate; Empirical findings and discussion of the results.

Response rate

The questionnaires were distributed in the middle of the year 2009, an off peak time for apparel industry, so that higher response rate may be recorded. Due to the difficulties encountered by many researchers in the field of industrial survey in Ghana, the researcher established rapport with some of the firms a month earlier. In total, 60 questionnaires were distributed and 50 responses were received, leading to a response rate of 83.33 percent. So the response rate 83.33 percent can be considered satisfactory compared to the benchmark 25 percent response rate for conducting an industrial survey (Soyibo, 1997).

Firm characteristics

Data in this part have been organized into different types according to the distinctive characteristics of the variables under consideration. The table below presents information on age of the firm, firm's size, type of ownership, nationality and type of organization.

Table 3: Firm characteristics

Variables	Categories	No of firms	%
Age of the firm	1 –5 years	8	16.0
	6 – 10 years	14	28.0
	11 – 15 years	11	22.0
	16 – 20 years	6	12.0
	21 – 25 years	5	10.0
	26 – 30 years	1	2.0
	31 – 35 years	3	6.0
	36 years +	2	4.0
Firms size	Micro	12	24.0
	Small	34	68.0
	Medium	4	8.0
Type of ownership	Private – owned	50	100.0
Nationality	Ghanaians only	47	94.0
	Foreigners only	3	6.0
Type of organization	Sole proprietor	48	96.0
	Partnership	1	2.0
	Private liab. comp.	1	2.0

Source: Field survey, 2009

Age of the firm: Using the normal statistical class interval of five (5), eight classes were obtained for the age of the firm. Table 3 reveals that 28% of the respondent firms were between the ages 6 – 10 years. This is followed by 11 -15 years (22%), 1 - 5 years (16%), and the least 26 – 30 years (2%). The youngest firm was two (2) years old and the oldest forty – one (41) years old. The mean age of firm in our sample is 14.18 years, standard deviation of 9.555 and a variance of 91.3. This means that about 44% of the firms selected lay below the mean class. The intention here is to get a fair idea about the age distribution of the firms, and further find out if age of firm is an important determinant of innovation in the apparel industry.

Firm size: Using employment size and also following the approach of Lee (2003), we consider firms employing less than twenty-nine employees as small enterprises, and between thirty and ninety-nine as medium enterprises. Among these, small enterprises led with 68% of the respondent firms followed by micro enterprises with 24% and medium enterprises had 8%. Employment seems to be low because most of the apparel firms use apprenticeship scheme as source of labour and do not need to employ more paid workers to take up those roles.

Type of ownership: Following the classification of ownership type used by the Statistical Service of Ghana in the 2003 industrial survey, Table 3 shows that 100% of the respondent firms that fall under the private-owned enterprises categories and none under the other categories. This shows no presence of the public sector in the apparel industry.

Nationality: About 94% of the firms in the data set are 100% owned by Ghanaians. There appears to be little participation of foreigners (6%) in the apparel industry in Ghana.

The type of organization: the data set in the Table show a greater presence of sole proprietorship (96% of the respondent firms) and low presence of partnership (2%) and private liability company (2%). The simple reason could be that, the initial capital required to set up the apparel firm is not as huge as compared to other types of enterprises. Due to this reason, a large number of people prefer setting up the business alone. It is also easier to operate an apparel firm single handedly than in a group which also makes decision making difficult.

Socio-economic and institutional characteristics of the entrepreneur

Data in this part have been organized into different types according to the distinctive characteristics of the variables under consideration. The Table below presents information on age of the entrepreneur, skill acquisition, schooling, experience of the entrepreneur, and training of the entrepreneur.

Age of the entrepreneur: Using the normal statistical class interval of ten (10), four classes were obtained for the age of the entrepreneur. Table 4 below reveals that 50% of the respondent firms' entrepreneurs were between the ages 31 – 40 years. This is followed by 41 - 50 years (22%), and lastly 21 – 30 years and 51 years +, 14% each. The mean age of entrepreneur in our sample is forty (40) years, standard deviation of 9.764 and a variance of 95.34. This means that about 64% of the respondent firms lay below the mean age of the entrepreneur. This

implies that people involve in the apparel business are predominantly youth who might have been fascinated into the business due to the lucrative nature of the apparel business as well as the less capital intensive nature of the business and high yielding in terms of revenue generation.

Table 4: Demographic characteristics of the entrepreneur

Variables	Categories	No of firms	%
Age of the	21 – 30 years	7	14.0
entrepreneur	31 – 40 years	25	50.0
	41 – 50 years	11	22.0
	51 years +	7	14.0
Skills acquisition	Informal	37	74.0
	Both formal & informal	13	26.0
Schooling	University	1	2.0
	Polytechnic	3	6.0
	Tech/Vocational	10	20.0
	Sec/Commercial	14	28.0
	J.H.S	16	32.0
	Primary	2	4.0
	Others	4	8.0
Experience of the	1 – 9 years	16	32.0
entrepreneur	10 – 19 years	20	40.0
	20 – 29 years	9	18.0
	30 years +	5	10.0
Trained	Abroad	3	6.0
	In Ghana	47	94.0

Source: Field Survey, 2009

Skills acquisition: It was discovered that one can either acquire the skills through formal (schooling) or informal (apprenticeship) or both. The data set in Table 4 show a greater presence of entrepreneurs who acquired their training through the informal means (74% of the respondent firms), low presence of entrepreneurs who acquired their training through both means (26%) and no presence of entrepreneurs who acquired their training through the formal means. This shows that informal (apprenticeship) way of skills acquisition is very important in this industry. This goes to confirm the findings of Steel (1977) that informal training or apprenticeship remains the dominant channel for diffusion or transfer of skills in the micro-enterprises in Ghana.

Schooling: Using the educational system of Ghana, we considered entrepreneurs who had completed university, polytechnic, tech/vocational, secondary/commercial, J.H.S, primary and others. Among these, J.H.S leads with 32% (16) of the respondent entrepreneurs followed by secondary/commercial with 24% (14) and university with the least of 2% (1). This stands to reason that most of the respondents have had education not less than sixteen years. Education is therefore expected to play a positive role in the determination of innovation.

Experience of the entrepreneur: Using the normal statistical distribution, four classes were obtained for the entrepreneurs' experience. Table 4 reveals that 40% of the respondent firms' entrepreneurs had between 10 – 19 years of experience. This was followed by 1 - 9 years of experience (32%), 20 – 29 years of experience (18%) and 30 years + of experience (10%). The mean year of experience of the entrepreneur in our sample is 16.1 years, standard deviation of

10.091 and a variance of 101.83. This implies that the majority of entrepreneurs interviewed have had at least 10 years of experience in managing their business. It is therefore assumed that entrepreneurs might have enough exposure in the apparel industry through which they could improve upon their performance to increase innovation specifically process innovation.

Trained: the data set in the table show a greater presence of entrepreneurs trained in Ghana (94% of the respondent firms), and low presence of entrepreneurs trained abroad (6%). The reason associated to these allocations or distributions of trained entrepreneur is the fact that individuals could afford the high training cost outside their country. Some of the respondents mentioned that, training outside the country gives you an 'upper-hand' over those who are trained in the country. They stated that training outside Ghana gives you exposure to external markets (raw materials, inputs and varieties of consumers) and increases firms' competitiveness.

Innovation Activities

Data in this part have been organized into different types according to the distinctive characteristics of the variables under consideration. The table below presents information on share of export in sales, training duration, training, and increase in finance.

Share of export in sales: Table 5 below reveals that 42% of the respondent firms did not have any share of export in sales. However, 24% of the respondent

firms had between 40 – 60% shares of export in sales. This is followed by 60 – 80% (22%), 20 – 40% (8%), and 0.01 – 20% (4%).

Table 5: Innovation activities

	Variables	No of firms	%
Share of export in sales	0%	21	42.0
	0.01 – 20%	2	4.0
	20.01 – 40%	4	8.0
	40.01 – 60%	12	24.0
	60.01 – 80%	11	22.0
Training		43	86.0
Training duration	1 – 4 months	7	14.0
	5 – 10 months	8	16.0
	24 months	13	26.0
	36 months	13	26.0
	37 months +	2	4.0
Increase in finance		42	84.0

Source**:** Field Survey, 2009

Training: Table 5 reveals that 86% of the respondent firms had received training.

Training duration: This includes both upgrade of skills and apprenticeship. 14% of the respondent firms upgrade their workers with 1 – 4 months and 16% between 5 – 10 months. Considering the apprenticeship, 26% of

the respondent firms undertake apprenticeship in both 24 and 36 months, and 4% in 37 months and over.

Increase in finance: Table 5 reveals that 84% of the respondent firms had increased their finance base.

Types of innovation

Table 6 presents information on product innovation, process innovation and organization and market innovation. This presentation is not different from those in the literature review.

Product innovation: There were two (2) sub categories under the product innovation. It was found that about 70% of the firms had undertaken changes or improved goods produced, and 42% reported changes or improved services. We were also interested in knowing the underlying objectives for the introduction of each innovation. Regarding the new or significantly improved goods, the main objectives were: to boost sales revenue (60%), to fit into the competitive market (10%), to ensure customer satisfaction and loyalty (25%), and to increase market share (5%).

Process innovation: There were three (3) sub categories under the process innovation. It was very difficult to get reasons associated with each of category but the overall objectives were: reduced time to respond to customer or supplier needs (12%), improved quality of goods or services (25%), reduced costs per unit output (30%), improved employee satisfaction (2%) and other combinations (31%).

Table 6: Types of innovation

Type of innovation	Description	No of firms	%
Product innovation	New or significantly improved goods	35	70.0
	New or significantly improved services	21	42.0
Process innovation	New or significantly improved methods of manufacturing or producing goods and services	5	10.0
	New or significantly improved logistics, delivery or distribution methods for a firm inputs, goods or services	26	52.0
	New or significantly improved supporting activities for a firm processes, such as maintenance system operations for purchasing, accounting, or computing	9	18.0
	New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within a firm.	8	16.0
Organization and marketing innovation	New or significant changes in a firm relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting	9	18.0
	Significant changes to the design or packaging of goods or services	11	22.0
	New or significantly changed sales or distribution methods, such as internet sales, direct sales or showroom	11	22.0

Source: Field Survey, 2009 Note: Multiple responses

Organizational and market innovations: There were four (4) sub categories under this type of innovation and it also shows the most evenly distributed changes. It was found that 16% of the firms had new or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within the enterprise, 18% had new or significant changes in a firm's relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting, 22% reported changes to the design or packaging of goods or services, and 22% reported significant changes in sales or distribution methods, such as internet sales, direct sales or showroom. Reasons regarding this type of innovations were: reduced time to respond to customer or supplier needs (30%), to boost sales revenue (40%), to increase market share (17%), and other combinations (13%).

Empirical finding and discussion of the results

The review of theoretical and empirical literature guided the variables chosen for inclusion in the model. Variables included in the model are: age of the firm, extent of local ownership, firm size, share of export in sales, training duration, lack of financial resources, and experience of the entrepreneur.

Regression Results

The results of the logistic regression analysis of factors determining innovation are presented in Tables 7 to 9.

Table 7: Logistic regression results: Product innovation only (Pdt)

Variable	Odds Ratio	Coefficient	Standard Error	P > □ Z □
Ln AGEF	0.167056	- 1.789425**	0.653219	0.036
ELOWN	0.021077	- 3.859553	2.724353	0.251
FSIZE	1.040449	0.039654	1.121593	1.013
SXPORT	2.576036	0.946253*	0.472912	0.056
TRD	1.454364	0.374569	0.625567	0.824
LFR	0.089367	- 2.415002	1.831461	0.124
EXE	1.672501	0.514320*	0.215973	0.097
CONSTANT		3.152102	2.516215	0.146

No. of observations = 49

Log Likelihood = -23.265293 Pseudo R^2 = 0.2045

LR X^2 (7) = 13.65 Prob > X^2 = 0.0028;

Wald X^2 (7) = 11.57 Prob > X^2 = 0.0034

Specification Link Test: hatsq. P > □ Z □ = 0.224

Source: Field Survey, 2009

Note: ** indicates significant at 5% and * indicates significant at 10%

Table 7 presents the results of a direct logistic regression analysis performed on product innovation only as dependent variable and seven independent variables: firm's age, extent of local ownership, firm size, share of export in sales, training duration, lack of financial resource, and entrepreneur's

experience. MacFadden (1979) contends the R^2 values of between 0.2 and 0.4 represent a good fit of the model. The model specification is therefore good, given by the insignificant chi-square for prediction squared (Specification Link Test: hatsq. P > □ Z □ = 0.224) and Pseudo R^2 = 0.2045. Correct classification is also satisfactory.

Age of Firm: The negative sign of this variable indicates that younger firms are more likely to innovate (product innovative) compared to older firms. The firm's age is statistically significant at 5%. The estimated coefficient of the age of firm indicates that a unit increase in the years of a firm leads to a decrease of 0.167056 of the odds that a firm will product innovates. The outcome of this study is consistent with Hegde and Shapira (2007) in Malaysia. In their estimation, the age of a firm accounts for a negative effect on product innovations. Srholec (2008), using Mlogit on PICS data from 28 countries, mostly developing, found that the age of a firm influenced product innovation negatively. One explanation, which seems plausible, is that younger firms are more eager to have more customers than the older firms who are had already secured some share of the market. Owing to this, younger firms tend to be more product innovative than older firms.

Share of export in sales: The positive sign of the coefficient for this variable indicates that firms that produce and export tend to be more innovative (product innovative) than those producing for the domestic market. This variable is significant at 10%. Thus, a 1% increase in the share of export has 2.576036 odds in favour of product innovation. Falk (2008) studied the effects of foreign

ownership on innovation activities and found a positive effect of share of export in sales on product innovation. Srholec (2009) studied the effects of foreign ownership on innovation using pooled micro data from the enlarged European Union at the firm-level and found that the shares of export in sales positively affect innovation. These studies corroborate our results on the effect of share of export on product innovation. Possible explanations for this trend are that; firms that export are confronted with consumers of different taste and culture, the firms are also exposed to other products (styles) not found in the local market, and the firms give feedbacks that are different from the domestic market. Operating on this bigger stage calls for more creativity. Owing to this, firms that export their product tend to be more product innovative than those producing for the domestic market.

Experience of the entrepreneur: The positive sign of the coefficient for this variable indicates that entrepreneurs with more experience tend to be more innovative (product innovative) than those with little experience. This variable is significant at 10%. More specifically, a unit increase in the experience of the entrepreneur results in an increase of 1.672501 in the odds that a firm will product innovate. The explanation for this trend is that accumulated production experience is quite different from that required to initiate product innovation. Accumulated experience gives the entrepreneur a fair idea of what is in the market, what the consumers want and what can be done to improve it. This leads to more product innovation. Our findings support the empirical evidence of Wignaraja (2008). Wignaraja (2008) studied electronic firms in three late industrializing East Asian

countries, and found accumulated experience to play an important role in innovation process.

Others: all the other variables (extent of local ownership, firm size, training duration, and lack of financial resource) met their expected signs. These variables and the constant term are all statistically insignificant.

Table 7 also indicates a statistically significant model [LR $X^2(7) = 13.65$ Prob > $X^2 = 0.0028$ and Wald X^2 (7) = 11.57 Prob > $X^2 = 0.0034$]. This suggests that the independent variables (as a group) discriminate well between product innovating firms and others firms.

Hypothesis testing: The Table 7 reveals that we cannot reject the null hypothesis of no relationship between firm size and product innovation. However, the coefficient of share of export in sales and experience of the entrepreneur are significantly different from zero, and so we reject the null hypothesis of no relationship between either share of export in sales or experience of the entrepreneur and product innovation.

Table 8 presents the results of a direct logistic regression analysis performed on process innovation only as dependent variable and five independent variables: firm's age, firm size, share of export in sales, lack of financial resource, and entrepreneur's experience. The model specification is good, given the insignificant chi-square for prediction squared (Specification Link Test: hatsq. P > □ Z □ = 0.178) and Pseudo R^2 = 0.2164. Correct classification is also satisfactory.

Table 8: Logistic regression results: Process innovation only (Prs)

Variable	Odds Ratio	Coefficient	Standard Error	P > □ Z □
Ln AGEF	3.503134	1.253658**	0.546216	0.031
FSIZE	2.260829	0.815732	0.967336	0.433
SXPORT	3.128394	1.140520*	0.528032	0.053
LFR	0.147704	- 1.912569	1.345039	0.216
EXE	1.524264	0.421512*	0.216281	0.065
CONSTANT		0.682564	2.623476	0.623

Number of observations = 34

Log Likelihood = -20.479542 Pseudo $R^2 = 0.2164$

LR $X^2(5) = 14.06$ Prob > $X^2 = 0.0025$

Wald X^2 (5) = 11.07 Prob > $X^2 = 0.0046$

Specification Link Test: hatsq. P > □ Z □ = 0.178

Source: Field Survey, 2009

Note: ** indicates significant at 5% and * indicates significant at 10%

Firm's age: the positive sign of this variable indicates that older firms are more likely to innovate (process innovation) compared to younger firms. The firm's age is statistically significant at 5%. The possible explanation for this is that, as firm ages, the deeper the understanding of processes used in production. The older firms are also able to acquaint themselves with the various institutions and associations that can help develop new processes and acquire new equipment.

This leads to increase in process innovation. This finding does not support that of Hegde and Shapira (2007). In their estimation, they found out that the age of a firm accounts for no effect on process innovation.

Share of export in sales: From theory, share of export in sales is one of the factors assumed to determine process innovation. Omission of this variable renders incomplete analysis of the determinants of process innovation. Gonçalves, Lemos and De Negri (2007) studied drivers of technological innovation in Argentina and Brazil, and found that the share of export in sales was significant factor explaining process innovation. They found that the share of export in sales positively affect process innovation. Statistically, significant effects of share of export in sales on process innovation have been confirmed by obtaining the positive sign of the coefficient for this variable in the Table 8. This variable is significant at 10%. Possible explanations for this trend are that; firms that export are exposed to foreign markets where they can get different materials and equipment to enhance their production, they also get links with other garment producers in that country. These help the firms in the exchange of ideas and hence increase process innovation.

Experience of the entrepreneur: Another important question considered in the study is the impact of experience of the entrepreneur on firm's innovation ability. Our results in Table 8 have indicated that a marginal increase in propensity to under-take process innovations as entrepreneurial experience increases. Thus, the positive sign of the coefficient for this variable indicates that entrepreneur with more experience tend to be more innovative (process

innovative) than those with little experience. This variable is significant at 10%. A critical examination of our data shows that process innovations are stimulated by accumulation of entrepreneur experience through "learning by using", and "learning by changing". Thus, firms that responded to technical problems associated with product quality and maintenance succeeded in undertaking process innovations. However, those who responded to past experiences on customer choices succeeded in product innovation. Capt (1992) in her study of metal manufacturing in Bamako and Segou (Mali) found on-the-job work experience and seniority to play a predominant role in technological mastery.

Others: all the other variables (firm size, share of export in sales, and lack of financial resource) met their expected signs. These variables and the constant term are all statistically insignificant.

Table 8 also indicates a statistically significant model [LR $X^2(5) = 14.06$; $P < 0.0025$ and Wald X^2 (5) = 11.07; $P < 0.0046$]. This suggests that the independent variables (as a group) discriminate well between process innovating firms and others.

Hypothesis testing: Table 8 reveals that we fail to reject the null hypothesis of no relationship between firm size and process innovation. However, the coefficient of share of export in sales and experience of the entrepreneur are significantly different from zero, and so we reject the null hypothesis of no relationship between either share of export in sales or owner's experience and process innovation.

Table 9: Logistic regression results: Product and process innovation (PP)

Variable	Odds Ratio	Coefficient	Standard Error	P > □ Z □
Ln AGEF	3.594151	1.279308	2.346758	0.516
FSIZE	0.699566	- 0.357294	0.658936	0.352
SXPORT	3.021059	1.105607*	0.543587	0.082
TRD	7.759150	0.564831*	0.258490	0.055
EXE	2.592996	0.952814	1.251243	0.147
CONSTANT		-1.592756	2.465209	0.169

Number of observations = 40

Log Likelihood = -24.831437 Pseudo R^2 = 0.2048

LR $X^2(5)$ = 12.43 Prob > X^2 = 0.0017;

Wald X^2 (5) = 14.09 Prob > X^2 = 0.0164

Specification Link Test: hatsq. P > □ Z □ = 0.312

Source: Field Survey, 2009

Note: * indicates significant at 10%.

Table 9 presents the results of a direct logistic regression analysis performed on product and process innovation as dependent variable and five independent variables: firm's age, firm size, share of export in sales, training duration, and entrepreneur's experience. The model specification is good, given the insignificant chi-square for prediction squared (Specification Link Test: hatsq.

P > □ Z □ = 0.312). Hosmer – Lemeshow is also insignificant, and this indicates a good model fit. Correct classification is also satisfactory.

Share of export in sales: Share of export in sales is expected to increase the propensity to innovate, all other things being equal. The positive sign of the coefficient for this variable indicates that firms that produce and export tend to be more innovative than those producing for the domestic market. This variable is significant at 10%. Thus, exposure to international markets makes firms more innovative. This appears to be a particularly reasonable explanation to give, especially where the firm concerned is from a developing country.

The so-called "learning-by exporting" literature has been developed in that context and has been used by Dahlman and Westphal (1982) and more recently by Özçelik and Taymaz (2004) to examine the role of exporting on innovativeness of Turkish firms. Our findings are consistent with the empirical findings of Falk (2008), Gonçalves, et al (2007), and Srholec (2009) who have found some relationship between the share of export in sales and the innovative behaviour of firms.

Training duration: Training duration is expected to increase the propensity to innovate, all other things being equal. While the results in the logit model confirm this claim, the positive sign of the coefficient for this variable indicates that the longer the training duration, the more innovative. This variable is significant at 10%. The explanation to this is that, when people are trained for a longer period, their understanding towards the processes of the production of apparel is deepened, which will enable them to be creative. More so, continues

upgrade of skills enhances the creative ability of the individual. One of the reasons why the PSI on the youth in garment production did not bring innovative persons into the industry can be attributed to the shortness in training duration. Our findings confirm the empirical evidence of Hage and Aiken (1967), and Du and Girma (2007). For instance, Hage and Aiken (1967) show that knowledge in-depth, as measured by the extent of professional training, is positively correlated with innovation. Du and Girma (2007) did similar thing and found that training is positively related to innovation.

Others: with the exception of share of export in sales, all other variables (age of the firm, firm size and entrepreneurs' experience) met their expected signs. These variables and the constant term are all statistically insignificant.

Table 9 also indicates a statistically significant model [LR $X^2(5) = 12.43$; $P < 0.0017$ and Wald X^2 (5) = 14.09; $P < 0.0164$]. This suggests that the independent variables (as a group) discriminate well between product and process innovating firms and others.

Hypothesis testing: Table 9 reveals that we fail to reject the null hypothesis of no relationship between both firm size or entrepreneurs' experience and innovation. However, the coefficient of share of export in sales is significantly different from zero, and so we reject the null hypothesis of no relationship between share of export in sales and innovation.

Summary

The main findings of this study can be categorized as follows; reasons for pursuing innovation, and categorizes of innovation studied.

The empirical evidence on respondent firms indicates that firms pursued innovation for multiple reasons: to boost sales revenue, to fit into the competitive market, to ensure customer satisfaction and loyalty, to increase market share, to ensure the longevity of the customer's clothes, to increase the trust of customers in product quality, to reduce time to respond to customer or supplier needs, to improve quality of the firms' goods or services, to reduce costs per unit output, and to improve employee satisfaction.

The various innovations were categorized as product innovation and process innovation. The survey data show that age of the firm, share of export in sales and entrepreneurs' experience were significant factors discriminating product innovating firms and others, whereas, the age of the firm, share of export in sales and entrepreneurs' experience were significant factors discriminating the process innovating firms and others.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter serve as the concluding part of the study. It summarizes report gathered and presents the conclusions on the findings. It also entails policy implications and suggestions for further research.

Summary

The ability to innovate technology represents the highest degree of development of an industrial society. However, there has not been much research focused on innovation of a firm, especially among micro, small and medium scale enterprises in the apparel manufacturing industries in Ghana.

The purpose of this study was to investigate the determinants of innovation within the context of micro, small and medium scale apparel manufacturing industry, using cross sectional data collected on fifty (50) apparel firms selected from the Accra Metropolis in the Greater Accra region of Ghana. In order to understand the learning of innovation at the firm level, the theoretical

(economic theories) and empirical literature on innovation were reviewed. The review of literature gave directions on estimation of determinants of innovation and the methodology appropriate for the study.

Evolutionary framework was adopted, given the inherent weakness of the other framework. In view of this, questionnaires were used to collect data on innovation of 50 apparel firms. However, given the qualitative nature of the dependent variable (innovation), a logistic regression model was specified. The econometric software used in the analysis was STATA.

The results revealed that age of a firm positively influences process innovation but negatively influences product innovation. The results revealed that the share of export in sales and the experience of entrepreneurs are positively related to product and process innovation; but training duration was positively related to innovation. On the other hand, the results indicated that firm size, extent of local ownership, training duration, and lack of financial resources did not have significant effects on product and process innovation.

In order to aid the innovation activity by firms, explicit policy framework should be adopted. The elements of the policy framework should include: introduction of national apprenticeship and starting of firm scheme; annual awards or sponsorships to employees; employees should be granted industrial (study) leave to enable them upgrade themselves both technically and academically; employees could also be granted industrial attachment in other countries to enhance work efficiency; and increase the awareness on AGOA.

Conclusion

This study set out to determine factors affecting innovation in the Ghanaian apparel industry focused on industrial production of hats and caps, shirts, suits, trousers, blouses, gloves, dressing gowns, and is located in the Accra Metropolis. The data gathered were used to analyze the determinants of incremental innovation in the Ghanaian apparel industry.

In the descriptive analysis, our findings confirmed the importance of variables such as extent of local ownership, share of export in sales, training duration, lack of financial resources, and entrepreneurial experience in firm's capacity to innovate at the firm level. Our findings also confirmed the controversies around the age of firm and firm size in a firm's capacity to innovate at the firm's level.

Central to what pertains in our data set, the age of the firm, share of export in sales and entrepreneurs' experience were significant factors discriminating product innovating firms and other firms. Base on the empirical findings of this study, the propensity to product innovation is positively related to share of export in sales and entrepreneurs' experience but negatively related to age of the firm. Our findings indicated that the extent of local ownership, firm size, training duration, and lack of funds are not important determinants of product innovation in the apparel industry.

However, our data set show that age of the firm, share of export in sales, and entrepreneurs' experience were significant factors discriminating the process

innovating firms and other firms. Thus, the propensity to process innovation is positively related to age of the firm, share of export in sales, and entrepreneurs' experience. We also found that firms' size, and lack of funds were not significant determinants of process innovation in the apparel industry.

The empirical evidence of the study indicated that firms pursued innovation for multiple reasons: to boost sales revenue, to fit into the competitive market, to ensure customer satisfaction and loyalty, to increase market share, to ensure the longevity of the customer's clothes, to increase the trust of customers in product quality, to reduce time to respond to customer or supplier needs, to improve quality of firms' goods and services, to reduce costs per unit output, and to improve employee satisfaction. The various innovations were categorized as product innovation and process innovation.

Recommendations

The results of this study have the following policy implications for entrepreneurs in the apparel industry and policy makers.

There is the need for the Ministry of Trade and Industry to collaborate with AGI to formulate policies to encourage middle age/old firms to remain in the apparel business; there is the need also for policies to attract new firms into the apparel industry. Policy makers can introduce the national apprenticeship and starting of firm scheme under the National Youth Employment Scheme to encourage more youth into the apparel industry. On the part of the middle and old

firms, annual awards or sponsorships may be awarded to them to boost their morale.

Also, efforts should be made by the various associations in the apparel industry to formulate policies that will improve the knowledge of entrepreneurs. This may involve: providing both formal and informal education on the relevant accoutrements of the industry; employees should be granted industrial (study) leave to enable them upgrade themselves both technically and academically; and employees could also be granted industrial attachment in other countries (especially Taiwan, China, and Hong Kong) to enhance work efficiency.

Our results also indicate that share of exports in sales plays a significant role in product innovation but insignificant in process innovation. On the question of AGOA, which will provide some opportunity for entrepreneurs in the apparel industry to export their products to the U.S.A, it was realized that 63% of the respondent firms said they had never heard anything about AGOA, 27% said they had heard but did not know the procedure and the benefits of AGOA, and only 10% are benefiting from it. Lack of standardization was pointed out as one of the major obstacles for a successful export campaign. To ensure that firms realize the full benefit of trade, the Ministry of Trade and Industry must collaborate with AGI to formulate policies geared towards increasing the share of exports in sales. The Ministry of Trade and Industry can organise seminars, workshops and training programmes to emphasize on making quality and standardization aspects of apparel making to suit the AGOA requirements.

The study revealed that training duration plays a significant role in influencing innovation. To ensure that firms realize the intended benefits of the training duration, training programmes need to be customized. Thus, entrepreneurs should design their training programmes such that employees may be trained for not less than three (3) years, take continuous upgrading courses at least once a year, and in link with the various organizations set up by the government, like the GRATIS foundation to acquire necessary education and training. Accordingly, emphasis must be placed on training programmes for entrepreneurs should be placed on technological improvement and export readiness.

Limitations of the study

The main handicaps of the study include, among other limitations, constraint of resources, the evolutionary approach used and the quality of the data used in the study.

Due to time and financial constraints, the study was limited to the areas under the jurisdiction of the Accra Metropolitan Assembly. The study also concentrated on industrial seam-stressing and tailoring.

The data collected in the study represent the actual performance of the firms that were chosen but do not give a clear picture of the firms' capability if for one reason or the other did not undertake innovation. Thus, the approach concerns the definition and assessment of innovation and capability of firms only.

Another limitation of the study is the quality of data collected. The quality of data collected impact negatively on the results, if there is incomplete or inaccurate information provided by the respondents. To reduce their impact by asking probing questions in various ways which do not affect the research ethics.

Although the interpretations of results were in the context of these limitations, the quality of the results of the study was not eroded.

Areas for future research

This study does not answer all questions relevant to the research area, nor does it attempt to do so. But, undoubtedly, contributes to the understanding of the innovation process among micro, small and medium scale apparel manufacturing industry in the Ghanaian economy. However, this study raises some important issues in which this study can be extended.

One of the issues is, ensuring a complete understanding of the propensity to innovation of the apparel industry; future research should extend the investigation to other apparel firms in other parts of Ghana and also look at induced innovation.

It will also be interesting to look at threats to innovation activities in the apparel industry. In redesigning the study in this way, variables such as high costs, economic uncertainty, shortage of personnel, shortage of knowledge, market uncertainty, and policy regulations should be included.

Another useful area for future research will be why some firms undertake innovation while others do not, given the policy environment.

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APPENDIX

QUESTIONNAIRE

DETERMINANTS OF INNOVATION AMONG MICRO, SMALL AND MEDIUM SCALE ENTERPRISES IN THE GHANAIAN APPAREL INDUSTRY

The overall objective of the study is to analyze the determinants of innovations in the Ghanaian apparel industry.

The purpose of this questionnaire is to collect data for academic exercise. Information provided will be treated confidential.

Date:

Day		Month		Year			

A. General information

1. Name of establishment

2. Postal address……

……

3. Telephone numbers: Landline (s) ……

Mobile(s) ……

4. Type of ownership: State-owned ☐

Private-owned ☐

Joint(S & P) ownership ☐

5. Owner's nationality and shares: Ghanaian shares ☐ %

Foreigner's shares ☐ %

Male Female

6. Type of organization: sole proprietorship…… 1 ☐ ☐

Partnership ……2

Private limited company…3

Public limited company….4

Government ……..…..5

Co-operative society……..6

Others (specify) ……..……7

7. What are the main goods and services produced by the firm?

.....

8. Date of establishment ……..……..

9. Total employment ……

B. Entrepreneur/Owner

10. Age of the entrepreneur or owner ……..

11. What is the highest level of schooling attained?

i. University ☐

ii. Polytechnic ☐

iii. Training college ☐

iv. Technical/vocational ☐

v. Secondary/commercial ☐

vi. J.H.S ☐

vii. Primary ☐

12. How did you acquire your skills?

i. Formal (schooling) ☐

ii. Informal (apprenticeship) ☐

iii. Both ☐

13. How long were you trained?

i. Formal (schooling) ……

ii. Informal (apprenticeship) …….

14. Have you ever received any training abroad?

Yes ☐

No ☐

15. Have you ever received any training foreigner in Ghana?

Yes ☐

No ☐

16. For how long have you been working in the apparel industry? ……

C. Innovation

17. During the past 4 months, did your establishment introduce:

		Yes	No
i.	New or significantly improved goods and services.	☐	☐
ii.	New or significantly improved process of production.	☐	☐
iii.	New or significantly improved organisational or marketing procedures	☐	☐

C1. (Go to C2 if 15i is no) Product (good or service) innovation

18. During the past 4 months, did your enterprise introduce:

		Yes	No
i.	New or significantly improved goods. (exclude the simple resale of new goods purchased from other enterprises and charges of a solely aesthetic nature.)	☐	☐
ii.	New or significantly improved services.	☐	☐

19. Who developed these product innovations?

The entrepreneur ☐

Your firm with the help of other firms ☐

Senior workers in the firm ☐

20. Were any of your goods and service innovations during the past 4 months:

		Yes	No
New to Your	Your enterprise introduced a new or significantly improved good or service onto your market before	☐	☐

Market? your competitors (it may have already been available in other markets)

OnlyNew to Your firm? Your enterprise introduced a new or significantly improved good or service that was already available from your competitors in your market. ☐ ☐

C2. (Go to C3 if 15ii is no) Process innovation

21. During the past 4 months, did your enterprise introduce:

	Yes	No
New or significantly improved methods of manufacturingor producing goods or services	☐	☐
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐	☐
New or significantly improved supporting activities for your processes, such as maintenance system operations for purchasing, accounting, or computing	☐	☐

22. Who developed these process innovations?

The entrepreneur ☐

Your firm with the help of other firms ☐

Senior workers in the firm ☐

C3. (Go to D if 15iii is no) Organisational and marketing innovations

23. During the past 4 months, did your enterprise introduce: **Yes** **No**

Organizational Innovations	New or significantly improved knowledge management systems to better use or exchange information, knowledge and skills within your enterprise	☐	☐
	New or significant changes in your relations with other firms or public institutions, such as through alliances, partnerships, outsourcing or sub-contracting.	☐	☐
Marketing Innovations	Significant changes to the design or packaging of a good or service	☐	☐
	New or significantly changed sales or distribution methods, such as internet sales, franchising, direct sales or show room.	☐	☐

24. If your enterprise introduced a process innovation during the past 4 months, how important were each of the following effects?

	Effect			
	High	Medium	Low	Not Relevant

Reduced time to respond to customer or supplier needs	☐	☐	☐	☐
Improved quality of your goods or services	☐	☐	☐	☐
Reduced costs per unit output	☐	☐	☐	☐
Improved employee satisfaction or reduced rates of employee turnover	☐	☐	☐	☐

D. Innovation activities

25. In the last 4 months, did your enterprise engage in the following innovation activities:

Innovation activity	Description	Yes	No	If yes, then what is the cost
Intramural R&D	Creative work undertaken within your enterprise to increase the stock of Knowledge			
Extramural R&D	Same activities as above, but performed by other companies			
Acquisition of machinery, equipment and software	Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products			

	and processes			
Training	Internal or external training for your personnel specifically for the development and/or introduction of new or significantly improved products			

28.1Training

i. Has your establishment participated in any form of on-the-job training/internship/industrial attachment in 2008/9?

Yes ☐

No ☐ **go to 28.2**

ii. If yes, indicate

Type	2008/9			Duration	Institution involved
	Male	Female	Total		
On-the-job-training					
Internship/ industrial attachment					
Vacation employment					
Others					
Total					

28.2Finance

28.2.1 During the past 12 months, did your company lack any financial resources? Yes ☐ No ☐

28.2.2 Did your company receive any financial support for innovation activities from the following?

Institution type	Yes	No	Amount	Type of loan/grant
Government ministry				
Banks				
Credit unions				
Shares				
Sale of assets				
Others (specify)				

28.2.3 Was it enough for the intended activities? Yes ☐ No ☐

28.2.4 To what extent has the facility granted helped your company?

Extent	Yes	No
Acquiring land/building/equipment		
Acquiring raw materials		

Meeting market demand		
Meeting working capital		
Others(specify)		

E. Other areas

26. Human resource

i. What was the total number of people employed by this firm? ……

ii. What is the nature of employment?

Nature of employment	Male	Female	Total
Permanent workers			
Casual workers			
Daily rated			
Apprentices			
National service personnel			
Others			
Total			

iii. How many of the workers are in each of the following categories?

		Male	Female	Total
Managers	Employed managers			
	Assistant			
	Supervisor			
Professionals	Designers			
	Pattern cutters			
	Accountants			
Technicians	Technicians			
Other administrative workers	Those who do not fall in the categories stated above			
Production workers	Skilled			
	Unskilled			
Other categories	Skilled			
	Unskilled			
Total				

27. Sales and other receipts of this establishment

i. What is the value of production and sales of products in the 2008 financial year?

Description of products	Total produced			Value of sales		
	Quantity	Average unit price (cedis)	Value (cedis)	Total sales	Domestic (cedis)	Exports (cedis)
Total						

ii. Which countries do your company exports to? ……

……