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# An Investigation of the Effects of Intellectual Capital on Innovations in the Egyptian Banks: The Mediating Role of Organisational Capital

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**AN INVESTIGATION OF THE EFFECTS OF INTELLECTUAL CAPITAL ON  
INNOVATIONS IN THE EGYPTIAN BANKS: THE MEDIATING ROLE OF  
ORGANISATIONAL CAPITAL**

**By**

**AHMED MOHAMED ELSAYED AHMED ELSETOUHI**

**A thesis submitted to the Plymouth University  
in partial fulfilment for the degree of**

**DOCTOR OF PHILOSOPHY**

**School of Management  
Faculty of Plymouth Business School**

**2014**

**An Investigation of the Effects of Intellectual Capital on Innovations in the Egyptian  
Banks: The Mediating Role of Organisational Capital**

**By**

**Ahmed Mohamed Elsayed Ahmed Elsetouhi**

**ABSTRACT**

This research aims to analyse the direct and indirect effects of human capital, social capital and customer capital on the different types of innovations via organisational capital in the service sector. It also examines the interaction among the different types of innovations including product, process and organisational innovations and tests the role of human capital, social capital and customer capital in supporting organisational capital. This research employs the first stage of Actor Network Theory named problematisation to justify the research model. This study adopts a positivism philosophy, a deduction approach and a quantitative method as the research methodology. Hence, a questionnaire was used to gather data from 198 managers in the Egyptian banks (54% response rate). Structural Equation Modelling by Partial Least Square (warp PLS 3.0) was applied to test the research hypotheses.

The research findings indicate that product, process and organisational innovation are positively associated with organisational capital. It is found that social capital and human capital have direct and indirect positive effects on both product and organisational innovation via organisational capital. It appears that social capital and human capital do not have a direct influence on process innovation whereas organisational capital fully mediates the relationship between social capital, human capital and process innovation. The study explores the direct and indirect positive effects of customer capital on three types of innovation through

organisational capital. Additionally, organisational innovation has a positive relation with process and product innovation, which is significantly associated with process innovation. The most significant influence of intellectual capital is on product innovation, followed by organisational innovation, whereas the least significant influence is on process innovation. Moreover, the results also show that there are no significant differences between the public and private banks in terms of the path coefficients. The effect size of organisational capital on product and process innovation in the private banks is substantially larger than it is in the public banks. In the same way, the private banks have relatively larger effect sizes for human capital on product and process innovation via organisational capital than those in the public banks. Unexpectedly, in the public banks, the positive effect size of customer capital on product and process innovation via organisational capital is larger than it is in the private banks.

This study has contributed to intellectual capital, innovation and service sector literature. It explores many benefits for the managers of the banks. It suggests that they should view intellectual capital as a catalyst for the different types of innovations. For example, banks should maintain and promote social connections amongst their employees to support innovation and to foster the cohesion of informal organisation.

## **DEDICATION**

To my parents, my wife and my daughter

To my brothers, my family and my friends

Thank you for your love, sacrifice, and support

## **ACKNOWLEDGEMENTS**

All praise to God, the Almighty, for having made everything possible by giving me strength and courage to do this work.

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### **Author's Declaration**

I hereby declare that the material contained in this thesis has not been previously submitted for a degree in this or any other university. I further declare that this thesis is solely based on my own research.

Ahmed M. E. A. Elsetouhi

## **PUBLICATIONS**

### **Published paper**

-The Role of Owner-Manager in SMEs for the Adoption of Information and communication Technology in United Arab Emirates, Journal of Global Information Management, 21 (2), 2013, PP.23-50. (With Elbeltagi, Yahya and Glenn).

### **Accepted paper**

Intellectual capital and Innovation: Is Organizational capital a Missing Link In the Service Sector? International Journal of Innovation Management, (with Elbeltagi).

### **Papers in Progress**

- The effect of Intellectual Capital On innovations: The mediating Role of knowledge management.
- Strategic Planning, Entrepreneurial orientation and New Product Development in the Korea SMEs.
- Strategic Planning and Export Performance: The mediating Role of Collaborative Advantage Theory in the Korea SMEs.

### **Conference**

- The Relationship between Intellectual Capital and Process and Product Innovation in The Egyptian Banks: An Exploratory Study, 3rd European Conference on Intellectual Capital, 18-19 April 2011(with Elbeltagi).
- The Role of Human Capital and Customer Capital in Supporting Product Innovation, 5th European Conference on Intellectual Capital, 11-12 April 2013 (with Elbeltagi).

## **REVIEWER**

I am a reviewer for:

- International Journal of Innovation Management.
- Journal of Customer Behaviour.

## **CHAPTER 1: INTRODUCTION**

## **1.1 Background**

In recent years, the financial crisis has brought about the greatest economic depression in the industrial countries since World War II. Many banks have gone bankrupt whilst some required massive government help to survive. It led to the loss of share value and firms' profits and there were defaults on loans. In addition, there was higher unemployment and more public debts (Fuchs and Antonia, 2010). Many banks failed and they are less likely to lend money (Kwan, 2010).

Innovation is seen by shareholders, staff, and customers as a new tool in creating wealth (Ketchen, 2007). Innovation plays an important role in reinforcing a firm's efficiency. In the face of more intense competition and environmental uncertainty, the ability to innovate has become increasingly important as a means not only to encourage growth but for survival (Hage, 1999; Dinopoulos and Syropoulos, 2007; Tonveronachi, 2010). Firms should be able to adapt and evolve if they wish to survive as their competitors adopt new products or processes in order to enhance their competitive power. In a turbulent economic environment with rapid changes in technology, markets, competitive environment, customer preferences and financial crises, firms are facing an "innovate or die" situation (Trott, 2005; Madrid-Guijarro et al., 2009; Johnson, 2010) and innovation is a key element for survival.

Resources bundles (either tangible or intangible) are seen to be inputs which help support innovation in firms (Yang et al., 2009). The growth of knowledge-intensive organisations has demonstrated that economic success relies more on knowledge and its valuable applications than on tangible resources. In this knowledge economy, organisations should understand the intangible assets which lead to competitive advantage and how these assets can be deployed to compete and face the challenges (Alwis, 2004). Intellectual capital (IC) has become an

important factor of competitive advantage and overcoming an environment of uncertainty. This is in stark contrast to the past when enterprises' key resources were mainly physical assets such as land, buildings, etc. (Johnson, 1999), in the knowledge era a firm's IC is always more valuable than its financial capital. In general, an organisation's IC can be three to four times more than its book value (Edvinsson and Malone, 1997). In addition, added value occurs mainly in intangible assets. The difference between the market value and book value has been widened because of the essential role of IC in supporting firms (Stewart, 1997).

## **1.2 The Context of the Banks**

In order to investigate the relationship between intellectual capital and innovation, this study focuses on the banking industry for many reasons. Firstly, over the last few decades, the banking industry has suffered from great changes in the financial markets forcing them to declare bankruptcy. Secondly, in emerging economies, banks are a key factor in economic growth at the macroeconomic level (Rehman et al., 2012). Banks' services are considered to be a central product of all economic activities for individuals, firms and governments which are forced to use them (Davies, 1996). Thirdly, banks represent one of the most important knowledge-intensive industries; this suggests that intellectual capital has become a key resource to sustain innovation (Khedr, 2008) since, as in the previous studies, the research model have yet to be tested in banks. Fourthly, the characteristics of innovation in a banking context are different from those in a manufacturing context. Consequently, a theory, produced in one sector, might not be generalised in another sector (Adams, 2003). Fifthly, banks have adopted a lot of IT and internet applications (O'Keefe et al., 1998). For example, Egyptian banks have changed dramatically with more product innovation in order to adapt to a more competitive environment (Khedr, 2008). Finally, compared to other emerging

economies, the Egyptian authorities have been successful in applying liberalisation policies to banks because they have employed a cautious approach to reforming banking systems and there have been no financial crises in Egyptian banks (Arestis, 2000).

### **1.2.1 Historical Background**

Before the 1973 war, the Egyptian banking sector was controlled through a set of oppressive policies which encouraged widespread governmental interference in directing credit. In addition, these policies limited the private sector's role in supporting economic growth. There were restrictions to the entry of international capital. This policy was called the "closed door policy". During this period, the Egyptian economy had many problems such as a large trade deficit and a weak infrastructure. Moreover, all resources were directed to the Egyptian army (Hassan, 2008). In 1974, the political leadership recognised the importance of foreign direct investment and the private sector in the economic development of the country. Consequently, the government implemented another policy, namely the "open-door policy", which liberalised the banking sector in order to attract new investment to the country.

Therefore, the government had to reform the banking system in order to stimulate foreign and private capital to support the development processes. Consequently, in 1975, Law 120 was enacted which defined the nature of banks and their operations. There were three classifications of banks: namely commercial banks; business and investment banks and specialised banks. Furthermore, these banks were grouped according to ownership into public, private, joint venture or foreign banks (El-Shazly, 2001).

In 1991, the World Bank recommended that the government adopt the Economic Reform and Structural Adjustment Program (ERSAP). The ERSAP aims to change the economic system

from a centrally planned economy to a market economy. The former works on the premise that the government controls the economic decisions and the public sector has a key role in the development process. The latter, a market economy, means that an economy is led by the private sector since all decisions, related to production, investment and distribution depend on supply and demand. Moreover, a market economy tends to reinforce productivity and efficiency and supports market competition (Mohieldin and Nasr, 2003). Consequently, privatisation and liberalisation were the critical turning points of the Egyptian economy generally and the banking system in particular. Furthermore, in 2003, the government supported the issue of Law 88 which aimed to boost the banking system and encourage the merging process in order to establish strong banks which had more resources and facilities (Kenawy, 2009).

Consequently, Egyptian banks faced a competitive environment and a dynamic situation. Banks struggled to introduce an excellent service which would satisfy their customers' needs and expectations. Hence, they had to adopt the new technology, such as ATMs, telephone banking and internet banking in order to improve their processes and services in order to be able to work in the increasingly competitive market. This technology gives banks more access to national and international markets. They recognised the significance of investing in IT to manage costs, to attract new customers and to satisfy the current customers' needs for innovation (Metwally et al., 2012).

### **1.2.2 Forces Driving Innovation in Banks:**

There were many factors which led banks to adopt innovation. However, these factors are grouped into external and internal factors. The external factors affected the creation of a new product and the process which supported the production of services and products. These are customers, competitors and governmental policies which influence the adoption of

innovation. For example, customers are considered to be a key source of innovation through generating new ideas. Wu and Fang (2010) and Kammerer (2009) found that customer orientation was essential specifically for product innovation which would provide a competitive advantage. The internal factors are organisational and individual, group factors (Khedr, 2008). Previous studies viewed employees as an essential resource for innovation (Bornay-Barrachina et al., 2012). Many studies (e.g. Hayton, 2005; Bornay-Barrachina et al., 2012) found that HC had a positive effect on innovation.

### **1.2.3 The Egyptian banks' Problems:**

Over recent decades, great changes have taken place in the banks. They have adopted new technologies in an uncertain environment and they have had to transform some old ideas into new ones to accommodate these changes. Today, banks need to provide their services based on customers' needs. Khedr (2008) mentioned states that the Egyptian banks encountered many problems which forced them to employ new innovations such as the following:

External bank problems show that some customers had left their banks and taken their custom to foreign competitors. For example, due to increased educational levels, customers had the ability to distinguish between the different financial services and choose a service suitable to meet their needs. Moreover, Islamic religion prohibits the receipt of interest and, consequently, many customers do not wish to receive any interest for their savings. Furthermore, increased customer awareness and ability to deal with banks' services encourage competition among banks in the free market economy. Hence, banks are obliged to gather more information about customers' needs to provide appropriate services and products. Therefore, banks have to adopt IT to improve the efficiency of their processes which in turn, will lead to cost reductions and better products for the markets.

Khedr and Kok, (2006) mentioned that “Internal bank problems refer to the performance of different contact channels of the bank (e.g. front desk employee, IT staff, web portals, call centres, ATM’s, etc.) in acquiring satisfied customers and are based on available technology and employees’ attitudes towards customers. Further, there is little awareness of the new technology benefits within the management staff of the banks”.

### **1.3 Research Motivation**

The motivation for this study is divided into two groups. The first is to address some of the gaps in IC and innovation literature. It is necessary to empirically investigate the interactions between the actors or the four components of IC which include human capital (HC), organisational capital (OC), social capital (SC) and customer capital (CC). This is important in order to discover the extent to which these actors work together to achieve a network’s aim. It also empirically examines the direct and indirect effects of HC, SC and CC, not only on product innovation but also on process innovation and organisational innovation through OC in the service sector. The study analyses these simultaneous relationships with a structural equation model. This is important because, traditionally, past studies have focused on the direct effects of the three actors of IC on product innovation (incremental and radical innovation) in the manufacturing sector. Moreover, it is necessary to determine the internal relationships between organisational innovation, process innovation and product innovation. These relationships show that the extent to which product innovation mainly depends on organisational innovation and process innovation on developing the final product in the service sector. Furthermore, previous studies employed resource-based view to explain the relationship between IC and innovation. This study uses Actor Network Theory (ANT) to give a better understanding of how it can be used in the quantitative research. In addition, it is important to investigate the differences between private and public banks in terms of the

research model. It is fundamentally significant to test the role of IC in supporting innovation in the two different environments.

The second motivation for the study is to provide a comprehensive view for the managers of the banks in terms of the components of IC in reinforcing different types of innovation. It also provides a detailed analysis of these relationships to help bank managers to understand the most and least effective paths so that they are able to successfully implement innovation.

#### **1.4 Research Gap**

Although innovation is considered very important in a turbulent environment to achieve a competitive advantage for both the manufacturing sector and the service sector, most innovation research has focused mainly on the manufacturing sector (Droege, Hildebrand, and Forcada, 2009; Perks, Gruber, and Edvardsson, 2012). Research investigating innovation in the service sector is underrepresented (Gopalakrishnan and Damanpour, 2000). In the same vein, past studies have investigated the direct relationship between human capital (HC), organisational capital (OC), social capital (SC) and product innovation, specifically in terms of incremental and radical innovation in the manufacturing sector (Subramaniam and Youndt 2005). Huang et al., (2011) tested HC, OC, and information capital; and innovation capability using resource-based view. Also, Chen et al., (2006) investigated the relationship between HC, OC, customer capital (CC) and new product development performance while Wu et al., (2008) explored the effect of HC, OC and CC on innovation regardless the types of innovations.

Consequently, the research concludes that previous studies did not test the direct and indirect relationship between the four components of IC (HC, SC, CC and OC) and the different types

of innovations, namely product, process and organisational innovation in both the manufacturing and service sectors. Furthermore, the interaction among the actors of IC in the service sector has not been examined, though some work has been done to test the inter-relationships between organisational innovation, process innovation and product innovation in the manufacturing sector. Thus, there exists a need to test the relationships between IC and innovation in the private and public service sector.

### **1.5 Aim and Objectives of Research**

The key aim of the research is to investigate the direct and indirect relationship between the components of IC (HC, SC, CC and OC) and product innovation, process innovation and organisational innovation in the service sector. Therefore, the study adopts the following objectives:

- Examining the internal relationships among the components of IC.
- Testing the direct and indirect effect of intellectual capital on innovations.
- To examine the interactions between the Different Types of Innovations.
- To investigate the differences between private and public Banks in terms of the Research model.

### **1.6 Research Questions**

In order to address the research objectives, the following general question is asked:

What is the role of the components of IC in supporting the different types of innovation?

The research divides this question into the following sets of sub-questions:

- What are the effects of social, human and customer capital on organisational capital?

- What are the direct effects of organisational, social, human and customer capital on innovation (product, process and organisational innovation)?
- What are the indirect effects of social, human and customer capital on innovation (product, process and organisational innovation) via organisational capital?
- What are the effects of organisational, process innovation on product innovation?
- What are the differences between private and public banks in terms of the relationship between intellectual capital and innovation?

### **1.7 Research Hypotheses**

The research develops basic four hypotheses based on previous studies in order to answer the research questions. These hypotheses are presented as follows:

**Firstly, there are significant effects of some components of intellectual capital on organisational capital.**

This hypothesis is classified into:

*H1: Social capital is associated positively with organisational capital.*

*H2: Human capital is associated positively with organisational capital.*

*H3: Customer capital positively associates with organisational capital.*

**Secondly, Intellectual capital has a significant effect on the different types of innovations.**

This hypothesis is divided into the following sub-hypotheses:

*H4: Organisational capital has a positive effect on innovation.*

*H4a: Organisational capital has a positive effect on product innovation.*

*H4b: Organisational capital has a positive effect on process innovation.*

*H3c: Organisational capital has a positive effect on administrative innovation.*

*H5: Social capital has a positive effect on innovation.*

*H5a: Social capital has a positive effect on product innovation.*

*H5b: Social capital has a positive effect on process innovation.*

*H5c: Social capital has a positive effect on administrative innovation.*

*H6: Human capital has a positive effect on innovation.*

*H6a: Human capital has a positive effect on product innovation.*

*H6b: Human capital has a positive effect on process innovation.*

*H6c: Human capital has a positive effect on administrative innovation.*

*H7: Customer capital has a positive effect on innovation.*

*H7a: Customer capital has a positive effect on product innovation.*

*H7b: Customer capital has a positive effect on process innovation.*

*H7c: Customer capital has a positive effect on administrative innovation.*

**Thirdly, there is significant relationship among the different types of innovations.**

This hypothesis is divided into the following sub-hypotheses:

*H8: Administrative innovation has a positive effect on process innovation.*

*H9: Process innovation has a positive effect on product innovation.*

*H10: Administrative innovation has a positive effect on product innovation.*

**Fourthly, Intellectual capital has a significant indirect effect on innovations via organisational capital.**

This hypothesis is classified into the following sub-hypotheses:

*H11: Organisational capital mediates the relationship between social capital and innovation.*

*H11a: Organisational capital mediates the relationship between social capital and product innovation.*

*H11b: Organisational capital mediates the relationship between social capital and process innovation.*

*H11c: Organisational capital mediates the relationship between social capital and organisational innovation.*

*H12: Organisational capital mediates the relationship between human capital and innovation.*

*H12a: Organisational capital mediates the relationship between human capital and product innovation.*

*H12b: Organisational capital mediates the relationship between human capital and process innovation.*

*H12c: Organisational capital mediates the relationship between human capital and organisational innovation.*

*H13: Organisational capital mediates the relationship between customer capital and innovation.*

*H13a: Organisational capital mediates the relationship between customer capital and product innovation.*

*H13b: Organisational capital mediates the relationship between customer capital and process innovation.*

*H13c: Organisational capital mediates the relationship between customer capital and organisational innovation.*

**Fifthly, H14:** *There are no significant differences between private and public banks in terms of the effects of intellectual capital on innovations.*

## **1.8 Summary of Research Methodology**

The methodology used in this study has confirmed that its design is appropriate in providing answers to the research questions and in testing the research hypotheses. This study has adopted two assumptions of research philosophy named ontology (objectivism) and

epistemology which is concerned with the development of knowledge. These assumptions lead to the adoption of a positivist philosophy which presumes that theoretical models can be developed in order to explain cause and effect relationships. This philosophy has allowed the application of a deductive approach which requires the development of hypotheses based on the suitable theoretical framework which explains the relationship between intellectual capital and innovation. A quantitative method is employed to reach the research results and a questionnaire was used to collect data from the managers of Egyptian banks.

### **1.9 Outline of the study**

In addressing the research aim and objectives, this thesis is structured into the following chapters:

Chapter 2 discusses the importance of innovation for firms. It also reviews the definitions of innovation in order to reach the adopted concept in this study. Chapter 2 presents the different approaches that were used to study innovation. This chapter ends by discussing the different types of innovation such as radical and incremental innovation; technological and administrative innovation and product and process innovation.

Chapter 3 presents the different types of organisational resources. It also discusses the importance of intangible assets especially IC in supporting a firm's value. The chapter reviews the definitions of IC. In addition, this chapter presents the components of IC including OC, SC HC and CC.

Chapter 4 reviews the academic literature to build a theoretical model. Chapter 4 starts by presenting theories such as a resource-based view, a knowledge-based view and ANT, all of

which are employed to justify the relationship between IC and innovation. It also suggests a conceptual model. In addition, this chapter reviews empirical studies that have tested the effects of OC, SC, HC and CC on innovation in order to highlight the research gaps and explain the research model.

Chapter 5 discusses the research methodology which is a scientific method of achieving research results and research objectives and answering research questions. It also presents the different approaches of certain research philosophies, research methods and research design and it justifies why this study adopts a specific methodology. This chapter outlines the data collection and the measurement of variables. Finally, it presents different types of samples and it shows the most suitable type for this study.

Chapter 6 outlines the procedures employed to pilot and validate the form. The chapter aims to check different types of validities such as face, content and construct validity. It also presents the stages that have been followed to translate the questionnaire to be more valid. In addition, it tests the reliability of the questionnaire.

Chapter 7 discusses data analysis and results. Chapter 7 starts by analysing respondents including sample size, non-response bias and common method bias. The chapter also assesses data quality through testing missing data, outliers and normality. Furthermore, Chapter 7 evaluates the measurement model by investigating exploratory and confirmatory factor analysis. Finally, it tests the research hypotheses (structure model) using Warp PLS.

Chapter 8 presents the discussion of findings. This chapter aims to link the results of the current research with those in previous studies in order to see the extent to which both are

consistent. It also justifies the research results based on the theories of IC and innovation and the context of the Egyptian banks.

Chapter 9 presents the main conclusions of the current study which also discusses theoretical contributions for IC and innovation literature. Furthermore, it outlines practical contributions for the managers of the banks. Finally, it presents the research limitations and provides some recommendations for future research.

## **CHAPTER 2: INNOVATION**

## **2.1 Introduction**

Most organisations are working in a turbulent environment with rapid changes in information technology, market uncertainties, shortened product life cycles and competition (Dinopoulos and Syropoulos, 2007; Madrid-Guijarro, Garcia, and Van Auken, 2009; Roy and Sivakumar, 2012). Innovation is a fundamental requirement for survival and growth in these environments (Bohlmann, Spanjol, Qualls, and Rosa, 2012). Organisations consider innovation to be a critical variable between life and death (Govindarajan and Trimble, 2005). Moreover, Cooper, (2011) views that the goals of ambitious organisations can be achieved through innovation. In the 21st century, this is one of the main resources needed to achieve sustainability and economic growth (Gumusluog and Ilsev, 2009; Atalay and Anafarta, 2011).

Although innovation has played a key role in supporting the growth of both the manufacturing and services sectors, De Vries, (2006) and Droege et al., (2009) state that innovation studies focus mainly on the manufacturing context whilst a few studies investigated innovation in the service sector and especially in the banking industries. Barras (1990) shows that financial services have experienced great innovation. On the other hand, services have many distinctive characteristics which are different from products (goods). Zeithaml et al. (1993) state that most of the literatures investigate four characteristics of service: intangibility, inseparability; heterogeneity and perishability. Firstly, whilst goods physically exist and they are tangible, services are intangible) and cannot be tasted, smelt, touched, felt, or seen before they are sold (Edvardsson, Gustafsson and Roos, 2005). Secondly, inseparability indicates that production and consumption of services take place at the same time. Customers can affect the quality and performance of the service. They should connect closely with the production process. Therefore, the strong relationship between employees and customers reflects the development of successful products (Murray and

Kotabe, 1999). Thirdly, perishability denotes that services are not stocked. It is impossible to store services for future use. For example, if the customers do not come to the bank, the bank's activities stop and the services cannot be obtained (Zeithmal and Bitner, 1996). Fourthly, heterogeneity relates to variation in quality. Service cannot be standardised since it is performed by human beings. In contrast, within the service industry, it is easy to control the quality of goods which have standardised procedures (Zeithmal and Bitner, 1996).

Although services have unique characteristics which are different from goods, many researchers, such as De Vries (2006), Droege et al. (2009) and Nijssen et al. (2006) show that, in the service context and according to the assimilation approach, the concepts and theories of innovation employed in the manufacturing sector were easily transferrable to the service sector. In order to investigate innovation in the service sectors, Droege et al. (2009) state that without affecting the characteristics of innovation in service these studies used the same models as in the manufacturing sector.

Innovation is considered a complex phenomenon which includes the generation of new ideas that are translated into the new product or process (Lohmüller et al., 2003). In order to understand innovation, this chapter is organised as follows. Section 2.2 discusses the definition of innovation. Section 2.3 presents the approaches to innovation. Section 2.4 articulates the types of innovation.

## **2.2 Concept of Innovation**

There is a diverse range of definitions of innovation. Having analysed these definitions, the research divided them into two groups (Table 2.1). Firstly, much of the research shows that innovation means a creative thing. For example, Rogers (1995) shows that innovation creates

a new idea, practice, or object according to the view of an individual or other unit of adoption. In addition, Rogers discusses another concept known as diffusion of innovation which, over time, focuses on the spread, through particular channels, of innovation among the members of a social system. In contrast, Amabile (1983) suggests that innovation is different from creativity which is the only thing that could be defined as the production of new ideas. Innovation generates and implements new ideas, processes, and products (Trott, 2005). Therefore, creativity is a component of innovation (West and Farr, 1990).

Secondly, this group considers that innovation included the creation and adoption of new ideas. The European Commission (1995) shows that in the social and economic scopes, innovation is a function of the successful exploration and exploitation of novelty. Furthermore, it means the introduction of a new solution to tackle problems. This solution should satisfy the need of firms, employees and other stakeholders. For example, innovation can provide easier communications (internet, mobile phones), new marketing methods (E-banking) and better working environments (computers). Damanpour (1991) believes that innovation is the adoption of a new idea or behaviour.

In view of the above definitions, this study considers that innovation is a planned integrated activity to adopt or develop a new behaviour, product or process to achieve some benefits for employees, firm, group or other stakeholders. The definition suggests that:

1- Innovation is a planned activity to obtain many anticipated benefits (West and Farr, 1990). Moreover, it is not a single activity but it includes both the creation and adoption of novelty. The research suggests that innovation which focuses on either creation or adoption reflects an unproductively narrow understanding of innovation.

**Table 2.1: The Definitions of Innovation**

<b>Author(s)</b>	<b>Date</b>	<b>Definition</b>
<b>Innovation means creative.</b>		
<i>Tushman and Nadler</i>	1986	It is defined as the creation of any product, service, or process which is new to a business unit.
Rogers (p. 12)	1995	Innovation is “an idea, practice, or object that is perceived to be new by an individual or other unit of adoption”.
Hurley and Hult	1998	It is the notion of openness to new ideas as aspects of a firm's culture.
<b>Innovation includes both the creation and implementation of a new idea.</b>		
Becker and Whisler	1967	Innovation is defined as the first or early use of an idea by one of a set of organizations with similar goals.
Zaltman et al.,	1973	It is defined as any idea, practice, or material artefact perceived to be new by the relevant unit of adoption.
Damanpour and Evan	1984	Innovation is defined as the adoption of an idea or behaviour new to the adopting organization.
Drucker	1985	Innovation is the specific tool of entrepreneurs; the means by which they exploit change as an opportunity for a different business or service. It is capable of being presented as a discipline; capable of being learned; capable of being practiced.
Poole and Van de Ven	2004	Innovation is defined often as developing and implementing a new idea in an applied setting.
Fruhling and Siau	2007	It is as "an idea, practice, or object that is perceived as new to an individual or another unit of adoption."
Grawe, et al.	2009	Service innovation is the development of a new service which is perceived to be new and helpful to a particular focal audience.
West and Farr	1990	They defined innovation as the intentional introduction and application within a role, group or organization of ideas; processes; products; or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, organization or wider society.
Europe Commission (EC)	1995	Innovation is a function of the successful exploration and exploitation novelty in the social and economic scopes.
Mulgan and Albury	2003	Successful innovation is the creation and implementation of new processes, products, services and

		methods of delivery which result in significant improvements in outcomes efficiency, effectiveness or quality.
Brown, et al.	2004	Innovation is creating something new and implementing it successfully to a market.
Egbu	2004	Innovation can be viewed as a process of inter-linking sequences from idea generation to idea exploitation which are not bound by definitional margins and are subject to change.
Tidd, et al.,	2005	It is turning opportunity into ideas and putting these into widely used practice.
Trott	2005	Innovation is not a single action but a total process of interrelated sub processes. It is not only the conception of a new idea, nor the invention of a new device, nor the development of a new market. The process is all these things acting in an integrated fashion.
Oddane	2008	Innovation is a collective, open-ended activity aimed at the creation and implementation of new, appropriate products or processes in order to generate significant economic benefit and other values.
Kim,D., Kumar,V., Kumar, U.,	2012	Innovation refers to new applications of knowledge, ideas, methods, and skills which can generate unique capabilities and leverage an organization's competitiveness

This means that it produces new tangible and intangible items and such items are then utilised to obtain an economic or social value. Therefore, the following simple equation summarises these activities:

$$\text{Innovation} = \text{generation of new ideas (creativity)} + \text{implementation these ideas}$$

2- In the context of innovation, it is important to clarify the use of the term ‘new’. Descriptions of innovation are absolute novelty and relative novelty. Absolute (objective) novelty means that this type of innovation has never been used before in other organisations and, therefore, it is considered to be a new thing to the industry or market. This view is consistent with Levitt’s study (1962) where it emphasises that innovation relates to completely new something, whilst relative (subjective) novelty refers to the extent to which innovation is new to the particular company or the department (Totterdell et al., 2002). Following this approach, the novelty of financial services innovation includes (Den Hertog, 2000):

- According to its customers, the service is considered to be new.
- Customers should be involved in the production and consumption stages of the service.
- Employees should change the ways which are used to deliver the service.
- Technology can be applied to a process and product innovation.

The requirements of absolute novelty would create large difficulties in collecting the research data from firms which used objective novelty. Additionally, it is quite rare to find something “entirely new” (Leifer et al., 2000; Gaynor, 2002 as cited in Oddane, 2008). Therefore, the research considers that relative novelty of innovation is more appropriate for this study.

3- The definition is not limited to technological change and includes new ideas, products or processes which have administrative and technological innovation. Damanpour and Evan

(1984) state that innovation could occur not only in technological processes, but also in management methods and organisational practices.

4- Successful innovation should satisfy the needs of stakeholders. West and Farr (1990) show that innovation has significant benefits for the individual, the group, the organisation or other stakeholders.

### 2.3 Approaches to Innovation

Three approaches are identified in innovation literature by Wolfe (1994). However, this research suggests a new approach related to the benefits of innovation for individuals, organisations, groups and the external environment such as customers. Table 2.2 summarises these approaches.

**Table 2.2 Approaches to Analysing Innovation**

<b>Research Question</b>	<b>Research Approach</b>	<b>Research Focus</b>
What is the pattern/rate diffusion of an innovation?	Diffusion of innovation.	Focuses on diffusion of an innovation over time and space.
Investigating factors which affect on innovation.	Individuals, group organisational and environmental innovativeness research.	Focuses on the determinants of the innovativeness of organisations.
What are the processes organisations go through in implementing innovations?	Process theory research.	Focuses on the process of innovation within organisations
What are the benefits of innovation?	The effects of innovation.	Focuses on the benefits of innovation for internal and external stockholders.

Source: Wolfe (1994) and suggested approach for future research

The first stream aims to explain and forecast, over time, the rates of innovation through investigating diffusion of innovation. According to Rogers (1995), this process involves three stages which are innovation, communication channels and social system. The second approach aims to find the determinants of innovation which may be organisational, group, individual and external environmental antecedents. The third stream proposes to investigate

the processes of innovation which include the generation of new ideas and the adoption of suitable ones. Therefore, these innovation studies are interested in determining the stages of the innovation processes and the consequences of these stages.

This study adopts the second approach since the aim is to empirically examine the roles of some factors, such as human capital, organisational capital, social capital and customer capital, in supporting product, process and organisational innovations. Therefore, the research employs quantitative approaches and gathers the data depending on the survey questionnaire. This justification is consistent with Wolfe's (1994) study which supports the use of quantitative methods for the first and second approaches whilst qualitative methods are suitable for the third one.

## **2.4 Types of Innovation**

It is necessary to recognise the different types of innovation with their different features. Each type needs specific responses from a firm in order to achieve successful innovation. The studying of these types of innovation supports practitioners in assigning the firm's resources efficiently according to each type. The research presents these classifications as follows:

### **1.10 2.4.1 Radical / Incremental Innovation**

In order to distinguish between radical and incremental innovation, the study refers to them as major and minor innovation. Radical innovation involves fundamental changes in technology (Dewar and Dutton, 1986). It includes major transformations in current processes, products or services (Chandy and Tellis, 2000). Therefore, it is known as revolutionary changes in a firm's existing practices. Egbu (2004) confirms that radical innovation could be adapted suitably in line with the crises and pressures of the external environment. Moreover,

Ritala and Hurmelinna-Laukkanen (2013) state that, if firms only depended on internal information as a source of knowledge, radical innovation might result in failure. Therefore, in order to achieve successful radical innovation, a firm should rely not only on its internal knowledge but also on external knowledge. Furthermore, radical innovation creates a new need which has not previously been recognised by customers. Firms have to make extensive investments in the processes of production, communication and distribution and, therefore, the risks of radical innovation are increased when the development cycle is too long and so reduces the rate of success (Moosmayer and Koehn, 2011).

In contrast, incremental innovations are minor developments or the refinements of the existing products, services and processes (Subramaniam and Youndt, 2005; Un, 2010). Incremental innovations are concerned with creating a significant value for the firm or industry by improving the infrastructure or the current processes and products (Ritala and Hurmelinna-Laukkanen (2013). Innovation may be incremental which occurs in normal environments or changes (Egbu, 2004). Incremental innovation is a continuous process to improve the satisfaction of the customers' current needs. Hence, it does not create new markets (Garcia and Calantone, 2002). Sorescu and Spanjol (2008) suggest that about 90% of product innovations are incremental innovations which result in small improvements in current services and products. As a consequence, Table 2.3 summarises the differentiation between radical and incremental innovation.

**Table2.3: The Differentiation between Radical and Incremental Innovation**

<b>Criteria</b>	<b>Radical Innovation</b>	<b>Incremental Innovation</b>
Time	Long-term time	Short-term time
Frequency of occurrence	Seldom	Often
Nature of process	Discontinuous	Continuous
Objective	Creation of new products or	Improvement of existing

	processes	products or processes
Degree of change	Large	Small
Impact on competence	Destroying competence	Enhancing competence
Impact on market or industry	Creation of new markets/ transformation of existing markets/ destruction of old ones	Expansion of existing markets
Focus	Exploration	Exploitation
Risk and uncertainty	High	Low
Success rate	Low	High
Technical novelty	High	Low

Source: Oddane, 2008.

### **1.11 2.4.2 Technological / Administrative Innovation**

Administrative innovation is related to the application of new ideas in order to improve administrative processes, organisational structures and human resources. Although it does not provide new services or products, it can indirectly affect their introduction (Damanpour, 1987). Administrative innovation often responds to the firm's needs for internal structures (Choi, Garcia, and Friedrich, 2010). They pertain to structures, rules, roles and procedures. These tools play a key role in supporting communication between employees and improving work performance. Consequently, administrative innovation is concerned directly with organisational management whilst it is related indirectly to the basic activities of work (Jaskyte, 2011). Administrative innovation is top-down adoption which is initiated and supported by upper level managers. This means that administrative ideas should be innovated firstly by the firm's top level managers and then be delegated to employees (Henriques and Sadorsky, 2007).

There are many examples of administrative innovation such as planning job enrichment and enlargement, manufacturing cells, continuous improvement processes, just In time, re-engineering, the intelligent organisation of the total quality management, the agile enterprise,

incentive/reward system and a new performance evaluation system (Ishikawa, 1985; Hammer and Champy, 1993; Pinchot and Pinchot, 1993; Goldman et al., 1995).

Technology is a replicable artefact with a practical application (Dodgson, Gann and Salter, 2006). Technological innovations are defined as the advances in a product's performance and the processes of either generating new products or improving the existing ones significantly. They are an essential part of product and process innovation (Srivastava, 2007; Rubera, Griffith and Yalcinkaya, 2012). Either as products or processes, they relate directly to basic work activities (Damanpour and Evan, 1984). In the modern world, technological innovation, based on creating knowledge and applying knowledge (Betz, 2011) is an important factor for progress. Moreover, technological innovation increases production and promotes current products more efficiently.

Based on the above discussions, technological innovations include technological product innovation and technological process innovation. Technological product innovation is concerned with the implementation and commercialisation of a product with improved performance whilst technological process innovation focuses on the implementation of new or significantly improved tools to support production or delivery methods (e.g. Damanpour, 1991; OCED, 1997).

#### **1.12 2.4.3 Product / Process Innovation**

In an increasingly intense competitive environment, product innovation plays a key role in achieving the firm's aims. Process innovation is also an essential factor in supporting a firm in this environment and, because it is difficult to copy, it is considered to be a vital source for a firm to gain a competitive advantage. For example, Cimento and Knister, 1994; Sirilli and

Evangelista; 1998 and Lohmüller, (2003) show that in Italy, 65.9% of service firms had presented a product and process innovation. Therefore, as described below, a lot of research divides innovation into two types, called process innovation and product innovation.

Product innovations are new or developed final products (goods or service). These products may be brand new to the world and the firm (Edquist, Hommen, McKelvey, 2001). Product innovation is related to developing or producing new goods or services to meet the customers' needs (commercialisation) (Un et al. 2010). It involves offering new features to customers by developing an existing product or service or creating a new one and then launching it on the market. Product innovation is the main source of competitive advantage and profitability; it was shown that 30.6% of a firm's profits come from new products (Bohlmann et al., 2012). Moreover, product innovation gives a firm more flexibility in adapting to the needs of new customers (Lichtenthaler and Ernst, 2012). Product innovation is the result of the integration of many actors. These actors could be either internal or external resources (Kock et al. 2011). The result should offer new features to the customer whether through developing a current product or creating a new one (Bohlmann et al. 2012). In terms of product innovations in banks, there are many products such as mortgages, ATMs, m-banking, e-money, e-wallets, debit cards and personal bankers.

Process innovation is the discovery of a new process or method for the production of goods and services (Damanpour, 1991; Egbu, 2004). In other words, it is related to new or developed tools which transform resources into outputs. Process innovation aims to cut production costs and to improve the efficiency of production processes. A better understanding of process innovation allows firms to gain a competitive advantage (Reichstein and Salter, 2006). They include technology innovation related operations and changes in

production processes. Therefore, it may improve the firm's ability to adopt environmental changes. The process innovations of banks include automated voice response systems, computers, faxes, the internet, the streamlining of the cheque-handling process and the creation of new methods of service delivery.

Having analysed many kinds of innovation, this study adopts three kinds of innovation namely, product, process, and administrative innovation for the following reasons:

- Subramaniam and Youndt, (2005), Marqués et al., (2006) and Wu et al., (2008) examined the relationship between intellectual capital and radical and incremental innovation. Therefore, this research focuses on other types of innovation.
- No previous study has examined the relationship between the four components of IC and process, product and administrative innovation.
- Samson, (1991), Gadrey et al., (1995), Goffin and Pfeiffer, (1999), Edquist et al., (2001) and Sundbo et al., (2007) employed these classifications of innovation.

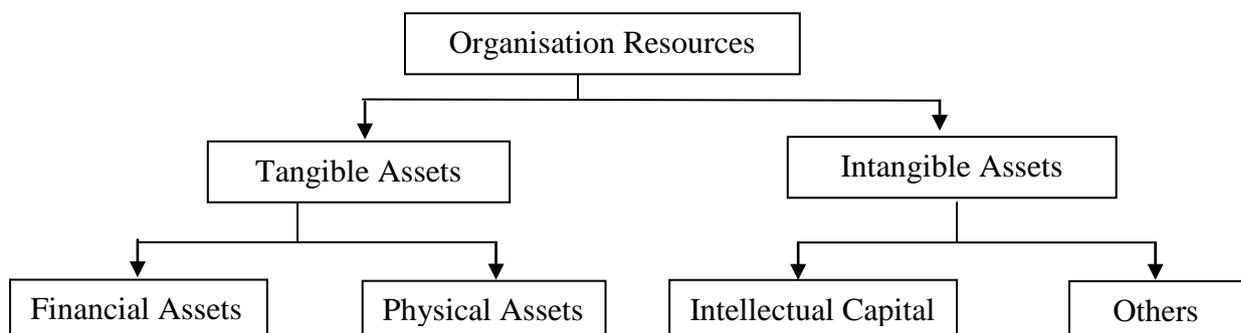
### **1.13 2.5 Summary**

This chapter has provided a review of some issues related to innovation. Based on the previous definitions of innovations, the current study considers innovation in terms of both creating and applying new ideas. To develop innovation, this study has adopted an approach that investigates the effect of many factors on innovation such as individuals, group, organisational and environmental factors. Innovation achieves some benefits for stakeholders so the research suggests that future research should examine the effects of innovation on employees, formal and informal organisations and customers. Product, process and administrative innovation are investigated in this study because no previous research has analysed the relationships between IC and these types of innovations.

## **CHAPTER 3: INTELLECTUAL CAPITAL**

### 3.1 Introduction

Figure 3.1 shows that organisations possess a lot of resources which they use to perform their activities. In the knowledge economies, organisations depend mainly on intangible assets rather than tangible ones (Alwis, 2004). Knowledge resource is considered to be an element which supports innovation significantly (Lev and Daum, 2004; Yang and Lin, 2009; Atalay and Anafarta, 2011). This resource is an engine for successful organisations which leads to (Ricceri, 2008).



**Figure 3.1:** Types of Organisation Resources

In addition, most organisations' innovation-related profits come from intangible assets such as IC (Yang, 2004). Intangible assets are the significant drivers of a firm's value in this economy (Lev and Daum, 2004). Moreover, Chen et al. (2009) emphasise that, for wealth, the fundamental resource is intangible assets which sustain organisations and allow them to interact with a competitive and uncertain environment. Within the intangible assets, IC is an important component which supports the sustainability of a business and creates new value (Bose and Thomas, 2007). IC plays a vital role in helping an organisation to achieve its aims in an uncertain environment (Johnson, 1999). It acts as a lever to attain competitive advantage (Chang et al., 2011) and is a suitable resource from which to create innovation (Subramaniam and Youndt, 2005). Wang and Chang (2005) reveal that the accumulation of IC ought to maximise the firm's outcomes. For example, successful innovation, which is a

central source of an organisation's profits, depends mainly on unique assets such as IC (Yang, 2004).

In order to analyse IC, Section 3.2 discusses the concept of IC. Section 3.3 breaks IC down into its components.

### **3.2 Perspectives to Study Intellectual Capital**

In the 1990s, academic researchers and the private and public sectors began to pay more attention to IC but there was no common method to evaluate it (Carrington, 2009). The two types of perspectives, for studying IC, are as follows:

#### **3.2.1 Accounting Perspective**

Intangible assets are non-financial fixed assets. Accountants view IC as being equal to intangible assets. Many researchers aimed to put a specific value on IC in the balance sheet (Dzinkowski, 2000; GU and Lev, 2001; Rowbottom, 2002). Huang and Wang (2008) consider that, in order to measure firms' values accurately, both IC and financial capital ought to be included in financial statements. Hence, this perspective aims to measure IC for external reporting purposes. Skandia (1995) states that IC can be calculated according to the following equation:

$$\text{Intellectual Capital} = \text{Market Value} - \text{Net Tangible Asset Value}$$

Where:

- Market Value = the market price for company's share × the number of company's shares.
- Net Tangible Asset Value = the Book Value of a company as reported in a balance sheet or an annual report.

### 3.2.2 Strategic Perspective

Many researchers have focused on IC management. They explain the role of intangible resources and capabilities in creating a competitive advantage and a better performance (e.g. Stewart, 1997; Bontis, 1998; Davenport and Prusak, 1998). Therefore, they investigate the role of IC in supporting firm’s outputs. Others have tried to investigate how firms built IC through the use of variables such as organisational culture (Gadman and Richardson, 2010), ICT (Mohamed and Mohamed, 2010), knowledge management (Robinson, 2010) and corporate responsibility (Pedrini, 2010).

Table 3.1 shows these perspectives. This study adopts the strategic perspective approach since it intends to investigate the role of the components of IC in reinforcing product, process and organisational innovation.

**Table 3.1 Perspectives to Study Intellectual Capital**

<b>Research Question</b>	<b>Research Focus</b>	<b>Field</b>
How does a firm measure IC?	Relates to the value of IC in a balance sheet.	Accounting literature
How can a firm create IC?	Relates to the determinants of IC.	Management literature
What are the benefits of IC?	Focuses on the effects of IC on the firm’s output such as performance, innovation and competitive advantage	Management literature

### 3.3 The Concept of Intellectual Capital

There are various definitions of IC in the literature. Table 3.2 presents these definitions. Many researchers have considered IC is equal to intangible assets. For example, Stewart (1997) defines IC as “the total stocks of the collective knowledge, information, technologies, intellectual property rights, experience, organization learning and competence, team communication systems, customer relations, and brands that are able to create values for a firm.”

**Table 3-2: The Definitions of Intellectual Capital**

<b>Author(s)</b>	<b>Date</b>	<b>Definition</b>
Itami	1987	IC is information-based asset such as consumer relationships brand image; corporate culture; management skills; technology and IC is considered the most important resource for organisational long-term success.
Hall	1989	Intellectual assets include intellectual property rights, i.e. patents, trademarks, registered designs, and copyrights, reputation, organisational and personal networks, and the knowledge and expertise of skilled employees.
Klein and Prusak	1994	It is intellectual material which has been formalized, captured and leveraged to produce a higher-value asset.
Brooking	1996	It is the term given to the combination of intangible assets which allow a firm to function properly.
Stewart	1997	IC is defined as the total stock of the collective knowledge, information, technologies, intellectual property rights, experience, organisation learning and competence, team communication systems, customer relations, and brands which are able to create values for a firm.
Roos and Roos	1997	Intellectual capital is the sum of the company's "hidden" assets not captured fully on the balance sheet and, thus, includes both what is in the heads of organisational members, and what is left in the company when they leave.
Edvinsson and Malone	1997	Intellectual capital was defined, also, as the total stock, of all intangible assets and capabilities in a company, which can create values or competitive advantages.
Masoulas	1997	It is "The combination of intangible assets that add value to the organisational effort in reaching its goal".
Bontis et al.	1999	It is a concept to classify all organisational intangible resources and their interconnections.
Youndt	2000	IC is referred to as "the aggregate stocks and flows of its potentially useful skills, knowledge and information".
Mouritsen et al.	2002	IC is defined as indicators which are an integral part of managing the firm's knowledge resources.
Cohen and	2007	IC is the combination of knowledge-bearing intangible resources which the firm has at its disposal and whose

kaimenakis		effective management can provide the firm with a sustainable competitive advantage.
Chang, et al.	2008	IC represents all knowledge-related intangible assets embedded in a firm.
Hsu and Frang	2009	"Intellectual capital is defined as a company's total capabilities, knowledge, culture, strategy, process, intellectual property, and relational networks which create value or competitive advantages and help a company to achieve its goals".
Hsu and Sabherwal	2012	IC is the sum of internal and external knowledge resources of a firm.

Others (e.g. Edvinsson and Sullivan, 1996; Edvinsson, 1997) discuss that IC is knowledge which aims to create value. This study adopts the second group's definitions for the following reasons:

- 1- The first group considers that IC is equal to intangible assets. Petty and Guthrie (2000) state that many elements are intangible but they do not belong to IC. For example, although reputation is a result of a successful use of tangible and intangible resources to satisfy a firm's customers, it is not a part of IC. Another example is that patents, trademarks and copyrights, which form intellectual property, are intangible assets. Compared to IC, intellectual property is considered to be a more tangible element of a firm's intangible assets. This is as a result of the interactions between the IC components since Bollen, et al., (2005) proved that capital, structure capital and relationship capital all had positive effects on intellectual property. IC is a main factor in reinforcing intellectual property. Consequently, some intangible assets, such as IC, are more likely to be indefinable whilst, for example, intellectual property and reputation are definable assets (e.g. Edvinsson and Malone, 1997; Petty and Guthrie, 2000; Bollen, et al., 2005).
- 2- The second group highlights that organisations ought to focus not only on possessing the components of IC but also in investing in IC through the effective interactions between these components in order to maximise the firm's output. Therefore, it is difficult for competitors to imitate resources (e.g. Teece, 1998; Nazari and Herremans, 2007).
3. These definitions confirm that the components of IC rely mainly on knowledge that facilitates the connections among these actors in order to fulfil the organisation's aims.

Based on the above discussions, IC is defined as a vital part of a company's intangible assets which is captured and utilised effectively to create value, a competitive advantages or to achieve the firm's objectives. In order to have an in-depth understanding of IC, the study broke IC down into its many components as detailed below.

### **3.4 The Components of IC**

The classification of IC into sub-domains supports our understanding of the concept of each component. It eases the collection and analysis of the data related to IC (Bounfour, 2005). From an analysis of the previous studies, IC is classified as follows:

- 1- Edvinsson and Malone, (1997) and Roos and Roos, (1997) divided IC into two main types, human capital and structural capital. The latter was separated into organisational capital and relational capital (or customer capital). Marr, et al., (2003) followed the same classification but they also divided OC into process capital and innovation capital, which focused on the firm's procedures, and related to its capability to create innovation.
- 2- Some researchers classified IC into three types: human capital, organisational capital and relational capital or customer capital (Marti, 2001; Marqués et al., 2006; Montequin et al., 2006; Tayles et al., 2007; Wu et al., 2008).
- 3- Moreover, Subramanian and Yound, (2005) Nazari and Herremans, (2007) and Ruta, (2009) used social capital instead of relational capital.
- 4- Joia, (2000) and Bounfour, (2005) divided IC into four types: human capital, organisational (or structural capital), relational (or customer capital) and innovation capital.

Based on the above studies, it can be seen that IC consists of three main elements: human capital (HC), organisational capital (OC) and customer capital (CC). This study adopts the

previous classification and adds social capital as a fourth component for IC. Hence, IC consists of four actors. The new classification is important because it will provide the whole picture about the different levels of knowledge; individual, group and organisational, which express internal knowledge (formal and informal knowledge) and external knowledge such as customers.

Drawing on the above analysis for different classifications related to intellectual capital, this study breaks IC down into human capital, organisational capital and relational capital related to customer capital and social capital. The following presents the definitions of these terms and their sub-components:

### **3.4.1 Human Capital**

HC embraces employees' competencies including knowledge, skills, talents, experiences, qualifications and education (Edvinsson and Malone, 1997; Roos and Roos, 1997; Chen et al., 2009; Kim, Yoob and Lee, 201; Hsu and Sabherwal, 2012). HC is embedded in the employees' minds (Lee et al., 2011). Martín-De Castro et al., (2006) emphasises that HC relates to the tacit and explicit knowledge possessed by employees. Firms can obtain this knowledge through renting or borrowing. HC is formed from genetic inheritance and , learning factors (e.g. Bontis, 1998; Chen, et al., 2009). Consequently, the key challenge is how a firm obtains HC to maximise its goals in uncertain environments.

Firms should deal with employees as an asset rather than as a cost since HC is a valuable factor for performance considerations. In the service economies, HC's importance and efficiency is considered to be one of the cornerstones of a successful firm (Ulrich, 1998). Crook et al., (2011) mention that, for both firms and employees, investment in HC could produce significant outputs performance. HC may be IC's most important actor because of its

main responsibility for developing OC and CC (e.g. Bontis, 2004; Bollen et al., 2005). HC is a key driver in creating value for a firm and in achieving effective performance and competitive advantage (Chen et al., 2009; Dokko and Rosenkopf, 2009; Nordenflycht, 2011). Ethiraj and Garg (2012) state that an organisation with unskilled employees was at the mercy of competitive forces in a turbulent environment and this might lead to failure. A firm must invest in HC to improve its knowledge and skills; these will reflect on the performance of both the firm and its employees (James, 2000).

In resource-based literature, HC is a firm's primary strategic asset. The Resource-based view (RBV) confirms that HC is a key resource in supporting competitive advantage, innovation and a firm's performance. This is because it is likely to be rare, valuable, non-substitutable and not imitated easily (Galunic and Anderson, 2000; Hsu and Wang, 2012; Kim et al., 2012). It plays an important role in the development of the IC's components and, therefore, is considered to be at the heart of the latter (Bontis, 2004; Bollen et al., 2005). Hence, employees, with good skills and knowledge are likely to benefit the firm by (1) generating new techniques for production, equipment and processes, and (2) innovating a new product or service (Wang, 2006).

### **3.4.2 Organisational Capital**

OC consists of various structural elements, which are embedded in an organisation and support employees in doing their work to create wealth (Bollen, Vergauwen and Schnieders, 2005; Chen, Shih, and Yang, 2009; Yang and Lin, 2009). OC is "everything that supports employees' productivity" (Edvinsson and Malone, 1997). OC relates to an organisation's knowledge and codified experience; these are part of its organisational culture, its knowledge management system, efficient processes and top management support (Yang and Lin, 2009).

Process effectiveness includes the internal procedures which allow the integration of knowledge which creates wealth for firms (Yang and Lin, 2009). Consequently, it represents non-human assets or the organisational infrastructure through which HC can create added value (Bontis, 2001; Chen, Lin, and Chang, 2006). If an organisation has a poor OC, IC does not accomplish its aims. In other words, OC is a critical component in leveraging IC and it may encourage employees to perform their work better (Bontis, 1998). OC improves the employees' knowledge which turns into the organisation's knowledge (Stewart, 1997).

Knowledge Management (KM) refers to the process of creating, sharing and applying knowledge resources (Liao, Chuang and To, 2011). KM focuses on the exploration and exploitation of knowledge to support decision making in an uncertain environment (Alavi and Leidner, 2001). KM is considered a pivotal antecedent which affects innovation (Honarpour, Jusoh and Md Nor, 2012). Moreover, Dalkir et al., (2007) maintain that the processes and activities of KM leverage facilitated the management of IC and innovation. Knowledge acquisition is a mechanism which facilitates obtaining knowledge or it is a process related to absorbing critical knowledge from its resources (Parra-Requena et al., 2010; Zhou and Li, 2012). A firm obtains knowledge from the outside marketplace and its employees. These resources provide many opportunities for organisations to recycle their current knowledge in order to create more valuable knowledge (Chen and Huang, 2009; Li et al., 2010). Employees make more effort and spend more time obtaining specialised knowledge related to their experiences (Kim et al., 2011). Knowledge acquisition concerns exploration. This means that it relates to discovering and searching for knowledge. Moreover, it tries to create or develop new ideas and learns from partners which are main sources of external knowledge (Lavie and Drori, 2012). Although knowledge acquisition is a key factor in KM, it is not sufficient to organise KM efficiently (Kotabe, et al., 2011). KM should also integrate

knowledge acquisition with other KM processes known as knowledge sharing and application to accomplish its objectives. Knowledge sharing is an essential tool which motivates employees to exchange mutually formal and informal knowledge. It contributes to the application of knowledge and supports innovation and competitive advantage (Wang and Wang, 2012). It transfers knowledge from one context to into another which needs it. Knowledge sharing happens between different levels. For example, it moves between employees or from individuals to a group or organisation (Choi et al., 2010). This means that, through sending and receiving, knowledge sharing includes often mutual exchanges of knowledge amongst organisations, groups and individuals (Foss et al., 2009). On the other hand, knowledge application is an important factor in successful new processes, services and products. Therefore, firms should continuously create , distribute and apply new knowledge to reinforce innovation and sustainable competitive advantage (Song, van der Bij and Weggeman, 2005). In firms, it involves organisational and individual users of knowledge (Berta et al., 2010). Knowledge application relates to exploitation and transformation of new or developed knowledge into effective processes or commercial products (Lavie and Drori, 2012).

Culture is defined as a set of norms and expectations, values, beliefs and attitudes which are common to a group (Jacobs et al., 2013). Organisational culture is described as the shared values, rules and assumptions which guide employees' behaviour in a firm (Schein, 2004; Braunscheidel et al., 2010). It is a significant social attribute which impacts on individual, group and organisational behaviour (Hartnell, Ou and Kinicki, 2011). Organisational culture, which is considered to be an intangible asset, acts a key source of competitive advantage (Zheng et al., 2010). Furthermore, many studies have confirmed that organisational culture plays a key role in supporting innovation because employees can accept innovation if they

believe that innovation is a basic value in the organisation. Hence this belief can encourage a significant commitment towards innovation (Naranjo-Valencia, Jimenez-Jimenez and Sanz-Valle, 2011). Parker and Skitmore (2005) mention that organisational culture is often regarded as the main reason for the failure to apply organisational change programmes and turnover in project management.

Organisational structure is defined as how authorities and work roles are distributed in order to organise and control decision-making activities (Huang, Rode and Schroeder, 2011). This study focuses on two major aspects of organisational structure which include centralisation and formalisation (Hage and Dewar, 1973; Oldham and Hackman, 1981; Sciulli, 1998). Centralisation is described as “the extent to which decision-making power is concentrated at the top management”. In the other words, it relates to the amount of employee participation in decision-making. Most previous studies have suggested that a decentralised organisational structure can support organisational effectiveness whilst only some consider that high centralisation may have a positive effect on organisational effectiveness (Zheng, Yang and McLean, 2010). On the other hand, formalisation is related to the extent to which a firm employs a set of procedures and rules to organise and support the behaviour of its employees (Liao, Chuang and To, 2011). It is a technique which guides and forms the employees’ behaviour. Consequently, different employees perform similar job activities. Therefore, high levels of centralisation and formalisation produce uniformity of behaviour, action and policing (Katsikea, Theodosiou, Perdikisand and Kehagias, 2011).

In the same vein, top management support is defined as the level of support top management gives to innovation through providing adequate capital, human resources and a suitable work environment in which to encourage creativity and innovation (Latting et al., 2004; Carbonell and Rodríguez-Escudero, 2009). Moore, Konrad and Hunt, (2010) assert that it is well

recognised that top management support increases effectiveness. Top management support is the most essential factor for a firm's success (Young and Poon, 2013). It focuses on the most strategic fields for firms (Young and Jordan, 2008; Talke et al., 2010). Hence, it plays a central role in strategic decisions which affects the organisation's current and future results (MacCurtain, 2005; Camelo et al., 2010). It is an important driver of product innovation since it possesses the authority, power and expertise to allocate the firm's resources efficiently in order to improve the organisation's output (Cooper and Kleinschmidt, 1995; Hoejmosse, Brammer and Millington, 2012).

### **3.4.3 Relational Capital**

Relational capital has become a core research area in IC studies and business marketing. It is a key factor in supporting the competitive advantage (Kohtamäki et al., 2012). Firms which build good relationships with partners, focus effectively on the main activities of service and product quality (Sambasivan, LokeSiew-Phaik, Mohamedd and Leong, 2013). Organisations suffer from some opportunistic behaviours by partners which increase the transaction costs. Consequently, based on mutual interests they build appropriate relationships with their partners (Kale, Singh and Perlmutter, 2000).

According to IC researchers, relational capital is a knowledge embedded in internal relationships known as social capital (SC) (Tsai and Ghoshal, 1998) and external relationships such as those between a firm and its customers (e.g. Bontis, 1999; Yang and Lin, 2009).

### **3.4.3.1 Social Capital**

SC is one of the topics related to informal communication (Yamaguchi, 2013). Academic research on management has become increasingly interested in SC since it is considered to be a valuable resource for successful innovation and performance (Arribas, Hernandez and Vila, 2013). SC is related to “the sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit” (Nahapiet and Ghoshal, 1998). Moreover, Subramaniam and Youndt (2005) explain that SC represents the informal interactions amongst employees in developing a smooth and preferred work atmosphere through team members exchanging information. Therefore, SC is a result of the interaction and collaboration amongst employees within an organisation through sharing knowledge and experiences. Furthermore, Putnam (1995) maintains that “SC refers to the features of social organisation such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit.”

Based on the above definitions, SC has the following characteristics:

- SC is knowledge resources - intangible assets- embraced within an organisation.
- These resources depend on interrelationships between employees.
- These relationships are subject to networks, norms and social trust which facilitate coordination between employees.
- Networks can achieve many benefits not only for its members but also for the organisation and its economic growth.

SC facilitates access to resources and information that are necessary for exploration and exploitation of opportunities which produce a better performance for the firm (Petrou and Daskalopoulou, 2013). A broad consensus is emerging which suggests that SC is a valuable

asset (Moran, 2005). Increasingly, business organisations are using groups as their fundamental unit of organisational structure in order to respond more flexibly and quickly to rapidly changing environments. Reiche et al., (2008) emphasise that SC can provide an excellent atmosphere that gives more flexibility for employees in an uncertain environment. Groups can be more responsive because of the recurrent pattern of dynamic relationships amongst people both within and outside the group (Oh, Labianca and Chung, 2006). Cainelli, Mancinelli and Mazzanti (2007) state that SC should be interpreted as an important part of an investment. SC is considered to be the glue which holds employees together (Green and Brock, 2005). Firms cannot perform their processes effectively unless these are integrated with SC (Farris, 1979). They should pay more attention to SC in order to gain more flexibility in turbulent environments. This could be achieved by considering informal relationships between employees as an important driver in the organisational structure (Oh et al., 2006).

Moreover, IC grows if the organisation has a high level of SC since it enables the employees to perform complex tasks and overcome the environmental challenges (Nahapiet and Ghoshal, 1998; Badrinarayanan, Madhavaram, and Granot, 2011). SC increases the depth and efficiency of the exchange of mutual knowledge and this is considered to be a key factor in the SC process (Weber and Weber, 2007).

On the other hand, SC is often divided into three dimensions (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). Firstly, structural dimension is considered an essential element in identifying the efficiency of the network processes and member contribution. It relates to the social connections or network ties amongst colleagues (Nahapiet and Ghoshal, 1998; Tsai

and Ghoshal, 1998). The network structure should be organised so that the resources flow efficiently between actors; this assists innovative information exchange (Butler and Purchase, 2008). Secondly, the relational dimension refers to the powerful relationships which are built on the trust between partners. Therefore, it concerns the quality of the relationships which depends on mutual trust and respect between the actors (Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998). The trust relationships support knowledge sharing practices and promote transaction values, reduce transition costs and improve the productivity and efficiency (Dyer, 1997; Zaheer et al., 1998; Doh and Acs, 2010). Thirdly, the cognitive dimension relates to the actors' shared interpretations of goals and values. Shared expectations direct and rule the employees' behaviour to achieve the network's aims. It reinforces cooperation between members (Andrews, 2010; Hughes and Perrons, 2011).

#### **3.4.3.2 External Relationships**

As mentioned earlier, external relationships relate to the connection between the firm and its stakeholders such as shareholders, suppliers, customers, competitors and others. External relational capital is defined as the knowledge which is produced from these relationships. It has become another intangible asset for a firm (Chang et al., 2008). Although the relationships between employees and their external stakeholders play an essential role in supporting innovations, this study focuses only on the relationships with customers. This is for the following reasons:

- Compared to other stakeholders, customers are the most valuable (Zerenler and Gozlu, 2008; Cohen and Kaimenakis, 2007). Therefore, the relationship between the firm and its customers represents the most important component in relational capital (Mayo, 2001). Moreover, Sundbo (1997) emphasises that, compared to

manufacturing, customers are more important in service innovations such as life insurance, retail credit companies, restaurants and hotels.

- In addition, customers are the most important element of a firm, especially in banking activities. This is because banks work in a seriously competitive environment not only in terms of other banks but also because of other financial institutions (Kaynak and Kucukemiroglu, 1992; Hull, 2002). Therefore, building good customer relationships supports them in adapting to this environment.
- Many large companies, for example Apple and Coca-Cola, confirm that CC is the key source of the firm's value.
- Amara et al., (2009) maintain that clients play an important role in the creation and innovation of new services and products.

Customer capital (CC) is defined as knowledge resources derived from the relationships with customers (Bontis et al. 2000; Youndt and Snell, 2004; Yang and Kang, 2008; Yang and Lin, 2009). This intangible element embraces the knowledge which customers possess. Often, frustrated managers do not realise the importance of customers' knowledge (Bontis, 1998). However, CC is considered a central source of an organisation's current and future profits. Also, CC is as an important IC component since it is considered to be a major source of competitive advantage (Stewart, 1997; Edvinsson and Malone, 1997; Bontis et al., 2000; Duffy, 2000). Marketing resources, such as customers, are a key source of competitive advantage. The successful business aims not only to create a product or process using new technology but also to build a good relationship with its customers in order to guarantee that this innovation meets their needs (Yang and Kang, 2008). Organisations with loyal customers do not have to engage in costly sales promotions in order to attract new customers (Chen et al., 2004). Moreover, if they have CC, firms can transfer OC into added value (Shih et al.,

2011). Schneider and Bowen (1985) argue that firms ought to encourage customers to participate in the production of products or services since it would minimise the gap between its outputs and the customers' desires. For example, the Apple Company has successful products because it encourages the customers to be involved in the process of product development. Consequently, CC is considered a critical asset in supporting innovation.

Because of the rapid changes in technological innovations, the integration between an organisation and other organisations is becoming an essential factor of many firms' strategic planning (Huxham and Vangen, 2005; Devine, Boyle and Boyd, 2011). Due to positive interaction between internal resources and customers, 30% of innovations are successful. Organisations co-operate with customers to effectively develop new products (Nijssen et al., 2012). Some organisations encourage the collaboration between their resources and customers in order to innovate or develop their products (de Jong and von Hippel, 2009). Hence, with rapid changes in market uncertainties, shortened product life cycles and competition, managers face critical challenges in introducing a successful innovation into a turbulent environment (Dinopoulos and Syropoulos, 2007; Madrid-Guijarro, Garcia and Van Auken, 2009; Roy and Sivakumar, 2012, Kuester et al., 2012).

### **3.5 Summary**

A key driver of success within organisations is their intangible resources. IC is a vital intangible resource which helps to support a business's sustainability and creates new value. This means that IC is not equal intangible assets. IC plays an important role in reinforcing innovation and competitive advantage. IC includes four components and they are human capital, organisational capital, social capital and customer capital. Human capital relates to skills and competences of employees (individuals) While organisational capital is a non-

human asset or formal organisational infrastructure that provides other types of capital with the required resources to facilitate their jobs (formal organisations). Social capital is concerned with informal relationships among employees (groups). Finally, customer capital is knowledge about customers (environment).

## **CHAPTER 4: THEORIES AND THE CONCEPTUAL MODEL**

## **4.1 Introduction**

The conceptual model is based on theoretical foundations. Therefore, this chapter aims to discuss some theories which are employed to justify the relationship between IC and innovation (section 4.2). It also aims to present how the research applies ANT in the current study (section 4.3). Finally, Section 4.4 presents the conceptual model. This section is divided into the following four sub-sections: Section 4.4.1 summarises the studies which focus on the relationship between IC and innovation; 4.4.2 focuses on the relationships between HC, SC and CC and OC. Section 4.4.3 presents the direct relationship between the components of IC and innovation which are: the relationship between organisational capital and innovation; the relationship between social capital and innovation; the relationship between human capital and innovation and the relationship between customer capital and innovations. Section 4.4.4 focuses on the inter-relationships between different types of innovation which include the relationship between organisational innovation and process innovation, the relationship between process innovation and product innovation and the relationship between organisational innovation and product innovation. Section 4.4.5 presents the mediating role of organisational capital in its relationship with the other components of IC and innovation.

## **4.2 Theoretical Bases**

### **4.2.1 Resource-based View**

The Resource-based view (RBV) confirms that an organisation's performance relies on a set of internal resources and capabilities (Shahoub and Al Qasimi, 2006). It focuses on the internal resources and capabilities which can reinforce competitive advantage. Moreover, the RBV considers that a firm is made up of a heterogeneous set of tangible and intangible resources. This heterogeneity gives more flexibility to firms to compete in the marketplace

(Peteraf, 1993; Acur et al. 2010). It aims to illustrate the role of resources in supporting organisational performance in a dynamic, competitive environment. These resources are employed to support firms in producing better products and services in order to satisfy customers' needs (Peteraf, 1993). These resources have four attributes. They are rare, valuable, have few substitutes and are not easily imitable (Makhija, 2003; Shalhoub and Al Qasimi, 2006; Paladino, 2007). Firstly, in order to have a competitive advantage, resources should be rare. Secondly, if resources facilitate the firm to exploit opportunities or deal with threats and risks, these resources are valuable. This allows the firm to focus its effort towards the determined aim. Thirdly, the different resources face many difficulties in replacing the valuable resource. Fourthly, competitors should find it difficult to imitate this resource (Barney, 2001).

The RBV is also an important topic in the management of innovative technology and is considered to be a key approach in understanding innovation. Resource development is a key factor in innovative products and services (Hadjimanolis, 2000). The RBV states that intangible resources, such as IC, are the key elements of a firm's success. These resources have the ability to reinforce competitive advantage and innovation is considered to be a source of competitive advantage (Abu Bakar and Ahmad, 2010).

Hence, the RBV considers that an organisation's resources support innovation. Furthermore human resource management researchers employ RBV by strategy because a firm is a pool of human capital which is a source of innovation and competitive advantage (Chadwick and Dabu, 2009). Additionally, the RBV confirms that intangible resources such as OC and SC are the key drivers of product innovation performance (Abu Bakar and Ahmad, 2010). On the other hand, Yang and Kang (2008) state that this theory emphasises the role of marketing resources, such as CC, in supporting competitive advantage. It encourages firms to build an

effective relationship with customers in order to complete a successful new product. Consequently, the integration between internal knowledge, such as HC, SC and OC and external repositories, such CC, maximise the valuable knowledge which is a cornerstone of innovation (Martínez et al. 2012).

Based on the above discussions, the research concludes that the RBV emphasises the importance of an organisation's resources, such as IC, in supporting innovation and competitive advantage. It gives all these resources the same importance in terms of supporting innovation. It also does not investigate the interactions among these resources or the actors that provide a suitable working environment for innovation. Moreover, the RBV only focuses on internal resources whilst the research model has a variable which is related to knowledge about customers named CC (external knowledge). Hence, the RBV explains some research hypotheses and ignores others.

#### **4.2.2 Knowledge -based View**

Knowledge-based View (KBV) focuses only on intangible assets whilst the RBV is concerned with both physical and non-physical resources (Gassmann and Keupp, 2007). In the new economy, knowledge has a strategic position in creating a firm's value; this encourages the researchers to develop the KBV. It assumes that knowledge is the main source of a firm's outcomes. Knowledge is a unique resource (Kogut and Zander, 1992). It is the most difficult resource to duplicate and it needs to be integrated with many different capabilities (Spender, 1996; Sambamurthy and Subramani, 2005).

Stewart (1997) asserts that firms need to create new knowledge or IC in order to survive. The KBV views organisations as repositories of knowledge embedded in organisational processes, competences and relationships (Dyer and Singh, 1998). Moreover, knowledge is a

key source for competitive advantage which is translated into innovation (Kandampully, 2002). Successful innovation relies on the amount of knowledge possessed by the firm. The KBV gives a new view for the implications of product and process innovations (Gopalakrishana and Bierlyb, 2001).

Based on the above discussions, the research concludes that:

- The KBV considers knowledge an important resource for firms.
- The KBV emphasises mainly intangible resources such as IC.
- The KBV asserts the interactions between different actors who possess the knowledge to achieve the firm's aims.
- The KBV stresses that knowledge is a key source for supporting innovation.

Consequently, the KBV can be employed to justify the relationship between IC and innovation. Lu (2005) states that HC relates to experience, knowledge and skills which are embedded in employees. Human tacit knowledge supports innovation. Furthermore, Paiva, Roth, and Fensterseifer (2008) declare that structural capital or structural knowledge is embedded in organisational rules, processes' systems and routines. Structural knowledge is largely explicit. Therefore, it is expected that it has a significant effect on innovation. Moreover, relational capital or relationship knowledge focuses on knowledge which is produced from the relationships between an organisation's employees and its customers. Relationship knowledge is reflected by an ability to collaborate effectively. Relationship knowledge is largely tacit and that affects innovation positively (Lu, 2005).

Although the KBV can contribute to explaining the above relationships, it focuses only on the direct effects and it gives all actors the same importance in supporting innovation.

Meanwhile this study is concerned with the direct and indirect effects of IC on innovation through a key variable.

### **4.2.3 Actor-network Theory (ANT)**

#### **4.2.3.1 Background**

ANT is a critical social theory which Callon, 1986; Latour, 1986; Law, 1986; and Johannesson (2005) developed within science and technology studies and sociological studies. ANT is a research methodology which provides further exploration in developing project management knowledge in order to support the project's aims (Pollack, Costello and Sankaran, 2013). ANT has been applied to management and organisation studies especially in terms of innovation (Young, Borland, and Coghill, 2010). Moreover, it is employed in analysis information systems (Mutch, 2002). ANT is accepted widely in understanding the process of implementing technology projects. Pollack, Costello and Sankaran (2013) report that ANT focuses primarily on investigating and building interactions within the actors' network. This study analyses many areas that are related to ANT.

Firstly, ANT states that the world is made up of the interactions between human and non-human actors which produce a network. Consequently, a network is described as a black box since it includes complex relationships. In studying the networks of connections made by mediators taking action, Pollack, Costello and Sankaran (2013) report that ANT was also employed to investigate how different actors worked together to achieve the network's final goal. In contrast, the social networks' theory focused on people networks or human actors. Actors seek to achieve both individual and the network's goals (House, 2001). In other words, the actor network contains a complex bundle of heterogeneous resources which, in order for a firm to be successful, includes the interactions between material and non-material

actors (Rafea, 1999; Steen, 2010). For instance, within a bank, the relationships involve many actors such as employees, their ideas and technology. These actors work together to form a network.

Secondly, ANT considers that a network should possess a determined goal based on the alignment of interests. It stresses shared action for fulfilling the project’s aims. Therefore, although a network includes various actors, they have aligned interests (Bakhshaie, 2008). A network may be broken or destroyed if it has no common goal which gathers its actors to perform their activities as a team. Consequently, the actors have to move to another network since their interests are consistent with a new network (Monterio, 2000). A successful network consists of different actors with different ways of thinking, different knowledge and skills. They prefer to transfer their own interests into common interests within the network (Latour, 2005).

Thirdly, ANT confirms that the process of building or evaluating an actor-network should cover a series of four moments of translation, namely, problematisation, interessement, enrollment and mobilisation (e.g. Rhodes, 2009; Steen, 2010; Young et al., 2010). The next part presents these stages and other concepts in more detail.

#### 4.2.3.2 The concepts of ANT

Table 5-1 presents the following concepts related to ANT.

**Table 4-1: ANT Concepts**

<b>Concept</b>	<b>Description</b>	<b>Reference</b>
Actor or acts	An actor is defined as human and non-human entities which are parts of a network, for example, humans, technical	Ghazinoory and Hajishirzi, 2012.

	artefacts, texts and graphical representations. Actors try to convince others to create aligned interests in order to build a network.	
Actor network	An actor network is a set of heterogeneous factors including people; standards; and groups which have been brought together or it is a heterogeneous network of aligned interests in order to achieve a determined aim.	Callon, 1991
Translation	Translation is a main point in understanding how a project builds a coherent actor network. It is the process of persuading a diverse set of actors to adopt the focal actor's interests. In other words, it is the process of creating links between actors through aligning the different actors' interests with those of the focal actor. This process consists of four "moments of translation" known as problematisation, intersement, enrollment and mobilisation	Rhodes, 2009; Barry, 2013
Focal actor	The focal actor is the main actor that has resources and authorities to convince other actors to accept the network interests.	Potts, (2009)
problematisation	Problematisation is the first stage of translation which describes the nature of the problem whereby the focal actor defines a problem which other actors consider as their own problem. Moreover, a focal actor states the other actors' characteristics and interests which are similar to the network. Furthermore, this stage is very important since it supports	Callon (1986); Rodger, (2007); Rhodes, (2009).

	the focal actor not only in discovering which are the significant actors but also, those which are not. Moreover, the problem identification phase should determine an Obligatory Passage Point (OPP).	
Obligatory Passage Point (OPP)	The focal actor defines the requirements which are necessary to create a network whereby the actors are joined to the network if they qualify to satisfy these needs. An OPP may be either an aim; a question; or a programme which meets the different actors' interests. It is a point along the path leading to the various actors' goals as defined in the problematisation phase.	Rodger, 2007; Shin, 2010
Interessement	The second phase of translation relates to the focal actor persuading actors initially to adopt the suggested path. Consequently, it is considered to be a negotiated stage. While the problematisation phase defined the actors' allowable interests and identities, interessement strengthens the relationships between actors through stabilizing these actors' identities and interests.	Rafea, (1999); Rhodes, (2009); Ghazinoory and Hajishirzi, 2012.
Enrollment	Enrolment means that the actors accept the OPP or they accept the network's roles and interests which are decided on the above stages. Both enrollment and interessement are related since if the actors did not accept the roles and identities defined in the first stage (problematisation) and negotiated in the interessement stage, enrolment could not be	Duim and Marwijk, (2006).

	completed. Hence, the successful previous stages are essential if the enrolment moment is to be accomplished.	
Mobilisation	Mobilisation is the process in that certain actors are considered to be spokespeople or representatives to attract other relevant actors to support a network's aim. Therefore, maintaining the network is completed through persuading the actors that have interests which are consistent with the focal actor's interests. Also, they encourage others to participate in the actor network.	Rhodes, (2009).

### **4.3 How to Apply ANT (Problematization (The Formation of Innovation-Network))**

This study focuses on the first moment of ANT which is consistent with the research aims and hypothesis. Problematization emphasises that the focal actor defines a problem and what the role of other actors is in solving the problem. Moreover, actors should recognise this problem as their own problem. Therefore, in supporting the different types of innovations, the research examines the role of many actors known as OC, HC, CC and SC in supporting innovation.

#### **4.3.1 Define the Focal Actor and Other Actors**

ANT distinguishes between human and non-human actors. OC consists of both non-human factors such as organisational structure, organisational culture and knowledge management and top management support. OC is considered to be a formal actor which possesses the different resources that achieve the firm's aims. For example, organisational structure can impact on the success of implementing technologies in an uncertain environment (Phillips, 1980). Furthermore, organisational structure has an essential role in developing the radical

and incremental product innovation capabilities (Menguc and Auh, 2010). Martins and Terblanche (2003) confirm that organisational culture could stimulate creativity and innovation whilst KM was an approach to improve organisational effectiveness. It also facilitates the process of knowledge exchange which is essential for reinforcing innovation performance through developing new capabilities (Sherman et al., 2005; Chen and Jing-Wen Huang, 2009). Finally, top management support can create a supportive work environment for innovation (e.g. West and Farr, 1990; Salaman and Storey, 2002; Carmen et al., 2006). Moreover, OC is the main source of decision making and it is responsible for the strategic planning, it has the authority and the power to deploy and to direct all resources in an organisation. Therefore, OC can convince other actors to support innovation. Based on the above discussions, OC is considered to be, in this network, a good organiser or focal actor.

On the other hand, the focal actor should identify the relevant actors or factors which can support different types of innovation. This means that the focal actor should put an Obligatory Passage Point (OPP) in order to provide access for the actor to become a knot within the network. Besides, between them, these actors already have strong interactions which create a harmonious working environment. Based on the previous studies, the research suggests that the focal actor selects many factors such as HC, CC and SC.

#### **4.3.2 The Interactions between Actors**

This section aims to test the extent to which these actors have positive interactions, a sense of teamwork and work together effectively. For instance, firstly, the relationship between HC and OC has to be significantly positive. This means that organisations should focus not only on employing skilled workers but also on developing their skills by means of good training programmes which reflects positively on OC. Secondly, HC significantly affects CC. The

qualified employees can understand customers' needs which maximises the customers' loyalty to the firm. Thirdly, OC is closely associated with CC. In order to enhance innovation, OC could enable firms to utilise knowledge which is available in CC. However, the extent to which a firm can make the best use of its OC depends on how well a firm improves and maintains good relationships with their customers in both the short and long term. This means organisations which adopt customer orientation, build efficient organisational routines and processes which support good service (e.g. Bontis, 1998; Bontis et al., 2000; Bollen et al., 2005; Torres, 2006; Cohen and Kaimenakis, 2007; Hsu and Fang, 2009; Chen et al., 2009). Fourthly, HC and SC are closely related. Nahapiet and Ghoshal (1998) assert that informal relationships between group members boost the accumulation of employees' knowledge through communication and debate. Informal collaboration within organisations improves employees' ability to learn (Brown et al. 1991). Fifthly, OC relates significantly to SC. OC can facilitate the process of sharing new ideas and information at a social level (e.g. Zander and Kogut, 1995; Youndt, et al., 2004). Carmona-Lavado et al., (2010) reveal that OC creates a context which contributes to shared knowledge and enhanced cooperation. Moreover, Wu et al. (2008) reveal that SC has significant influence on OC. SC supports the formal channels so that, within a firm, knowledge can flow easily (Yang and Lin, 2009). Gulati and Puranam (2009) state that informal relationships can enhance business processes.

Finally, based on the previous discussions, this research concludes that these actors can effectively work with each other to reinforce an innovation network.

#### **4.3.3 The Role of the Actors in Supporting Innovation**

In recent years, although banks have introduced a great deal of innovation, many of them still went bankrupt. This prompted the focal actor (OC), within top management to identify the relevant actors or resources which would support innovation. The focal actor does not allow access for actors to join the network if they cannot positively contribute in supporting the different types of innovation. Many previous studies have emphasised that the components of IC (HC, SC, OC and CC) have had a significant effect on innovation. This research gives the following examples of these relationships:

#### **4.3.3.1 Human capital and innovation**

HC has a positive influence on innovation. HC mediates the relationship between SC, entrepreneurial orientation and innovation (Wu et al., 2008). HC interacts with SC to positively influence radical innovation (Subramaniam and Youndt, 2005). Moreover, HC has a positive effect on product innovation in the manufacturing sector (Pizarro et al., 2009).

#### **4.3.3.2 Organisational Capital and Innovation**

OC has a positive effect on the performance of new product development (Menona, et al., 2002). Wu et al., (2008) state that there is a positive relationship between OC and innovation and that OC supports the relationship between social capital, entrepreneurial orientation and innovation OC. Incremental innovation is associated positively with OC (Subramaniam and Youndt, 2005).

#### **4.3.3.3 Customer Capital and Innovation**

Through generating new ideas, customers are considered a key source of innovation (Wu and Fang, 2010). Kammerer (2009) found that customer orientation was essential specifically in respect of product innovation which provides a competitive advantage.

#### **4.3.3.4 Social Capital and Innovation**

If firms pay more attention to SC, they produce a high level of innovation (Laursen et al. 2012). Within organisations, social networks are shown to play a vital role in sustaining potential breakthrough innovations (Baba and Walsh, 2010). Moreover, supporting the ties amongst employees, trust and group cohesion are key factors of innovation (Zheng, 2008). SC, which develops an appropriate environment, can support innovation (Wu et al., 2008). This environment supports team as they try to solve problems by creating different ideas. It increases the conformity of members' thoughts and as they experience different forms of conflict and improved group cohesiveness (e.g. Jehn, et al., 1999; West and Farr, 1990).

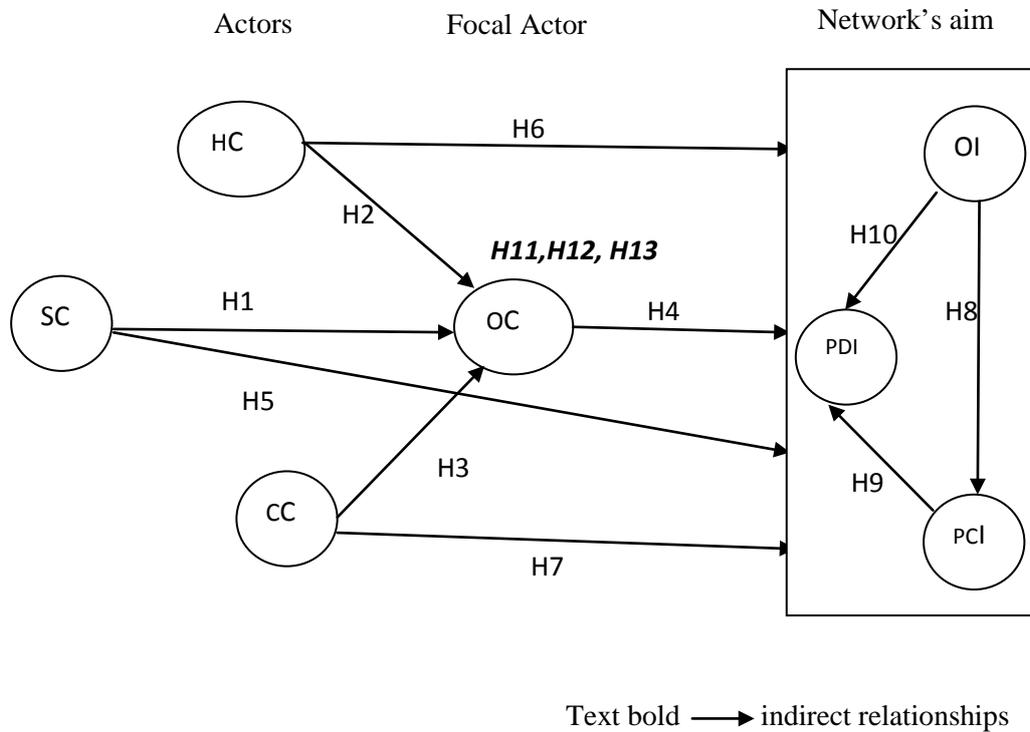
Based on the previous studies, IC (HC, SC, CC and OC) has an essential role in supporting innovation. This study expects that these components will sustain organisational, product and process innovation. Consequently, the research has chosen HC, SC and CC to work with OC in supporting an innovations network.

Finally, the stability of the actor-network depends on the strength of relationships between the focal actor and the other actors and the spokespersons' abilities to persuade other actors (Rhodes, 2009). Consequently, ANT has the ability to explain the interactions between some components of IC (HC, CC and SC) and OC which facilitates the relationship between these actors and the process, organisational and product innovation.

#### **4.4 The Research Hypotheses (the Research Model)**

This study adopts the research model (see figure 4.1). It aims to analyse the previous studies which tested the relationship between the components of IC (HC, SC, CC, OC) and product, process and organisational innovation. Moreover, it explores the studies that have

investigated the role of HC, SC and CC in supporting OC as well as the interactions among the different types of innovation.



**Figure 4.1 The Conceptual Model**

#### 4.4.1 The Relationship between Intellectual Capital and Innovation

This section presents previous studies which have examined the relationships between IC and innovation. Based on Table 4.2, the research pays attention to the following comments:

- Wu, et al., (2008) assert that IC can support the firm's level of innovation. However, they do not determine which kind of innovation the paper studied.
- As a part of IC, SC plays an essential role in converting the effect of HC on radical innovation from a negative to a positive effect (Subramaniam and Youndt, 2005).
- Chen, et al., (2006) emphasise that IC (HC, OC and CC) can impact positively on the performance of new product development. Consequently, they measured the performance of product innovation through items such as:

- 1) The ability of a new product to deal with a competitive environment.
- 2) The ability of a new product to satisfy the customers' needs.
- 3) The sales which related to a new product.
- 4) The profit derived from a new product.

In gathering the data, the above studies focused mainly on the manufacturing sector.

Based on the above discussions, previous studies have focused on the relationships between IC and two types of product innovations, namely, radical and incremental innovations in the manufacturing industries. Moreover, they have divided IC into only three components. In view of this, this thesis investigates, in the context of the banking industries, the role of IC which consists of four variables (HC, OC, CC and SC) in supporting the different types of innovation known as process, administrative and product innovation.

#### **4.4.2 The Relationship between the Components of IC and Innovation**

This section aims to analyse all the previous studies which investigated the interactions between the components of IC; the role of HC, OC, CC, and SC in supporting innovations; and the relationships between the types of innovations.

##### **4.4.2.1 The Interaction between the Components of Intellectual Capital**

Kamukama et al., (2010) considered that, in order to reach organisation goals, the components of IC ought to be complementing each other. Organisation consists of social communities which employ their relational structure to reinforce capabilities and skills (Zander and Kogut, 1995). OC cannot perform its processes effectively unless it is integrated with SC (Farris, 1979). In order to gain more flexibility in turbulent environments, firms pay more attention to SC by considering informal relationships between employees as an important driver in the organisational structure (Oh et al., 2006).

**Table 4.2 The Relationships between Intellectual Capital and Innovation**

<b>Author(s) &amp; Year</b>	<b>Title</b>	<b>Independent variables</b>	<b>Mediator or Moderator variables</b>	<b>Dependent variables</b>	<b>Population and Sample</b>	<b>Results</b>
Wu, W., Chang, M., and Chen, C., (2008)	Promoting innovation through the accumulation of intellectual capital, social capital, and entrepreneurial orientation.	Social capital Entrepreneurial orientation	-Intellectual capital which included: HC; OC; CC	Innovation which was measured by items related to product and process innovations	700 Taiwanese firms including manufacturing and non-manufacturing firms. The response rate is 22.71%.	<ul style="list-style-type: none"> <li>- The higher levels of social capital and entrepreneurial orientation firms performed the higher levels of IC.</li> <li>- IC can enhance the firm's level of innovation.</li> <li>- Entrepreneurial orientation and social capital had no effects on innovation but when IC is used as mediating variable the relationships became positive.</li> <li>-Therefore, IC mediated the relationship between social capital and entrepreneurial orientation; and innovation.</li> </ul>
Subramaniam, M., and Youndt, M., (2005)	The influence of intellectual capital on the types of innovation capabilities	Intellectual capital included HC, OC, SC	Social capital	Incremental innovative capabilities	The questionnaire was filled through 919 firms in U.S.	<ul style="list-style-type: none"> <li>- Human capital has no effect on incremental innovation and it has a negative effect on radical innovation.</li> </ul>

Author(s) And Year	The title of study	Independent variables	Mediator or Moderator variables	Dependent variables	Sample size and applied field	Results
				Radical innovation capabilities	The sample focused on CEO and president Or vice president of human resources marketing and R&D The response rate was 44%.	<ul style="list-style-type: none"> <li>- HC interacted with SC to positively influence radical innovation.</li> <li>- OC has a positive effect on radical and incremental innovation.</li> <li>- When SC was used as a moderator variable, there was no relationship between OC and innovation.</li> <li>- SC was positively associated with radical and incremental innovation.</li> </ul>
Chen, Y., Lin, M., and Chang, C., (2006)	The influence of intellectual capital on new product development performance the Manufacturing companies of Taiwan as an Example.	Intellectual capital: - HC - SC - CC	Growth rate of the industry	Product development performance	650 questionnaires were sent to the managers of the marketing, R&D production department Response rate was 24.46%.	Three types of IC had positive relationships with the performance of newly developed products. - The results indicated that when an industry's growth rate was higher, the positive relationships between the components of IC and the performance of newly developed products was stronger.
Marqués, D., Simón, F., and Carañana, (2006)	The effect of innovation on intellectual capital: An empirical evaluation in the biotechnology and telecommunications industries.	Radical innovation, incremental innovation		Intellectual capital which included:  - HC, - OC, - CC	The sample included 222 Spanish firms (102 from the biotechnology industry and 120 from the telecommunicati	Radical and incremental innovations have positive effect on HC; SC; and CC

					ons industry), The questionnaire respondent was the manager of the firm	
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Much of the employees' knowledge is produced and dispersed through SC. Then, such knowledge is codified and institutionalized in OC. There is a positive relationship between SC and OC since informal relationships are viewed as useful tools for decision makers (Youndt, Subramaniam, and Snell, 2004; Allen, James, and Gamlen, 2007; Soda and Zaheer, 2012). Simon (1957),( as cited in Gulati et al., 2009) stated that informal relationships enhanced OC by supporting a firm's authority and business processes. SC facilitates, also, knowledge sharing amongst employees; this sustains OC (Nahapiet and Ghoshal, 1998; Wu, Chang and Chin, 2008, Yang and Lin, 2009). Yli-Renko, Autio and Sapienza (2001) showed that the social interaction and network ties dimensions of SC had a positive effect on the acquisition of knowledge.

Chareonsuk and Chansa-ngavej (2008) considered that HC supported not only operating efficiency but built, also, solid SC. HC has a positive effect on OC (Shih et al. 2010). Wang and Chang, (2005) stated that the performance of process capital depended on HC. The quality of employees determines the quality of internal process capital. They concluded that HC had a direct effect on process capital which mediated the relationship between HC and performance. The competency-based view confirmed that employees' competencies were a valuable repository which impacted on business processes (Chen et al., 2009). If high skilled employees leave an organisation, this will reflect negatively on the OC. HC has a more significant effect on OC in non-service industries ( Bontis et al., 2000). Moreover, Kim et al. (2012) asserted that, in a firm, the efficiency of OC relied on the extent to which a firm possessed employees with high competencies. HC cannot be isolated from OC if an organization wants to achieve its aims (Bontis, 1998). OC obtains knowledge which is stored in the employees's minds (Robert, Herremans and Kline, 2010).

Bonits et al., (2000) stated that the relationship between CC and OC was important regardless of the industry (service and non-service sector). This means that an organisation, which focuses constantly on satisfying its customers' needs, will produce efficient organisational routines and processes. In turn, these will affect the service quality positively. Shih et al., (2010) reported that the interactions between customers and employees resulted in more absorption of information which built the accumulation of OC. Customers' loyalty and satisfaction has a positive influence on OC. Therefore if they have good relationships with their customers, firms can transfer OC into added value. For firms, customers are an important source of knowledge and can supply many ideas to improve the efficiency of business processes and innovation. Consequently, the above mentioned literature would lead the researcher to the following hypotheses:

*H1: Social capital has a direct positive effect on organisational capital.*

*H2: Human capital has a direct positive effect on organisational capital.*

*H3: Customer capital has a direct positive effect on organisational capital.*

#### **4.4.2.2 The Direct Effect of Intellectual Capital on the Different Types of Innovations**

##### **4.4.2.2.1 The Relationship between Organisational Capital and Innovations**

The previous studies found that there was a positive relationship between OC and innovation. Wu, Chang and Chin (2008) revealed that higher levels of OC produced a higher level of innovation. Tesluk et al. (1997) suggested that organisational structure, culture and climate were associated with innovative capability. Organisational culture sustains new product development through its effect on the generation of new products (Lohmüller, 2003). Subramaniam and Youndt (2005) demonstrated that OC improved incremental innovative capabilities through the application of formal knowledge embedded in business processes and culture. OC has a positive effect on innovative capability in the biotechnology industry (Huang, Lai and Lin, 2011). Kaplan and Norton (2004) provided empirical evidence on the

key role of technologies and organisational climate in reinforcing innovation. Similarly, product development performance is correlated positively with OC (Chen et al., 2006). OC has been found to have a positive effect on the performance of innovation (Zerenler et al., 2008). Leenders and Voermans (2007) recommended that the organisational memory, which included an accessible internal knowledge, was associated positively with successful innovation. Acquisition knowledge, conversion knowledge and application knowledge have a positive effect on product and process innovation (Ju et al., 2006). Moreover, they are shown to mediate significantly the relationship between SC and the performance of innovation (Huang et al., 2009). Carmona-Lavado, et al., (2010) showed that, through SC, OC had an indirect effect on product innovation.

Sciulli (1998) examined the role of organisational structure which included centralization and formalization in supporting the different types of innovations in the 229 Indiana retail banks. The results indicated that, compared to non-adopters, the adopters of product innovations had much lower levels of centralization and formalization. Also, compared to the non-adopters of incremental innovation, the adopters of incremental innovation had lower levels of formalization. In addition, the adopters of radical innovations had much lower levels of centralization than non-adopters. Zaltman, et al., (1973) proposed that high centralization and formalization hindered the initiation of innovation since centralization reduced available information and restricted the channels of communication. Consequently, the greater participation allows more knowledge sharing which produces a greater diversity of ideas. In the same context, Kimberly and Evanisko (1981) found that, in hospitals, there was a significantly negative relationship between centralization and the adoption of technological innovations. On the contrary and based on a survey of 195 Taiwan firms, Liao (2007) examined the effects of organisation structure measured by formalization and centralization

on product innovation. The results showed that an organisational structure, which emphasized centralization and formalization, could enhance product innovation. Gudmundson et al., (2003) examined the relationship between organisational culture, leadership styles and innovation in SMEs. The findings confirmed that there was a significant relationship between organisational culture, leadership and innovation. It explored, also, whether or not organisational culture is more important for both the initiation and implementation of innovation. Jaskyte and Dressler, (2005) examined the relationship between organisational culture and organisational innovativeness. This was measured by administrative and technological innovations in non-profit service organizations in Alabama. Organisational innovativeness was related inversely to cultural consensus. It correlated positively with innovative value and aggressiveness value, and correlated negatively with the stability value.

Lau and Ngo, (2004) examined the mediating role of developmental culture in the relationship between the human resource (HR) system and product innovation. Based on the data from a survey of 332 firms in Hong Kong, the empirical findings confirmed that organisational culture had a direct effect on the development of new products. Furthermore, through organisational culture, the HR system had an indirect effect on the development of new products. Moreover, empirical results, from a sample of 223 Chinese enterprises, indicated that strategic human resource management had a positive impact on firms' product innovation and this relationship was stronger if firms had a developmental culture (Wei et al., 2011). Pizarro, et al., (2009) mentioned that entrepreneurial culture had a positive influence on product innovation and that the integration between entrepreneurial culture and HC supports product innovation.

Knowledge lies at the heart of innovation. There are many factors, such as creating, storing and transferring knowledge about technologies and customer needs, which support successful new products or services (e.g. Basadur and Gelade, 2006; Inganäs and Hacklin, 2006). Knowledge is unable to promote innovation if it cannot be shared or distributed to the relevant people. (Carrillo et al., 2004). Therefore, firms can boost innovation through the application of knowledge. Ju, et al., (2006) tested the effect of knowledge management capability by measuring it on the acquisition of knowledge, exchange knowledge and application knowledge, on innovation in the Taiwanese semiconductor, precision machinery, communication, and biotech industries. The research results concluded that knowledge management capability had a significant impact on a firm's innovation. Moreover, Huang and Li (2009) examined the mediating role of knowledge management, by measuring, in Taiwanese firms listed in the China Credit Information Service Incorporation, knowledge acquisition, sharing, and application in the relationship between social interaction and innovation performance, including administrative and technical innovation. The results indicated that, in turn, knowledge management related positively to administrative and technical innovation performance. Furthermore, the results provided evidence that knowledge management played a mediating role between social interaction and innovation performance. Chen and Huang (2009) concluded that knowledge management played a mediating role between strategic human resource practices and innovation performance. Darroch (2005) aimed to provide important empirical evidence by investigating knowledge management's role measured by knowledge acquisition, knowledge dissemination and responsiveness to knowledge in supporting innovation determined with regard to new to the world and new to the firm in New Zealand organisations. The findings indicated that all three components of knowledge management predicted innovation positively. Chapman and Hyland (2004) stated that continuous product innovation capabilities were associated closely

with a company's knowledge management systems and processes. Liao, (2007) reported that a knowledge management strategy impacted positively on product innovation. Knowledge management is considered to be a key method in supporting product innovation.

There are many studies which tested the relationship between top management and innovation. These studies are divided into two groups. Firstly, some researchers focused on the relationship between top management characteristics, such as age; educational level; and functional diversity; and innovation. Zahra and Wiklund, (2010) examined the effect of Top Management Teams (TMT)'s characteristics on radical product innovations. The results showed that TMT's awareness, functional heterogeneity and growth orientation were associated positively with radical product innovation. Talke et al., (2010) mentioned that TMT diversity enhanced a firm's performance by facilitating an innovation strategy which reinforced the innovativeness of the firm's new product portfolio. MacCurtain, (2005) confirmed that TMT diversity was correlated strongly to product innovation. Camelo et al., (2010) mentioned that educational level, functional and tenure diversity had effects on product innovation measured by a number of new and improved product innovations. Daellenbach et al., (1999) tested the previous same relationship but they measured product innovation by R&D intensity whilst Lyon and Ferrier (2002) added another dimension for product innovation known as product - market innovation. Their results showed that TMT demographic heterogeneity interacted with product-market innovation. Moreover, Huffman and Hegarty (1993) found that TMT characteristics affected not only product innovation but, also, administrative innovation. Secondly, other researchers examined the relationship between top management support and innovation. Harmancioglu et al., (2010) mentioned the positive effect of TMT support on product innovation. Also, product innovation had a mediating effect on the relationship between TMT support and overall business performance.

Carbonell and Rodriguez-Escudero (2009) examined the same relationship but they used another factor called innovation speed. They aimed to test the moderating effect of uncertainty on the relationships between three organisational context factors (i.e. top management support) and speed of innovation. The results were that, under conditions of high technology novelty and high technological turbulence, top management support had a more positive effect on innovation speed. Rapp et al., (2008) found that top management support had a positive effect on technological innovation.

Consequently, the study suggests the following hypothesis:

*H4: Organisational capital has a direct positive effect on the three types of innovations.*

#### **4.4.2.2 The Relationship between Human Capital and Innovations**

Bontis (1998) and Bornay-Barrachina, Rosa-Navarro, López-Cabrales, and Valle-Cabrera, (2012) considered that HC was of central importance for innovation and strategic renewal. Many studies tested the direct relationship between HC and innovation (Hayton, 2005; Bornay-Barrachina et al. 2012). Employees' knowledge creating capability relies on the number of years of education and the diversity in their knowledge bases (De Winne and Sels, 2010). In the large technology firms, this knowledge is a main source of new products and services (Smith et al., 2005). Organisations should create an innovative culture by satisfying their employees' needs and listening carefully to them since they are a major channel for generation and application of new ideas (Wei, Frankwick, and Nguyen, 2012). Marvel and Lumpkin (2007) found similar results but they focused on radical innovation and HC. Dakhli and De Clercq (2004); Wu, Chang and Chen (2008) and Zerenler et al. (2008) postulated that employees could promote innovation through education; training; and skills. The last study was interested in innovation performance amongst automotive suppliers. Furthermore, the

employees, who have the professional skills; creativities; managerial capabilities; specialties; and excellent experiences affect the development of new products positively (Barczak and Wilemon, 2003).

In this regard, HC was shown to have a significant effect on the performance of new products developed by Taiwan's SMEs (Chen, Lin, and Chang, 2006). Similarly, Schneider, Gunther, and Brandenburg (2010) revealed that the value and unique competencies of employees were associated positively with product innovation in the manufacturing sector. Meanwhile, employees, who lacked skills, could act as a barrier to innovation. Entrepreneurial teams, who have more education and experience, are expected to be more open to new solutions to problems in production processes (Musteen and Ahsan, 2013).

SMEs adopt product innovation capabilities based on their HC development (Branzei and Vertinsky, 2006). Pizarro, et al., (2009) tested the impact of the value and uniqueness of the employees' skills on product innovation in the different Spanish manufacturing companies with relatively high innovations from their R&D activities. The results reported that there was a significant direct correlation between the characteristics of HC and innovation. The uniqueness of HC contributed strongly to support innovation rather than the firm's value. Competence is considered to be a main source of product innovative activities.

Katzy and Crowston (2008) stated that competency rallying, described as the identification and development of competencies, supported technical innovation. Leiponen, (2005) and Bayo-Moriones, Billón and Lera-López (2008) stated that the relationships, between employees' competence and firms' innovation activities, were complementarity. If a firm had insufficient skills, it benefitted less from innovation. The results showed high technical

competences complemented innovation. Holbrook and Hughes (2003) reported that a lack of skilled employees hindered innovation. Consequently, the researcher suggests the following hypothesis:

*H5: Human capital has a direct positive effect on the three types of innovations*

#### **4.4.2.2.3 The Relationship between Social Capital and Innovations**

Zheng (2010) reviewed the relationship between SC including structural dimension; the relational and cognitive dimensions; and innovation. The findings suggested that the SC's structural factor, embracing ego network size; structural holes; and tied strength and centrality had a significant effect on innovation. The relational components, such as trust and cognitive norms, were associated positively with innovation whilst the cognitive dimension, such as shared vision, had no significant effect on innovation. SC arises as complementary driving forces for innovation and its dimensions have different effects on innovation (e.g. Tsai, 2006; Cainelli, et al., 2007). Rodan and Galunic (2004) stated that network structure, which encouraged the members of a network to share knowledge, was of greater importance for innovation. Levin and Cross, (2004) stated that strong ties amongst employees were important to generating new information because they were more accessible and willing to cooperate to get useful knowledge. However, Granovetter (1973) stated that weak ties might be sources of new knowledge because strong ties tended to be connected to others which had the same knowledge. Firms, which pay more attention to SC, produce a higher level of innovation (Laursen et al., 2012). Moran (2005) considered that the trust in the relationships reflected positively on the performance of innovation and the launch stage for product innovation (Hsieh and Tsai, 2007). SC which includes knowledge sharing supports creativity; this results in the firm's innovativeness (Song and Thieme, 2006). Social networks have an

ability to reinforce potential breakthrough innovations (Baba et al., 2010). Molina-Morales and Martínez-Fernández (2010) found that, in Spanish manufacturing firms, there was a positive relationship between SC and process and product innovation. More specifically, radical product innovation was shown to be associated significantly with SC (Carmona-Lavado et al., 2010), whilst Subramaniam and Youndt (2005) found that SC had a significant effect on both incremental and radical innovative capabilities. Most innovation literature confirmed that communication between individuals was a key factor for innovation. The strong relationships encourage persons to create new ideas and provide more enthusiasm to turn these ideas into successful products or processes (Poolton and Barclay, 1998). The positive relationship between IC and innovation improves when the organisation has a higher level of SC (Wu, Chang and Chen, 2008). Gu, Wang and Wang (2013) confirmed that, in R&D teams through psychological safety, innovation was associated positively with the structural and cognitive capital and relational capital. Regarding these arguments, the researcher defines the following hypothesis:

*H6: Social capital has a direct positive effect on the three types of innovations.*

#### **4.4.2.2.4 The Relationship between Customer Capital (CC) and Innovation**

Especially in the service sector, organisations believe that the customer is a cornerstone of innovation (Carbonell et al. 2009). Similarly, Chen et al. (2006) found that, in Taiwanese SMEs, CC affected positively the development of new products. In both manufacturing and non-manufacturing industries, CC was shown to have a significant effect on innovation (Wu et al. 2008). Acquiring information about customers' needs is a necessity when redesigning a service process. Process innovation should make use of dynamic cooperation between a firm and its customers. Additionally, when customer requirements are recognised, a firm can adopt new processes to satisfy them (Chen and Tsou, 2012). Customers are an important

source of knowledge which leads to innovation (Schirr, 2012). Paladino (2007) and Spanjol et al. (2012) concluded that a high level of customer orientation produced a high rate of innovation. Hence, firms obtained more chances to produce successful new products and processes.

Services require greater customisation than manufactured goods. It is possible for customer orientation to enhance innovation more uniformly in service firms than in manufacturing firms (Spanjol et al. 2012). Through generating new ideas, customers are considered to be a key source of innovations (Wu and Fang, 2010). Kammerer (2009) found that customer orientation was essential specifically for product innovation which would provide a competitive advantage. Based on the results of its interaction with customers, an organisation can change its production process and service delivery (Skaggs and Galli-Debicella, 2012). Consequently, it could use marketing opportunities to distinguish its goods or services from those of its competitors. Successful product and service development depends on the extent to which customers are involved in the innovation process (Carbonell et al. 2009; Bohlmann et al. 2012). In the workplace, customer stories reinforce knowledge sharing which boosts the components of IC (Gorry and Westbrook, 2013). Customer orientation focuses on product innovations which satisfy the customers' needs or preferences. It is an important factor of new product performance (Thoumrungroje and Racela, 2013). Customer orientation contributes to developing incremental product innovation (Im and Workman, 2004).

Following this line of reasoning, the researcher proposes the following hypothesis:

*H7: Customer capital has a direct positive effect on the three types of innovations.*

#### **4.4.3 The Interactions between the Three Types of Innovations**

In order to achieve successful implementation and diffusion of process innovation, there is a crucial need for substantive improvements in structure and administrative practises (Nabseth and Ray, 1974). In early studies by Damanpour and Evan (1984) and Damanpour et al. (1989), it was reported that changes, in social structure, encouraged the improvement or replacement of technical systems leading to the enhancement of the innovation process. Similarly, Ruttan and Hayami (1984) established, from the agricultural sector, that technical innovations could not have taken place without prior organisational and institutional innovations. Later, Bantel and Jakson (1989) and Zahra and Covin (1994) revealed positive and significant correlations between administrative and technical innovations. Precisely, Ettlíe and Reza (1992), Staropoli (1998) and Gunday et al. (2011) pointed out that, in manufacturing firms, organisational innovation might support the process of innovation via a mechanism of cooperation and coordination amongst firms. Ettlíe and Reza (1992) explained that, from cooperation, innovative outcomes enhanced the productivity, capacity and flexibility of the innovation process. They concluded that “The introduction of new integrating mechanisms can guide and encourage systematic proposals and deployment of process innovations, organisational innovation efforts do not come about by intent alone, and the success of innovative projects cannot be guaranteed”. Eventually, through their longitudinal study, Tushman et al. (2010) found that the initiation of a novel organisational design to the firm affected innovations to both products and processes.

Although it is agreed that product and process innovations influence each other, the direction of this interaction remains unclear (Damanpour and Gopalakrishnan, 2001; Gunday et al., 2011). In exploring the factors affecting the successes and failures of product innovation, Madíque and Zirger (1984) found that an effective execution of the R&D process was amongst the important factors which determined whether or not there was successful product

innovation. In this sense, Barras (1986) indicated that process innovation would improve the service quality and, then, results in product innovations by generating new types of services. Furthermore, based on their study on pharmaceutical firms, Ettlie (1995) and Pisano and Wheelwright (1995) and Li et al. (2007) indicated that, when developing new products, the adoption of an innovative process increased the innovativeness of the final product. Oke's (2007) study on British SMEs confirmed that the novelty of the production process increased the success of developing new product. Similarly, evidence, from the banking sector, demonstrated that development of new products relied on the development of new processes (Buzzachi et al., 1995; Damanpour and Gopalakrishnan, 2001). Buzzachi et al. (1995) declared that "The main reason is that it is extremely difficult to separate new products (i.e. new services) from the processes on which they rely. The production of new services requires in most cases the introduction of new production processes or significant modifications of the existing one". Ultimately, Gunday et al. (2011) deduced that higher process innovation correlated significantly and positively with higher product innovation.

Despite Walker's (2008) suggestion on the complementary relationships between the different types of innovation, Gunday et al.'s (2011) findings revealed an insignificant correlation between organisational and product innovations. However, earlier studies confirmed indirectly such a correlation. In fact, Damanpour and Evan (1984) stated that the introduction of an organization's new strategy and/or structure led generally to the implementation of innovations. Kotabe and Swan (1995) found that, particularly in the high technology sectors, organisational cooperation and particularly between the firms' similar functions, such as R&D consortiums, had the strongest effect on product innovation and. Moreover, Sivadas and Dwyer (2000) established a positive relationship between

organisational cooperation and product innovation. The authors suggested that cooperation led to new and more sophisticated organisational developments which, in turn, would affect the development of new products. More recently, Walker's (2008) stressed that correlations between the different types of innovation did exist. However, further research is required to clarify those relationships. Based on the above discussions, the researcher proposes the following hypotheses:

*H8: There is a positive association between organisational innovation and process innovation.*

*H9: There is a positive association between process innovation and product innovation.*

*H10: There is a positive association between organisational innovation and product innovation.*

#### **4.4.4 The Mediating Role of Organisational Capital**

Many IC studies focused mainly on a direct innovation relationship. As shown above, they discovered that HC, SC, CC and OC were associated positively with innovation (radical; incremental innovation; new product development performance; and innovative capabilities). However, others such as Foss, Laursen, and Pedersen (2011) found that customer interaction did not have a significant effect on innovative performance. Subramaniam and Youndt (2005) found that HC had a negative effect on radical innovation capabilities and did not have a significant relationship with incremental innovation capabilities. Wu, Chang and Chen, (2008) considered that SC was not related significantly to innovation.

There has been very little empirical study testing of intermediating variables through which, ultimately, SC, CC, and HC affect the different types of innovations. The research results encourage the investigation of potential mediating variables. OC is a critical component in leveraging IC to achieve the organisation aims. In other words, if a firm includes poor

processes and systems, the overall IC is unable to accomplish its aims (Bontis,1998). The previous studies considered that OC was integrated with all kinds of intangible assets.

OC is considered to be a key mediating variable in the relationship between intangible assets such as HC and innovative capability (Huang, Lai and Lin, 2011). Hence, it is a central requirement for innovative capabilities. OC represents the organisational infrastructure through which HC can create added value (Bontis, 2001;Chen, Lin, and Chang, 2006). Strong organisational culture plays an important role in developing employees' competencies which contribute to satisfying the needs of their company and customers (Kim et al., 2012). Foss, Laursen and Pedersen, (2011) explained that, in the context of innovation, organisational practices, such as organisational structures, could sustain firms to develop their customers' knowledge. In the other words, organisational practices have the capabilities to absorb, from customers, the information and knowledge which support the decisions related to an innovation project.

In summary, HC, CC and SC may drive OC which, in turn, may reinforce the different types of innovations. It is necessary to have effective capitals; these should complement each other as a coherent system to support innovation through OC. Consequently, the researcher suggests the following hypotheses:

*H11: Organisational capital mediates the relationship between social capital and the three types of innovations.*

*H12: Organisational capital mediates the relationship between human capital and the three types of innovations.*

*H13: Organisational capital mediates the relationship between customer capital and the three types of innovations.*

Finally, based on the above discussions, the researcher adopts the following hypothesis

*H14: There are no significant differences between the private and the public banks in terms of the effects of IC on innovations.*

#### **4.5 Summary**

This chapter presents the different theories that have been used in the management literature to explain and analyse the relationships between IC and innovations. These are Resource-based view, knowledge-based view and Actor Network Theory. The RBV confirms that firms have a set of internal resources which are tangible and intangible and capabilities that are employed to reinforce performance and competitive advantage. These resources have four attributes named; rare; valuable; have few substitutes and are not easily imitable. This theory can justify some relationships related to HC, OC and SC while the relationships relate to CC did not be explained by the RBV because CC mainly relies on external environment (customers). On the other side, the KBV views organisations as repositories of knowledge embedded in organisational processes and competences and relationships which are a key source to reinforce competitive advantage. So, KBV focuses on intangible assets while RBV concerns with both tangible and intangible assets. This theory supposes that all intangible assets have the same important in their effects on supporting competitive advantage. Therefore, it can explain the direct effects not the indirect one which highlighted on the mediating role of a main variable on the relationship between independent and dependent variables. Finally, ANT is considered to be a way to reinforce innovation which was a result of a series of connections between human and technological actors. This chapter displays four stages to evaluate an actor-network, this study adopts the first one named problematisation because it concerns with investigating the role of some actors in supporting innovation. It shows a key role that is played by focal actor in providing required resources which facilitate

their role in achieving network's aim (innovation). Hence, this study employs ANT to build the research model.

Additionally, this chapter presents the different previous studies that have tested the relationships between IC and innovations. First, the researcher finds that there are only three studies that have investigated the direct effect of three components of IC (HC, OC and CC or SC) on radical and incremental innovation capabilities; new product development performance; and innovation in the manufacturing sector. Second, Bonits et al., (2000) test the role of HC, CC in supporting OC in the service and non-service sector and they conclude that HC has non-significant effect on OC. The study of Bonits et al. (2000) analyse these relationship in business performance model not innovation model. They also did not mention about the relationship between SC and OC. Third, there is no previous study investigating the interactions among the three types of innovation in the service sector.

## **CHAPTER 5: RESEARCH METHODOLOGY**

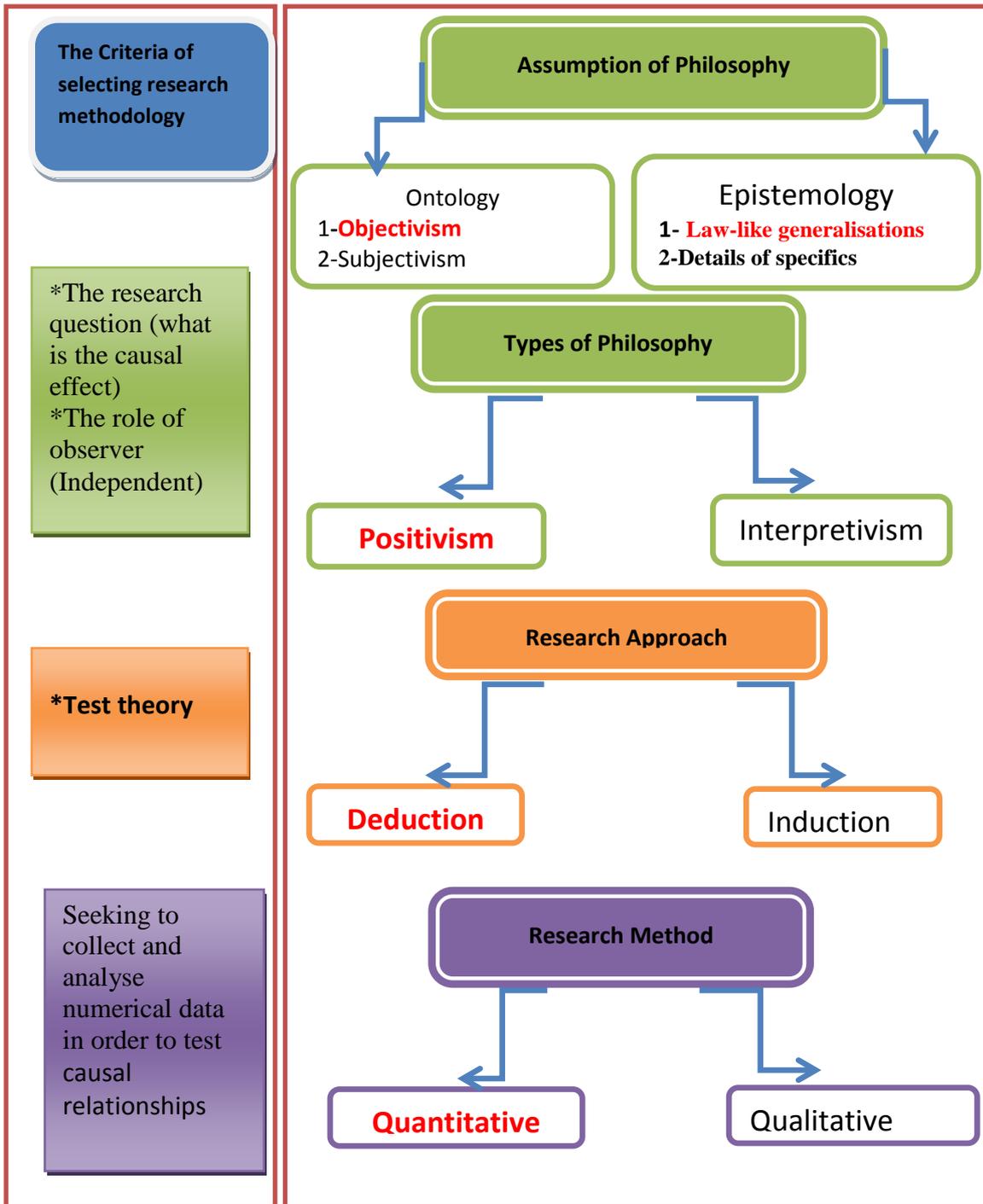
## **5.1 Introduction**

Chapter 4 presents the theoretical aspects of the relationship between IC (HC, OC and SC) and CC, as well as the process, administrative and product innovation. This chapter reports the research methodology which is a systematic way to accomplish the research objectives or to solve the research problem. It refers to how research is performed scientifically. Researchers should adopt many logical steps to studying the research problem. Research methods are defined as the procedures and techniques employed for conducting research. The methods include those related to the collection of data, statistical techniques and to evaluate the accuracy of the results. Therefore, research method is a part of the research methodology. As put by Kothari (2004), that “when we talk of research methodology we not only talk about the research methods but also consider the logic behind the methods we use in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others.”

This chapter is structured as follows. Firstly, Section 5.2 outlines the research philosophy. Section 5.3 presents the research paradigm and Section 5.4 provides the different types of research approach. Section 5.5 explains the research methods and Section 5.6 describes the research design and strategy. Figure 5-1 summarises the research methodology.

## **5.2 Research Philosophy**

The term research philosophy relates to the development and the nature of knowledge (Saunders et al., 2012). There are numerous reasons why an understanding of philosophical issues is important. Firstly, it can help to refine and to identify the research methods, which



Red texts denote to a suitable research methodology for the study

Figure 5.1 Research Methodology

are used in a particular study and to illuminate the overall research strategy which is employed. This includes the type of gathered data and its source, and how it helps to answer the research questions. Secondly, knowledge of the research philosophy supports and assists the evaluation of different methodologies and methods and to employ suitable methods for a study. Thirdly, it may inform the selection or alteration of the research (Easterby-Smith et al., 2008). Therefore, ignoring the research philosophy can affect the quality of the research and it may become unsuitable (Neuman, 2010). Although there are many research philosophies, this research focuses on just two types, namely positivism and anti-positivism. Before discussing these philosophies, the present study firstly presents the assumptions that build research philosophy, namely ontology and epistemology. Table 5-1 summarises the main points for these assumptions.

### **5.2.1 The Assumptions of Research Philosophy**

- **Ontology (what exists or what the nature of knowledge is)**

The word ontology is made up of two Greek words: “onto” (being); and “logos” (science, study or theory) (Johnson and Duberley, 2000). Blaikie (2007) illustrates the definition of ontology as “the science or study of being”. Ontology deals with the nature of knowledge and the structure of world, reality, truth or being (Bryman, 2008). Ontology answers the question: “To what extent can an external reality exist” (Howell, 2013). It is concerned with the discovery of the theory behind the truth and how to understand existence. In the social sciences, ontology embraces claims and assumptions which make up social reality (Blaikie, 2007).

Saunders et al. (2012) discuss two aspects of ontology. The first aspect is objectivism which assumes that social and natural reality exists but they are outside of human thoughts, beliefs

and conceptions. The role of research relates to achieving reliability (Johnson and Duberley, 2000; Saunders et al., 2012; Howell, 2013). Therefore, the relationship between research and social phenomena separates. Objectivism assumes that there is only one truth or fact (Burrell and Morgan, 1979). The second aspect is subjectivism (idealism). Saunders et al. (2012) states that subjectivism is viewed as “social phenomena are created from the perceptions and consequent actions of social actors”. Basically, truth is built on the views of a particular person or persons. Truth has different versions depending on the context and, therefore, there is no absolute truth which is part of human conception.

- **Epistemology (How research builds or develops knowledge)**

The word epistemology is divided into two Greek words: “episteme” knowledge; and “logos” theory (Johnson and Duberley, 2000). Epistemology is the theory behind knowledge or how to discover knowledge about the world. It aims to develop knowledge and theories which are built on gaining knowledge of the world. Consequently, epistemology is concerned with organising and explaining knowledge related to theories (Schmitt, 1994). It includes a set of assumptions or claims which have justified beliefs about a social phenomenon (Blaikie, 2007). Epistemology is concerned with how knowledge is generated or “knowing how you can know” (Hatch and Cunliffe, 2006). It begins with claims and research seeks knowledge which justifies these claims (Saunders et al., 2012).

For example, Lancaster (2005) suggests that “an epistemological approach to a theory of leadership might be based on exploring what we can observe about effective leadership in the real world. By developing our knowledge of effective leadership in this way, we might observe that effective leadership seems to be associated with the possession of certain traits or characteristics on the part of the leader. This knowledge can then be used to form theories

of leadership based on the possession of certain traits and their relationship to effective leadership.”

**Table 5-1: The Assumptions of Research Philosophy**

<b>Question (dimension)</b>	<b>Continue</b>
What is the nature of reality?	external ↔ socially constructed
	objective ↔ subjective
What is considered acceptable knowledge?	observable phenomena ↔ subjective meaning
	law-like generalisations ↔ details of specifics
What is the role of values?	value free ↔ value bound

Source: Saunder et al., 2012.

## 5.2.2 Types of Research Philosophy

### Positivism

The positivist position is employed mainly in natural science which is concerned with a single truth or reality. Positivism can be applied to social studies if the research follows a scientific method or scientific principles (Webb, 1992). Positivism supposes that objects can be investigated as hard facts and the relationships related to these facts in order to become scientific rules. Therefore, social issues can be studied in much the same way as natural issues (Smith, 1998). The positivists believe that the study of consumers and marketing phenomena should be a scientific study. Marketing research establishes causal relations (laws) which support research which tries to understand, explain and predict marketing phenomena (Huberman and Miles, 2002).

Positivism believes that science assesses independent facts quantitatively and the social world exists externally and objectively (Guba and Lincoln, 1994; Tsoukas, 1989). Consequently, knowledge is valid only if it comes from observations and experiences which are the key means to understanding human behaviour. Facts are measured empirically through using quantitative methods, such as surveys and experiments and statistical analysis (Hatch and Cunliffe, 2006; Easterby-Smith et al., 2008; Saunders et al., 2012). According to the positivists, a phenomenon should be isolated and observations should be repeatable.

Johnson and Duberley (2000) and Easterby-Smith et al., (2008) discuss that there are some suggestions which facilitate the determination of positivism's key characteristics in management research.

- **Aim:** the research should aim to analyse the causal relationships that explain human behaviour.
- **Research Method:** the rational science method is the only source of knowledge in the natural sciences. Hence, in the social sciences, it should be adopted through implying that some considerations are either valid generalizations or to evaluate the research and its internal validity, external validity and reliability. This means that the researcher should employ a quantitative method.
- **Causality:** social sciences aim to determine the causal relationships that justify regularities of human behaviour.
- **Value-freedom:** the choice, of what to study, and how to study it, should be determined by objective criteria rather than by human beliefs and interests.
- **Operationalisation:** variables should be determined operationally through choosing suitable items that are consistent with the concepts of research variables.

- **Independence:** the role of the observer is an organiser who objectively observes the phenomena. So, the research should separate this from what is observed during research.
- **Reductionism:** the research problem should be reduced into the simplest possible components to obtain a better understanding.
- **Generalisation:** The researcher can generalise the study findings if the sample size is sufficient.
- **Hypothesis and deductions:** Science suggests a hypothesis that explains the theory and then it deducts what kind of observations will or will not confirm the hypothesis.

Based on the positivist perspective, Johnson and Duberley (2000) mention that management research aims “to generate laws which govern the ways in which organisations operate. The generation of these causal relationships or laws will enable management to become more scientific and managers to become better able to predict and control their environments. The focus is on the observable and the approach to the analysis of organisations assumes that their reality is objectively given, functionally necessary and politically neutral. Determinism prevails, with human behaviour often reduced to the product of external forces of the environment. Thus, social interactions are to be studied in the same way as physical elements - as a network of causal relations linking aspects of behaviour to context and stimuli in the external environment thus conditioning people to behave in a certain way.”

### **Anti-positivism (Interpretivism)**

Anti-positivism or interpretivism is important in understanding better the differences between people rather than objects (Saunders et al., 2009). Interpretive perspectives view reality as being socially constructed (Howell, 2013). Research can explain reality only through a

subjective interpretation which focuses on the details of a situation, a reality behind these details and the motivations of action (Denzin and Lincoln, 2000). Research which adopts an anti-positivistic perspective is not concerned with the issue of generalisability (Bryman and Bell, 2003).

Burrell and Morgan (1997) report that “for the anti-positivist, the social world is essentially relativistic and can only be understood from the point of view of the individuals who are directly involved in activities which are to be studied. Anti-positivists reject the standpoint observer, which characterises positive epistemology, as a valid vantage point for understanding human activities. They maintain that one understand by occupying the frame of reference of the participant in action. One has to understand from inside rather than outside. From this point of view social science is seen as being essentially a subjective rather than an objective enterprise. Anti-positivists tend to reject the notion that science can generate objective knowledge of any kind.” This is highly contextual and, hence, is not widely generalisable (Saunders et al., 2012). It focuses on understanding what people are thinking and feeling and how they communicate. In gathering data, this philosophy is associated with qualitative methods (Easterby-Smith et al., 2008). Finally, Table 5.2 summarises the characteristics of the two philosophies discuss above.

**Table 5.2 Characteristics of Positivism and Interpretivism Philosophy**

<b>Basis of comparison</b>	<b>Positivism Philosophy</b>	<b>Interpretivism Philosophy</b>
Basic beliefs	World external and objective	World socially constructed and subjective
The observer	Observer must be independent	Observer is part of what is observed
Human interests	Should be irrelevant	Science driven by human interests
Researchers focus	Focus on facts	Focus on meanings
Explanations	Look for causality and fundamental laws	Try to understand what is happening

Concept	Operationalizing concepts so they can be measured	Uses multiple methods to establish different views of phenomena
Research progress through.	Formulate hypotheses and, then, test them	Develop ideas through induction from data
Unit of analysis	Reduce phenomena to simplest elements	Look at whole of each situation
Generalization	Statistical probability	Theoretical generalization
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Small samples, in-depth investigations, qualitative

Source: Easterby-Smith et al. (2008), and Saunders et al. (2012).

### **Research Philosophy Adopted for This Study:**

This study is considered to be applied research as it aims to answer the research question which is: what the cause and effect relationships between IC and innovation? Some hypotheses are formulated. Therefore, this study accepts the objectivism reality of an ontological perspective. It also accepts the epistemological position as the research hypotheses focus on causality and low-like generalisations through sufficient sample size and using statistical analysis. This means that the research is independent of the subject under examination. Its role is only related to achieving reliability. It is decided that positivism is the most suitable philosophy for this study.

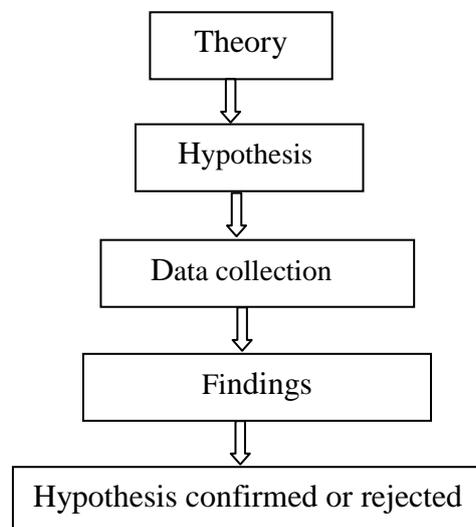
### **5.3 Research Approach**

Saunders et al (2012) state that there are two types of research approaches: the deduction approach and the induction approach. These are as follows.

#### **5.3.1 Deduction Approach (test theory)**

Deduction is "the process by which we arrive at a reasoned conclusion by logical generalization of a known fact" (Sekaran, 2003). A deduction approach adopts current theories and concepts to justify research relationships. The empirical findings are employed

to test this theory (Vanderstoep and Johnston, 2009). In a deduction approach, the research is interested in studying some issues which are related to previous theories and concepts and these make up the research hypotheses. The research selects proper techniques to collect data and to test the research model. Based on these results, the existing theory is developed (Easterby-Smith et al., 2002). Saunders et al (2009) indicate that the deduction approach is more likely to be supported by positivism. Moreover, the deduction approach (testing of theory) is related to quantitative research (Bryman and Bell, 2003). Figure 5.2 presents the stages of the deduction approach.



Source: Bryman (2004)

**Figure 5.2: The Deduction Approach Process**

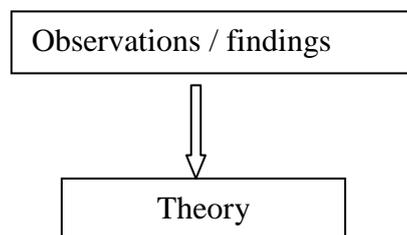
Saunders et al. (2012) report that the characteristics of the deduction approach include

- Searching for an explanation of the causal relationships between variables.
- Collecting the data by using – in most cases – a quantitative method.
- Applying controls to allow the testing of hypotheses.
- Operationalising the concepts (variables) in a way which enables facts to be measured quantitatively.

- Following the principle of reductionism which aims to reduce problems as a whole to the simplest possible elements in order to seek a better understanding of them.
- Generalising from the chosen sample to the whole population.

### 5.3.2 Induction Approach (build theory)

Induction approach is a “process where we observe certain phenomena and on this basis arrive at conclusions” (Sekaran, 2003). Basically, inductive research reverses the stages applied in the deductive research (Lancaster, 2005). An inductive research approach does not need previous theories or hypotheses. Therefore, this type of research is more flexible than the deduction approach. Inductive research starts from a description or observation and then moves towards an explanation (see Figure 5.3). This approach initially focuses on observations which lead to the development of a hypothesis and theories in order to explain those particular observations (Lancaster, 2005). This means that the induction approach begins with collecting data and then analysis is conducted to reach a theory (Bryman and bell, 2003). Saunders et al., (2012) indicate that inductive research tends to lean towards interpretivism and Bryman and Bell (2003) show that the induction approach relates mainly to qualitative research which followed the interpretivism approach.



Source: Bryman (2008)

**Figure 5.3: The Induction Approach Process**

An inductive research has many features as cited below: (Saunders et al., 2012)

- Humans have a role in interpreting the cause-effect link between the variables rather than the unthinking research objects which respond to certain circumstances in a mechanistic way.
- There is flexibility in the explanations of the studied phenomenon as a result of determining the theory after collecting the data.
- A small sample is used when studying the phenomenon.

In summary, Table 5.3 details the key differences between the deduction approach and the induction approach.

**Table 5.3: The Differences between the Deduction Approach and the Induction Approach**

<b>Basis of Comparison</b>	<b>Deduction Approach</b>	<b>Induction Approach</b>
Research focus	Facts	Meaning
Process	Moving from theory to data	Moving from data to theory
Aim	The need to explain the causal relationships between the variables	A close understanding of the research context
Collected data	Data collected quantitatively	Data collected qualitatively
Relationship between researcher and subject	Researcher is independent of the research process	Researcher is part of the research process
Generalization	It focuses on sufficient sample size to generalize conclusion.	Less concerned with generalization
Structural methodology	A highly structured approach	A more flexible structure to permit changes to the research emphasis as the research progresses

### **Research Approach Adopted in this Study:**

The conceptual framework or research hypotheses are built based on the previous studies (theories). This study employs an appropriate statistical technique named structural equation modelling to test the hypotheses which can be supported or rejected. Therefore, the deduction approach is a suitable research approach for this study.

## **5.4 Research Methods**

Quantitative and qualitative methods are used in this study (see Table 5.4). It is believed that these methods can contribute greatly to business research and are used either separately or together as “mixed method research” (Mathie and Camozzi, 2005).

### **5.4.1 Quantitative Method**

Quantitative method is an objective and systematic process in which pieces of numerical data are used to obtain information about the world and which are analysed by using mathematical methods. Quantitative research emerges from a positivism paradigm which operates on strict rules of logic, truth, laws and predictions (Burns and Grove, 2003). Quantitative research is concerned with producing data in a quantitative form which can be subjected to precise quantitative analysis in a rigid and formal way. Quantitative research is used to test a theory by identifying the variables based on the previous studies, examining the research relationships and obtaining the findings (Kothari, 2004). Johnson and Onwuegbuzie (2004) raise that there are many reasons to account for the use of quantitative research which include the following:

- Quantitative method can generalise research findings when the study collects data from a random sample which represents its population and it has sufficient sample size.

- Quantitative method can achieve greater objectivity and more accurate results. It depends on a few variables and it follows many tools in order to test the validity and reliability of the data.
- Quantitative method enables researchers to compare findings statistically between different groups.
- By using standard means, quantitative methods help support researchers to compare their results with others from similar studies.
- Data collection is relatively quick through using some quantitative methods.
- It provides precise quantitative numerical data.
- Analysing data is relatively less time-consuming.
- The research results are relatively researchers' personal bias can be avoided who can keep a 'distance' from participating subjects and employ subjects unknown to them.

Although quantitative researches have many merits, qualitative researchers, namely Johnson and Onwuegbuzie (2004), as well as Gray (2009) are critical of this research method. These criticisms are as follows:

- Quantitative researches can have little or no engagement with either people or in a studying environment. This is because the questionnaires are either sent in the post, emailed or done online. Therefore, the responses do not necessarily reflect the respondents' feelings towards a specific subject.
- The researcher may lack flexibility or have insufficient to discover the roots of phenomenon because this type of research is concerned with testing a theory or hypotheses rather than generating a new theory, otherwise known as the confirmation bias.

- Quantitative research produces knowledge which may be too abstract and too general for direct application.
- The results may have limited use since they provide numerical descriptions rather than a detailed narrative, and generally provide less elaborate accounts of human perception.

#### **5.4.2 Qualitative Method**

Qualitative method is an interpretive naturalistic approach. Qualitative research is concerned with extracting and interpreting individuals' attitudes, perception and beliefs of situations. This means that qualitative researchers investigate topics in their original contexts in order to interpret the phenomena based on the meanings of people who have more experience of the subject. Qualitative research attempts to make sense of personal stories to solve the research problem (Thomas, 2003). It relies on words rather than numbers (Miles and Huberman, 1994). This is useful especially when discovering a new concept or phenomenon. A qualitative method seeks to understand problems in a particular environment. It is not concerned mainly with measuring the event through observation (Malhotra, Birks and Wills 2012).

Miles and Huberman (1994) show that most qualitative research involves a number of characteristics. These are as follows:

- It is managed through intense contact in an actual context.
- The researcher is seeking to obtain complete or integrated knowledge about the participants' perceptions towards a phenomenon.
- Themes, which result from the data, are reviewed often with informants for verification purposes.
- This research tries to understand people's motivations behind their actions.

On the other hand, Johnson and Onwuegbuzie (2004) confirm that qualitative research has some weaknesses. These are as follows:

- Knowledge, which is generated by qualitative research, may not be generalised to different contexts or other people.
- The research method is unsuitable to test the theories and hypotheses or to make quantitative predictions.
- Very often more time is required to collect and analyse data as compared to quantitative research.
- The researchers are not independent and, consequently, their results suffer from their personal bias.
- Qualitative studies are often blamed of being impressionistic, subjective, and lacking precision.

**Table 5.4: The Differences between Quantitative and Qualitative method**

<b>Basis of Comparison</b>	<b>Quantitative method</b>	<b>Qualitative method</b>
Aims	- Precision - Generalizability - Test hypotheses	- Deeper understandings - Describing contexts - Generating hypotheses - Discovery
Structure	Research procedures specified in advance	Flexible procedures evolve as pieces of data are gathered.
Ontology(perceptions of reality)	Researchers assume that a single, objective world exists.	Researchers assume that multiple, subjectively derived realities can coexist.
Epistemology	Positivism	Interpretivism
Setting for data gathering	Office, agency or via mail or internet	Natural environment of research participants
Research approach	Deductive	Inductive
Sample size	Larger	Smaller
Sample type	Random, probabilistic sample	Purposeful, key informants
Most likely timing in	Later, after familiarity	Early, to gain familiarity with

investigating phenomena	with phenomenon has been established	phenomenon
Emphasise on objectivity or subjectivity	Objectivity	Subjectivity
Nature of data	Numbers	Words
Depth and generalisable of findings	More superficial, but more generalisable	Deeper, but less generalisable
Richness of detail and context	Less contextual detail	Rich descriptions with more contextual detail
Nature of data gathering methods emphasized	Various, but highly structured	Lengthier and less structured observations and interviews
Types of designs and methods commonly used	- Experiments - Quasi-experiments - Single-case designs - Surveys	- Ethnography - Case studies - Life history - Focus groups - Participatory action research - Ground theory
Data –gathering instruments emphasized	Closed-ended items in questionnaires and scales	Open-ended items and non-standardised interviews with probes
Labour intensiveness of data collection and analysis for researchers	Less time-consuming	More time-consuming
Data analysis process	Statistical analysis	Pattern and content analysis non-numerical data such as categorising data
Ease of replication by other researchers	Easier	More difficult
Relationship between researcher and subject	Distant/ outsider	Close/ insider

Source: Rubin and Babbie, (2011).

### **Suitable Research Method**

Based on the research aims and matched with the research philosophy of positivism, and the research approach of deduction, this study considers the quantitative method a suitable research method. The deductive design uses quantitative methods to achieve the research objectives and it seeks to collect and analyse numerical data in order to test the relationship between intellectual capital and innovations.

## **5.5 Research Design**

Research design is considered to be an important part of reliable and valid research. It is a plan or framework for conducting the research (Yin, 1994). A research design is the preparation of conditions for the collection and analysis of the data required either to solve the research problem or to achieve the research purpose (Kothari, 2004). It describes the purpose of the study and the types of questions being addressed, the techniques to be used for collecting data, approaches to select samples and how the pieces of data will be analysed (Gray, 2009). The next section discusses these issues.

### **5.5.1 The Purpose of the Research**

There are three types of research namely; exploratory, descriptive, and explanatory research as follows.

#### **5.5.1.1 Exploratory Research**

An exploratory research aims to develop a hypothesis rather than testing or confirming a hypothesis (Kothari, 2004). Such research seek either to identify the research problem or to address an issue when little or no prior research has been conducted to provide enough information about the subject (Saunders et al., 2009). The main focus of these researches is to discover ideas and insights. Therefore, an exploratory research is useful when the researcher does not know the essential variables to be investigated (Creswell, 2009). Studies that adopt exploratory research must be flexible to be able to gather different aspects around a research problem (Kothari, 2004). An exploratory research includes the following three methods: a search of the literature, interviewing experts on the subject and conducting focus group interviews (Saunders et al., 2009).

### **5.5.1.2 Descriptive Research**

Descriptive research portrays the characteristics of a particular phenomenon, event, individual, or group. It provides a description of the position of affairs as it is at present. Researchers seek to collect data about some variables such as some items such as frequency of shopping and demographic questions (Kothari, 2004; Salkind, 2010). Therefore, it is concerned with counting the frequencies. In order to collect this data in descriptive studies, researchers use survey methods and they employ comparative and correlation methods for the purpose of analyses (Kothari, 2004).

### **5.5.1.3 Explanatory (causal) Research**

Explanatory research aims to answer the question why some variables have an effect on other variables or the explanatory research seeks to test a theory which is a set of logically organized and interconnected principles, rules, assumptions, statements and propositions which are employed to explain, describe and predict the phenomenon. Many theories illustrate the critical effects of the relationships between the variables. They hypothesise the direction, which may be positive or negative, and the strength and causal relationship between variables. For instance, RBV mentions that firms possess many resources which support competitive advantage positively. The researcher measures these variables and provides evidence which confirm the hypotheses. Explanatory research attempts to go beyond the findings of exploratory research and descriptive research to understand the real reasons behind the phenomenon (Kothari, 2004; Saunders et al., 2009). It distinguishes between dependent and independent variables (Gray, 2009).

The purpose of a research should be determined by the research questions and research objectives. Accordingly, the present study is explanatory research. ANT is used to test the relationship between the dependent variables (innovation) and independent variable (IC).

### **5.5.2 Research Strategies**

Research strategies are employed to identify the sources of data collection and the research limitations money, time, and location. These strategies help researchers to provide data that can answer the research questions or achieve the research objectives. While some strategies are deductive (quantitative) in nature, many others are inductive (qualitative). There are many types of research strategies such as experiment, survey, case study, action research and grounded theory (Neergaard and Ulhøi, 2007; Saunders et al., 2009).

- **Experiment**

Experimental research is an empirical quantitative research method. It follows the positivism paradigm and seeks knowledge through objective and systematic methods (Miller and Salkind, 2002). The purpose of the experimental research is to test a research hypothesis. Researcher manipulates either the independent variable or the experimental group subject to some special programme or condition (Kothari, 2004). An experiment seeks to discover either cause-and-effects or explanatory variables which must be defined and measured (Saunders et al., 2009).

- **Survey**

Survey is usually employed to answer the questions of who, what, how much and how many (Saunders et al., 2012). This strategy is more likely to apply in descriptive and explanatory research and it is linked mainly to the deduction approach (Gray, 2009). Normally quantitative data are collected through questionnaires or structured interviews. The data explain the relationships between the research variables. This strategy uses statistical analysis to achieve the research results (Saunders et al., 2009).

- **Case study**

Yin (2003) mentions that case study is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used”. Case study is a very popular method employed in qualitative research which aims to collect data or to observe a social unit, for example, a person, a family, a cultural group, an organisation, or a whole community. It is concerned with studying the phenomena in depth rather than widely. Also, it fully examines a limited number of events or conditions and their interrelationships. Therefore, case study is fundamentally an intensive analysis of a particular unit under specific considerations (Kothari, 2004) and offers a deeper understanding of a complex topic. Social studies have extensively employed the qualitative research method in analysing real life situations and in providing basic information for the application of ideas (Saunders et al., 2009). It attempts to answer the question related to “how” and “why” (Gray, 2009). The data collection techniques may include tools such as observation, interviews, questionnaire and documentary analysis. Consequently, it allows triangulation of multiple sources of data. For instance, it denotes qualitative data collected through semi-structured interviews followed by quantitative data collected by other tools such as a questionnaire (Saunders et al., 2012).

- **Action Research**

Kemmis and McTaggart (1988, cited in Johnson and Duberley, 2000) define action research as “a form of collective self- reflective inquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of these practices and the situations in which these practices are carried out”. O'Brien (2001) regards action research as “learning by doing” - a group of people determine a problem and endeavour to find the best solution. Kothari (2004) notes that applied or action research aims to reach a solution for an urgent problem faced by an

organisation or society. In order to achieve the aim of this research, the focus is on the active collaboration between the researcher and the clients. Also, it should emphasise the importance of co-learning which is considered to be a key part of the research process (O'Brien, 2001). Marketing research is an example of applied research (Kothari, 2004).

- **Grounded Theory**

Grounded theory is defined as “theory derived from data that has been systematically collected and analysed using an iterative process of considering and comparing earlier literature, its data and the emerging theory” (Glaser and Strauss 1967; Strauss and Corbin 1998, cited in Neergaard and Uihøi, 2007). Grounded theory is the most commonly used method in qualitative research. It is used to develop a current theory or to build a new one, and is concerned with explaining behaviour. It starts with the collection of the data and has no initial conceptual framework. It is developed based on data generated by a series of observations (Saunders et al., 2012).

- **Suitable Research Strategy:**

The present study aims to examine the relationship between IC and innovation. As discussed above, survey is usually employed to answer the questions of what, how much and how many. In addition, this strategy is more associated with the deduction approach and enables data to be collected quantitatively. Furthermore, the data, collected from the survey strategy, can be used to suggest a possible explanation of the relationship between the study's variables. Consequently, the survey is the most relevant to the research philosophy, deduction approach and quantitative method of this study.

### **5.5.3 Data Collection**

#### **5.5.3.1 Types of Data**

There are two types of data: primary data and secondary data. Primary data is collected for a specific issue. It could be either qualitative such as interviews, semi-structured or unstructured; focus groups; observations; and case studies, or it could be quantitative such as questionnaires; and structured interviews. On the other hand, secondary data is available to any researcher to obtain what is required, and consequently, it is not created for specific topics. Secondary data embraces raw data and published summaries (Saunders et al., 2012). This type of data is suitable for both descriptive and explanatory research, for example, Collis and Hussey (2003), Hair et al. (2007) and Saunders et al., (2012). Based on the research questions and objectives, this study employs primary data.

### **5.5.3.2 Data Collection Techniques**

The following are two techniques to collect the data.

#### **5.5.3.2.1 Questionnaire**

In general, questionnaire can be used for descriptive or explanatory research (Saunders et al., 2009). According to Gray (2008), questionnaire survey is one of the most appropriate data collection methods in the social sciences and has the following advantages:

- Compared to the cost of an interview, it costs less in terms of both time and money.
- The inflow of data is quick and from many people.
- Respondents can complete the questionnaire at a suitable time and place.
- Data analysis of closed questions is relatively simple and questions can be coded quickly.
- Bias errors made by interviewers can be avoided because it gives respondents the opportunity to think freely or to consult other people rather than having to give immediate answers as in the case of interviews.

- Questionnaires allow greater anonymity. Consequently, it is suitable when the survey deals with sensitive issues.

### **5.5.3.2.2 Interviews**

Many types of interviews are used in qualitative research. Table 5-6 presents the characteristics of structured, semi-structured and unstructured interviews.

#### **5.5.3.2.2.1 Structured Interviews**

A structured interview is called a standardised interview whereby the questions are closed-ended and every interviewee is asked the same questions (Saunders et al., 2012). Sekaeen (1992) states that “structured interviews are those conducted by the interviewer when they know exactly what information is required and has a prearranged list of questions that will be posed to respondents”. A structured interview is more objective and easy to analyse but it is less flexible because the questions are standardised (Bryman, 2008). A structured interview stresses rational rather than emotional responses (Punch, 1998). It is quantitative and is more concerned with the frequency of actions (Saunders et al., 2009).

#### **5.5.3.2.2.2 Semi-structured Interviews**

A semi-structured interview follows a less severe format. A semi-structured interview contains standardised questions, such as age, sex and educational qualifications, as well as, open-ended questions designed to extract more qualitative information (Clarke, 1999). The strength of semi-structured interviews take place when, on the same topic, the researcher discovers different aspects from one interview to the next (Hussey and Hussey, 1999). Therefore, it is more flexible than structured interview.

#### **5.5.3.2.2.3 Unstructured Interviews**

An unstructured interview is the most open-ended approach to interviewing. It is also known as, the “informal conversational interview” (Fontana and Fery, 2000). The unstructured interview provides maximum flexibility because it enables interviewees to answer questions within their own frames of reference. Unstructured interviews seek to explore the behaviours, experiences, thoughts, and feelings of the respondents without putting preceding questions which may be considered to place limitations on their answers. Furthermore, they give interviewees the opportunity to deal with issues freely (Punch, 1998).

#### 5.5.3.2.2.4 Focus Group Interviews

Focus group interview is an interview with small groups of people to discuss a particular subject. It allows researchers to focus on group norms and dynamics related to the issues which they want to examine. A focus group interview usually consists of eight to twelve members who are chosen randomly. This type of interview is conducted by a moderator leading discussions concerning a specific topic or product (Sekaran, 1992).

**Table 5-6: Characteristics of Structured, Semi-structured and Unstructured Interviews**

<b>Structured</b>	<b>Semi-structured</b>	<b>Unstructured</b>
Quick to capture data	Slow and time-consuming to capture data and analyse.	Like semi-structured.
Use of random sampling	It is advisable to use random sampling.	Opportunity and snowball sampling often used.
Interview schedule followed exactly	Interviewer refers to a guide containing mixture of open and closed questions. Interviews improvises using own judgment.	Interviewer uses aide-memoire of topics for discussion and improvises.
Interview-led	Sometimes interviewer-led sometimes informant-led.	Non-directive interviewing.
Easy to analyse	Quantitative parts easy to analyse.	Usually hard to analyse.
Tends to positivist view of knowledge	Mixture of positivist and non-positivist.	Non-positivist view of knowledge.
Respondents' anonymity easily guaranteed.	Harder to ensure anonymity.	Researcher tends to know the informant.

**Source:** Arksey and Knight, 1999 (cited in Gray, 2009).

#### **5.5.4 Time Horizons of the Collected Data**

After determining the method and techniques for collecting the data, there is another important part to be taken into account. It relates to the time horizons of the collected data. Based on the horizons of the collected data, studies can be divided into cross-sectional or longitudinal studies. Firstly, cross-sectional studies are concerned with the study of a particular phenomenon at a specific time called a “snapshot”. Basically, the current research used a cross-sectional study. Secondly, a longitudinal study focuses on investigating a particular phenomenon over a certain period. Different data are collected in a regular schedule (Hair et al., 2007 and Saunders et al., 2012).

#### **5.5.5 Questionnaire Surveys**

##### **5.5.5.1 Introduction**

A questionnaire is considered to be a key tool in collecting data and it is the most widely used tool in social research (Lancaster, 2005). It contains standardised questions whereby all respondents may understand these questions in the same way. Therefore, it is more suitable for descriptive or explanatory research and is inappropriate to exploratory research which requires many open-ended questions (Saunders et al., 2007). Hence, this study collects data using a questionnaire because the present study is an explanatory research.

There are two methods to administer a questionnaire survey. The first method is self-administered questionnaires in which the participants administer them on their own after completing the questionnaires. Researchers can deliver and collect the questionnaires by using either the Internet-mediated questionnaires, or intranet-mediated questionnaires; or by postal or mail questionnaires; or by hand-delivery and collection questionnaires. The second method is interviewer administered questionnaires and the interviewer meets each respondent

and records the interview. An interviewer can contact the respondents by telephone or meet the respondents face-to-face (Saunders et al., 2009). In this study, data were collected from Egyptian banks. Since data were collected using self-administered questionnaires which were hand-delivered and hand-collected.

#### **5.5.5.2 Designing the Questionnaire**

Questionnaire is regarded as a communication tool or a remote tool which controls the dialogue between the researcher and the respondent (Brace, 2004). This means that if a researcher designs and manages the remote tool/questionnaire inefficiently, it may be difficult to achieve the purpose of the questionnaire. Therefore, in order to develop a good questionnaire, an integrated approach called the Tailored Design Method (TDM) is proposed (Dillman, Smyth and Christian, 2009). This method introduces a set of guidelines to conduct a successful self-administered survey. It helps to get both high response rates and high quality information. In developing the survey, the following TDM recommendations were adopted:

- Appearance

The questionnaire is printed as a booklet.

Appropriate font size is used.

The questionnaire is printed on good quality white paper.

- Questions

Questions relate to the research topic were designed.

Enough spacing is given to enable respondents to answer them easily.

Questions are clear.

Questions are phrased according to banks' common concepts.

- Order questions

Questions are ordered according to their significance.

Questions are kept in a logical order.

Questions which measure the same content were placed together.

- Page Design

The questionnaire is clearly designed to distinguish questions from answers.

The answers are registered in a vertical line.

The directions, relating to how to answer, are placed on the top of every page.

Every page includes approximately the same number of questions.

- Covering letter

It is printed on one side of A4 paper.

It includes information related to the research objectives.

It explains the aim of research which is testing the relationship between intellectual capital and innovation.

It explains the respondent's key role in ensuring the success of the study.

It reassures that the respondent's information would be kept strictly confidential.

It emphasises that the respondents' participation was voluntary and appreciated.

- Front back cover design

The Mansoura University logo is used on the front page to create a positive image and to emphasise the academic nature of this survey. Also in order to enhance the study's credibility, the cover page includes the researcher's name and states that it was sponsored by Mansoura University.

No question is placed on the back cover.

Closed questions are used in the survey. The respondents are instructed to place a tick next to or circle the selected answer. For statistical analysis, the closed questions are easier than other types. It did not give much space to elicit respondents' opinions, but it was suitable for explanatory research. On the other hand, to facilitate delivering and collecting the

questionnaires, it is very significant to maximize the response rate. After pilot testing the questionnaire, the researcher and his colleagues deliver the final version of questionnaires with a cover letter which is similar to that of the postal survey. The researcher made some follow-up phone calls and reminder visits at different times.

### **5.5.5.3 Layout of Questionnaire**

The questionnaire is divided into three sections. Firstly, Section 1 aims to discover issues related to the components of the IC. There are six questions for HC. These questions aim to obtain information about the extent to which Egyptian banks acquired and retained talented employees, how they used advanced programmes to develop their skills and to encourage the employees to share their knowledge. The OC questions explore the banks' ability to provide effective management and knowledge management systems. Additionally, they explore whether the senior management team viewed employees as a main source of innovation and whether the bank was concerned about spreading innovative culture amongst their employees. This section includes four questions. SC questions received more explanations through five questions. For example, did employees clearly understand the bank's goals/values and did they share the same ambitions? Finally, there are six questions which explore the relationship between the bank and its customers. These measure the bank's ability to satisfy the customers' needs, its market-oriented focus on and its concerns for customers' feedback.

Secondly, Section 2 consists of 17 questions which investigate the extent to which Egyptian banks introduced products and process and organisational innovation. For instance, the questions for product innovation related to the bank's ability to replace obsolete services and innovate many services. The questions of process innovation explore its ability to manage

new technological methods, to organise its service processes efficiently, and to develop programmes to reduce service costs. In particular, questions on organisational innovation include information about the bank's ability to adopt a new welfare system for staff, a new staff recruitment system and a new performance assessment method.

Lastly, Section 3 was constructed to obtain personal information about respondents such as their gender, academic qualification and the type of bank. These questions aim to provide information about the profile of the study sample.

### **5.5.6 Research Measures**

This section outlines both the dependent and independent variables for this study. The independent variable is intellectual capital which includes human capital, organisational capital, customer capital and social capital, whilst the dependent variable refers to innovation which involves process, administrative and product innovations. In addition, this section presents the measures used in the quantitative survey.

All research variables were measured as first-order factors with reflective indicators. Each construction was measured with multi-item scales which were developed to be appropriate to the banks. Items were measured on a five-point Likert-type scale ranging from "1= strongly disagree" to "5 = strongly agree" (see Table 5.7).

#### **Measures of IC Components**

HC and CC were measured by six items for each construction from Bontis (1998) and Wu et al. (2008). OC was measured by a four-item scale based on Yang and Lin (2009). SC was measured by seven items from Nahapiet and Ghoshal (1998), Tsai and Ghoshal (1998) and Wu et al. (2008).

## Measures of Types of Innovations

Product and process innovations were captured by Camisón and López's (2010) four and six-item scale respectively. Organisational innovation was measured by three and five items adopted from Camisón and López (2010) and from Liao et al. (2007).

**Table 5.7 shows the Measures of the Research Variables**

<b>Constructs</b>	<b>items</b>	<b>References</b>
HC	Our bank acquires employees with suitable knowledge and competencies	Bontis (1998); Wu, Chang and Chen (2008)
	Our bank develops talent through programmes such as formal job training.	
	Our bank retains the most talented employees who have a suitable educational level.	
	Our employees can share their knowledge with their colleagues.	
	Employees can work brightly.	
	Employees would share their creativity with their colleagues.	
OC	Our bank has an effective management process.	Yang and Lin (2009)
	Our bank culture is supportive and comfortable to innovation.	
	Our bank has an effective knowledge management system.	
	Our top management team regards employees as the source of innovation	
SC	Employees often exchange information informally.	Nahapiet and Ghoshal (1998) ; Tsai and Ghoshal (1998); Wu, Chang and Chen (2008)
	Our bank is characterised by personal friendships among colleagues at different levels.	
	Employees avoid making demands which could seriously damage the interests of others.	
	Our colleagues always keep their promises to us.	

	Our colleagues clearly understand the goals/values in our bank.	
	Our colleagues share the same ambitions as us.	
	People, in our department, are enthusiastic about pursuing the collective goals of the whole bank.	
CC	Our customers would indicate that, generally, they are satisfied with our bank.	Bontis (1998); Wu, Chang and Chen (2008).
	Our bank tries to offer the best customer service in the banking industry.	
	We get lots of feedback about our customers' wishes.	
	We strive to meet our customers' wishes.	
	Our bank is heavily market oriented.	
	We are confident of our future with our customers.	
PDI	Our bank is able to replace obsolete services.	Camisón and López (2010)
	Our bank innovates many services such as packaged accounts/services for the target market.	
	Our services are innovatively designed.	
	Our bank develops its services speedily.	
PCI	Our bank is able to manage a portfolio of technological methods.	Camisón and López (2010)
	Our bank is able to absorb the basic technologies of business.	
	Our bank has valuable knowledge for technological process innovation.	
	Our bank continually develops programmes to reduce service costs.	
	Our bank organises its service processes efficiently.	
	Our bank assigns resources to the service processes efficiently.	
OI	Our bank uses databases of best practices.	Camisón and López (2010)
	Our bank implements new practices for employee development.	

	Our bank uses quality-management systems.	
	The new staff welfare system, adopted by our bank, provides effective incentives to our staff.	Liao et al. ( 2007)
	Our bank emphasizes creative capability when recruiting staff.	
	The new staff recruitment system, adopted by our bank, is effective.	
	The new performance assessment method, adopted by our bank, informs department heads of the extent to which staff have achieved the bank's goals.	
	The new financial management system, adopted by our bank, monitors effectively the difference between our actual performance and our goals.	

### 5.5.7 Sampling

#### 5.5.7.1 Introduction

It is impossible to gather data from the whole population as defined basically through the research topic because of some considerations such as accuracy, time and money. Samples are likely to be smaller and more specialised (Lohr, 2009). Researchers should not believe that the results, which depend on collecting data from the entire population, would be more useful than those from a sample (Saunders et al., 2009). Information extracted from surveys can be important (Howitt and Cramer, 2011). Therefore, the selection of research sample is very important. In comparison to a census, a sample is a valid option. Such reasons given by (Kotharia, 2004) are:

1. In general, trained and experienced investigators are involved in a sample study. Hence, sampling may be a more precise measurement.

2. Sampling costs less and provides findings faster than a census. Consequently, it can save time and money.

3. Sampling is considered the best method to collect data when the size of the population is unlimited.

The main goal of a research is to examine how the results obtained from the sample can be applied to its population. A researcher can generalise the sampling results to represent those of the entire population. The generalisation of findings contributes to supporting the external validity of a study. If researchers aim to generalise the sample results to the planned population, a sample study must rely on a sufficient sample size which is actually representative of the population. Sampling must be selected carefully (Vogt, 2007; Bordens and Abbott, 2014). There are two methods to choose a sample from a population: random sampling and non-random sampling which is also called judgemental sampling, whereby the researcher has no information about the probability of the selected items. Non-probability sampling can be classified into three types which are quoted sampling, purposive sampling and snowball sampling (Saunders et al., 2009). In terms of the first type of sample, random samples assume that, in the population, each case has the same probability or a quantifiable probability of being selected. Random sampling means that the selection of members from the population is performed randomly. Hence, a sample is representative of a population (Mackey and Gass, 2005). Most researchers prefer random samples because such a sample improves the external validity and thus avoids researcher bias in selecting the sample. The principle of random sampling can be understood most readily from a description of the process of simple random sampling. Four methods are identified to select random sampling, namely, simple, systematic, stratified and cluster random sampling. They can be conducted in two ways: single-stage sampling and multi-stage cluster sampling (Saunders et al., 2009).

Zikmund, Babin, Carr and Griffin (2000) have proposed some criteria to determine which type of sample is preferred in a study. These include the degree of allowed error, accuracy, the research objectives and the need for subsequent statistical analysis. As far as the present study is concerned, probability sampling is used. The procedures of random sampling include determining a sampling unit, a sampling frame, sample size and sampling technique and checking the extent to which a sample represents its population.

#### **5.5.7.2 Sampling Unit**

Before selecting a sample, researchers should determine a sampling unit which may be a social unit, such as a family or club; a geographical unit such as city, village; a construction unit such as a flat, or it may be an individual (Kotharia, 2004). Since this study aims to examine the relationship between intellectual capital and innovation in Egyptian banks, the sampling unit is an Egyptian bank.

#### **5.5.7.3 Sampling Frame - Source List**

For a probability sample, the sampling frame is “a complete list of all the cases in the population from which your sample will be drawn” (Saunders et al., 2009). Researchers set up a sampling frame when it is unavailable. This list should be inclusive, correct, reliable and suitable for research and it should be as representative of the population as possible (Kotharia, 2004). For this study, two sampling frames were used. Firstly, Egypt was divided into the five districts including Western, Eastern, Delta, Central and Southern districts. Secondly, the researcher prepared a list of banks for the area of Delta, which he selected randomly (see Table 5.8). As shown in Table 5.8, this area consists of seven governorates which were divided into three groups.

**Table 5.8: List of Banks in Delta**

	Number of banks	Number of banks in Capital cities	Number of banks in Capital city without social banks
East and central Delta			
El Sharkeya	86		
El Dakahleya	83	41	40
North Delta			
Damietta	52	30	29
West and south Delta			
El Gharbeya	83	43	39
El Monofeya	49		
El Beheira	44		
Kafr El Sheikh	31		
Total	438	115	108

Source: Yallow.com

#### **5.5.7.4 Sample Size**

There are three reasons to justify why an adequate sample size is important to the study. Quantitative method is adopted to run this study; to confirm that the study addresses some issues related to the reliability and validity across independent samples (Byrne 2010); and due to simultaneously investigating, through using the indirect effects in the research model.

The study employed SEM to test its hypotheses. The SEM fit model depends mainly on the sample size and it helps support the sufficient statistical power and precision of the parameter estimates in an SEM research (Brown, 2006). A review of the SEM literature suggests some guidelines to determine the optimal sample size. For example, the cases/parameter ratio should be 5:1 (Bentler and Chou, 1987; Kline, 2011), 10 or 15: 1 (Garson, 2009), 20:1 (Schreiber et al., 2006). The sample size should involve at least 100 to 200 cases (Hoyle, 1995; Loehlin, 2004). Kline (2011) confirms that, in SEM models, a sample size would be

unreasonable if it is less than 100. On the assumption that the reasonable response rate for the delivery and collecting questionnaires by hand is between 30-50% (Saunders et al., 2007), the following formula is used to calculate the actual sample size in this study (Saunders et al., 2007).

$$n^a = \frac{n \times 100}{re\%}$$

Where:

$n^a$  is the actual sample size.

$n$  is the required sample size

$re\%$  is the estimated response rate expressed as a percentage.

In order to calculate the formula's variables, the researcher should determine the level of certainty of which the normal used level is 95% and margin of error explains the accuracy of the estimated population. Based on the table prepared by Saunders et al. (2003, p.212), if the population size is 400, which is within plus or minus 3 to 5 per cent of its true value, and the margin of error is 5%, the required sample size is 196. Hence, the actual sample size is 392 and the estimated response rate is 50%.

#### **5.5.7.5 Sample Type**

Probability sampling is used most commonly in survey-based research. The five techniques used to select probability sampling are simple random, systematic, stratified random, cluster and multi-stage sampling (Saunders et al., 2009). Due to the geographical dispersal of the Egyptian banks, multi-stage sampling was used to select the sample from these banks. Normally, it was used to overcome problems associated with a geographically dispersed population when face-to-face contact was needed or where it was too expensive and time consuming to construct a sampling frame for a large geographical area. The following procedures are involved in this study:

- 1- As mentioned previously, the capital Egyptian cities are divided into five districts.
- 2- Each group contained at least 80% of the banks working in Egypt. Moreover, especially in the capital cities, the current main bank and its branches are similar in terms of their services and policies. Therefore, there are no differences between these groups. The one district, named Delta, is chosen to use simple random sampling.
- 3- The Delta area has seven capital cities which were clustered in three groups (see Table 6.7). The researcher then randomly selects a city from each group, and since the other managers are unwilling to cooperate with the research, the researcher and his colleagues delivered by hand, 362 questionnaires to banks' managers such as a general manager, his/her vice, finance manager and investment manager in 108 Egyptian banks.
- 4- After follow-up phone calls and reminder visits, 198 usable questionnaires are collected, representing a response rate of 54%.

## **5.6 Summary**

This chapter aims to adopt a suitable methodology to examine the cause and effect relationships between IC and innovations. Then the research formulates some hypotheses. Based on the two assumptions of research philosophy ontological perspective - objectivism reality and epistemological position, positivism is found to be the most suitable philosophy for this study because it depends on empirical evidence rather than individuals' opinions. Therefore, the researcher is independent of the subject under examination. His role focuses on achieving validity and reliability of the study. Furthermore, the study employs an appropriate statistical technique, named structural equation modelling in order to test the hypotheses which may be supported or rejected. It is found that a deductive approach and a quantitative method are both suitable for this study. The study conducts a survey which is more associated with the deductive approach and enables data to be collected quantitatively.

Furthermore, the study's data suggests a possible explanation of the relationship between the variables. The questionnaire is delivered to the Egyptian banks' managers and 198 usable questionnaires are collected, with a response rate of 54%.

## **CHAPTER 6: QUESTIONNAIRE PILOT TESTING**

## **6.1 Introduction**

In business research, a questionnaire is a common tool used to collect data. This questionnaire should be piloted. The pilot test aims to refine the questionnaire to ensure that respondents have no problems answering the questions. It assesses, also, the validity and reliability of the questions (Saunders et al., 2009). A pilot study should be undertaken for pre-testing the questionnaire. Based on the results of the pilot study, the questionnaire may be edited (Kotharia, 2004). Therefore, this chapter illustrates the testing of the reliability of the questionnaire and its content validity; translation validity; and construct validity.

## **6.2 Validity**

Validity refers to the extent to which an instrument measures what it is supposed to measure (Bryman and Bell, 2007). A measure's validity relies on the definitions of the variable which is used to design the measure. There are four types of validity: namely, face validity; content validity; criterion-related validity; and construct validity. These are discussed as follows (Bordens and Abbott, 2011).

### **6.2.1 Face validity**

Face validity is the degree to which the instrument appears, on the face of it, to be an appropriate measure in obtaining the desired information from the perspective of a potential respondent. This means that questions appears to relate directly to the construct. Therefore, they should produce a valid response (Colton and Covert, 2007). Face validity is concerned with whether or not the measure "looks valid" to the respondents (Bornstein, 1996). Face validity is a subjective assessment since it depends on the judgment of experts who check the tool for grammar; suitability; and confirmation that it appears to flow logically. Therefore, it is considered to be the weakest form of validity (DeVon et al., 2006).

### **6.2.2 Content validity or Expert validity**

Content validity is “the extent to which a test represents the universe of items from which it is drawn and it is especially useful when evaluating the usefulness of tests that sample a particular area of knowledge” (Salkind, 2010). Alternatively, content validity is the extent to which the indicators measure the different aspects of the concept (De Vaus, 2007). Expert validity is achieved by inviting experts, in a particular topic, to evaluate it. The measure should include adequate coverage of the subject being studied. Content validity depends on the quality of the literature and the theories which are used to build this instrument and some experts should assess the questionnaire, also, in order to determine whether or not the questionnaire measures what it should measure (Ruane, 2005; Vogt, 2007). This research tested the relationship between IC and innovations. After analysing the literature review, the study was conducted through four actors named HC, SC, OC and CC which might affect product, process and organizational innovations.

The initial questionnaire was delivered or emailed to five lecturers/senior lectures / professors in Plymouth University’s management department. They had different specializations such as human resource management; information technology; knowledge management; and banking. At the same time, it was checked by ten doctorate students specializing in business management in order to check how well they could understand the questions. Most of the feedback confirmed that the items related to their constructs and the students recommended that some items be rephrased in order to be clearer and more understandable. A member of staff recommended that the questionnaire should be translated into the Arabic language which was the respondents’ mother tongue. Therefore, the next process related to this issue.

### **6.2.3 Translation of Questionnaire**

It is necessary for researchers, who apply their studies to a different language context, to translate the original questionnaire into the target language. The researcher employed back-translation as a technique to obtain a target questionnaire (Saunders et al., 2009). Back-translation means that the source questionnaire is translated into the target questionnaire (e.g. Arabic questionnaire). The final questionnaire was translated, also, into the original questionnaire (e.g. English questionnaire). Then, the researcher compared the two original questionnaires to create a final questionnaire.

The researcher sent the Arabic questionnaire by email to three professors of human resource management, marketing and banking at Business Management Department- Mansoura University- Egypt. They recommended that some words be changed so that they were clear to Egyptian banks' managers.

### **6.2.4 Construct Validity**

Construct validity is the extent to which items reflect the concept whereby these items are used to measure it (Howitt and Cramer, 2005). Many concepts are not measured or observed directly and, therefore, the instrument measures the constructs. Construct validity is necessary in order to check on the perceived overall validity of the measure. It is expected that a measure has high construct validity if it is built well on some theoretical construct (Clark-Carter, 2004). Colton and Covert (2007) divided construct validity into two sub-types: namely, convergent validity; and discriminant validity which are related concepts. They were assessed in the measurement model.

Firstly, convergent validity refers to the extent to which the correlation between the items of a construct exists strongly or, in measuring a construct, convergent validity is an association between indicators which are theoretically similar (Bergh and Ketchen, 2011). In order to obtain convergent validity in a construct, there should be high correlation coefficients (Brown, 2006; DeVon, 2007). The indicators measure the same concept. Average variance extracted (AVE) is employed to evaluate convergent validity. AVE means the overall amount of variance in the items accounted for a construct (Hair et al, 2010).

The researcher used the following formula to calculate AVE:

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \text{Var.}(\epsilon_i)}$$

Where:

- $\lambda_i$  represented the standardised factor loadings between a variable and its indicators (Factor loading for each construct),
- Var. related to variance
- $\epsilon$  was the measurement error of the indicators of construct.

In order to indicate sufficient convergent validity, the AVE should be greater than 0.5 (Dalgaard, 2008). If the researcher has convergent validity issues, this is because, within their variable, the items do not correlate well with each other; i.e., the latent factor is not explained well by its observed variables. Moreover, Composite Reliability (CR) reflects how error affects the scale. It confirms the validity of the constructs (Field, 2009). Hair et al. (1998) reported that the CR ought to be equal to or more than 0.70 to become acceptable. The researcher calculated the CR by using the following equation:

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \text{Var.}(\epsilon_i)}$$

Secondly, discriminant validity refers to the extent to which the constructs differ from other related constructs (Tanaka, 1987; Tarling, 2009; Hair et al., 2010). Discriminant validity exists if there is no strong relationship between the constructs (Colton and Covert, 2007). Each construct should be distinct from other constructs. Therefore, high discriminant validity provides evidence that a construct is unique (Hair et al., 2010). Discriminant validity is evaluated by the square root of the AVE; this must be greater than the correlations between the constructs (Fornell and Larcker, 1981). If, for each construct, the AVE is greater than its shared variance (which is the amount of variance that a variable (construct) is able to explain in another variable) with any other construct, discriminant validity is supported. If the researcher has discriminant validity issues, this is because his/her items correlate more highly with items outside their parent factor than with the items within their parent factor; i.e. the latent factor is explained better by some other items (from a different factor), than by its own observed variables.

### **6.3 Reliability**

Bordens and Abbott (2011) showed that reliability related to the extent to which a test measured consistently regardless of what it measured or whether or not a test produced the same results on different occasions. The measure was reliable when respondents gave the same answer in different situations. A question might be unreliable because it contained words which could be misunderstood and, consequently, which might cause confusion. Researchers use multiple-item indicators to create reliable indicators. In order to improve the question's reliability, the researcher should select the words of the questions carefully (De Vaus, 2007).

Scale reliability refers to a set of items used to measure a latent construct. The reliability can be evaluated through several methods such as internal consistency which focuses on the relationships between items within a single instrument (Colton and Covert, 2007). Therefore, it investigates the homogeneity of a scale. Internal consistency is assessed through calculating Cronbach's alpha is commonly used to measure of scale reliability (Ketchen and Bergh, 2009). Cronbach's alpha is computed by the following statistical formula which gives more accurate results of reliability (DeVellis, 2011).

$$\alpha = \frac{K}{K - 1} \left( 1 - \frac{\sum_{i=1}^K \sigma_{Y_i}^2}{\sigma_X^2} \right)$$

Where:

- K is the number of items in the scale.
- $\sigma_X^2$  the variance of the observed total test scores (total observed),
- $\sigma_{Y_i}^2$  the variance of component i for the current sample of persons (true score).

The values of Cronbach's alpha range from 0 (observed items are not consistent) to 1 (they completely correlate). This means that internal consistency will be acceptable if Cronbach's alpha is high (George and Mallery, 2003). Hair et al. (2010) and Field (2009) reported that Cronbach's alpha ought to be equal to or above 0.70 or 0.60 according to Heung and Chu (2000) Liu and Arnett (2000).

In order to achieve Cronbach's alpha, the study conducted a smaller sample (Clark-Carter, 2004). Therefore, the initial questionnaire was delivered to and collected from 50 Egyptian bank managers in order to obtain some assessment related to the questions' reliability and validity. 30 usable questionnaires were returned (a response rate of 60 %.). This was an

acceptable response rate according to Saunders et al. (2009) who recommended that a 30% response rate was reasonable for questionnaires delivered and collected by a person.

This study depended on the following two criteria to evaluate reliability: (1) Cronbach's alpha ought to be above 0.70 (Hair et al., 2010; Field, 2009) and (2) Corrected item-total correlations ought to be retained if the value was placed between 0.35 and 0.80 (Netemeyer et al., 2003). This value revealed the extent to which, within a scale, an item correlated with the other items. It was employed to determine the items which ought to be retained in a scale to support construct validity. Table 6.1 shows that the measure of HC began with 6 items. The two items (HC5 and HC6) were below 0.35 and, therefore, they were omitted after two trials. Hence, Cronbach's alpha for HC was 0.74.

**Table 6.1: Corrected Item-Total Correlation and Cronbach's Alpha for HC**

	$\alpha = 0.55$		Trial 1, $\alpha = 0.65$		Trial 2, $\alpha = 0.74$	
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
HC1	.493	.399	.585	.498	.524	.691
HC2	.496	.428	.560	.535	.632	.637
HC3	.541	.370	.611	.482	.664	.596
HC4	.296	.512	.297	.646	.352	.768
HC5	<del>.015</del>	.653				
HC6	.053	.597	<del>.014</del>	.740		

Cronbach's Alpha of OC, SC, process innovation and organisational innovation was above 0.70, 0.72, 0.87, 0.86 and 0.90, respectively. The study had to delete some items because, through one trial, the corrected item-total correlations were less than 0.35 (see Tables 6.2, 6.3, 6.4, 6.5).

**Table 6.2 Corrected Item-Total Correlation and Cronbach's Alpha for OC**

	$\alpha = 0.69$		Trial 1, $\alpha = 0.72$	
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
OC1	.448	.605	.641	.499
OC2	.512	.572	.448	.728
OC3	<del>.317</del>	.718		
OC4	.582	.508	.538	.634

**Table 6.3 Corrected Item-Total Correlation and Cronbach's Alpha for SC**

	$\alpha = 0.78$		Trial 1, $\alpha = 0.87$	
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SC1	<del>.306</del>	.816		
SC2	<del>.339</del>	.791		
SC3	.715	.721	.844	.813
SC4	.652	.735	.614	.870
SC5	.692	.739	.728	.850
SC6	.476	.767	.707	.849
SC7	.591	.744	.670	.859

**Table 6.4 Corrected Item-Total Correlation and Cronbach's Alpha for PCI**

	$\alpha = 0.82$		Trial 1, $\alpha = 0.87$	
	Corrected Item-Total Correlation	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Deleted
PCI1	<del>.079</del>	.079		
PCI2	.729	.729	.718	.837
PCI3	.639	.639	.662	.847
PCI4	.754	.754	.750	.831
PCI5	.771	.771	.836	.813
PCI6	.637	.637	.626	.853
PCI7	.457	.457	.468	.888

**Table 6.5 Corrected Item-Total Correlation and Cronbach's Alpha for OI**

	$\alpha = 0.865$		Trial 1, $\alpha = 0.90$	
	Corrected Item-Total Correlation	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha if Item Deleted
OI1	.749	.749	.775	.879
OI2	.651	.651	.656	.892
OI3	<del>-.052</del>	<del>-.052</del>		
OI4	.632	.632	.652	.891
OI5	.786	.786	.792	.876
OI6	.846	.846	.820	.871
OI7	.750	.750	.772	.879
OI8	.525	.525	.530	.907

Tables 6.6 and Table 6.7 show that the Cronbach's Alpha for CC and product innovation was 0.86 and 0.87 respectively. Also, the values of corrected item-total correlations were more than 0.35. Therefore, there were no deleted items for both constructs which retained all items.

**Table 6.6 Corrected Item-Total Correlation and Cronbach's Alpha for CC**

	$\alpha = 0.86$	
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CC1	.653	.843
CC2	.559	.851
CC3	.588	.845
CC4	.710	.825
CC5	.662	.835
CC6	.793	.805

**Table 6.7 Corrected Item-Total Correlation and Cronbach's Alpha for PDI**

	$\alpha = 0.87$	
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PDI1	.719	.831
PDI2	.667	.854
PDI3	.751	.820
PDI4	.745	.820

## **6.4 Summary**

This chapter has addressed the content and construct validity of the questionnaire to confirm that the instrument measured what it was supposed to measure. The questionnaire was checked by PhD researchers, management academics and the bank's employees. The researcher employed back-translation as a technique to obtain a target questionnaire. Furthermore, Cronbach's alpha is commonly used to measure the scale of reliability and this study conducted a smaller sample to calculate the Cronbach's alpha. The initial questionnaire was delivered to and collected from 50 Egyptian banks employees to measure the reliability of the questions. 30 usable questionnaires were returned. After omitting 7 items which have low Cronbach's alpha, the reliability statistics show that the constructs have adequate reliability.

## **CHAPTER 7: DATA RESULTS AND ANALYSIS**

## **Introduction**

After collecting data by the questionnaire, this chapter presents quantitative statistics in order to analyse data and test hypotheses. This chapter starts by analysing respondents and assessing quality of data (section 7.1). It also evaluates the measurement model by investigating exploratory and confirmatory factor analysis (section 7.2). Finally, it ends to test the research hypotheses (structure model) by using warp PLS (section 7.3).

## **7.1 Data Analysis: Analysing the Respondents and Assessing the Quality of Data**

### **7.1.1 Analysing the Respondents**

#### **7.1.1.1 Analysing the Sample Size**

The researcher adopted three statistical techniques: namely, Exploratory Factor Analysis (EFA); Confirmatory Factor Analysis (CFA); and Path Analysis to reach the final research results. The sample size affected the accuracy of all the statistical estimates. Many researchers suggested rules of thumb for sample size minimums which relied on the number of measured variables. For example, Gorsuch (1983) proposed five cases for each variable and that, in order to perform EFA, these cases be no less than 100. For SEM, the sample size had to be at least 100 to 200 cases (Hoyle, 1995; Loehlin, 2004). Alternatively, the cases/parameter ratio was 5:1 (Bentler and Chou, 1987; Kline, 2005). In SEM models, a sample size was unreasonable if it was less than 100 (Kline, 2005). In this study, a sample size was suitable for performing the EFA; the CFA; and the structural model.

#### **7.1.1.2 Testing for Non-Response Bias**

In any survey research, it is normal to find less than a 100% response; this produces the potential for non-response bias. Non-response bias happens when there is a difference

between the respondents' and non-respondents' answers (Lambert and Harrington, 1990). For this study, the response rate was 54 %. According to Saunders et al. (2009), this was an acceptable rate. The problem of non-response bias related to reducing the generalisation of the respondent sample's results to the whole population. When non-response bias occurs, there is an unrepresentative sample. Therefore, the researcher should address the issue through testing for non-response bias. Armstrong and Overton, (1977) recommended that, if there were significant differences between the early and late returned surveys, it was expected that on the assumption that individuals, who responded late were more similar to non-respondents, this survey had a non-response bias.

Lambert and Harrington (1990) and Wu et al., (2008) examined non-response bias using t-tests which aimed to determine the extent to which the differences between the early respondents and the late ones were significant. T-tests were performed to compare the medium of early and late respondents. There was no consensus around the number of items which should be tested. Armstrong and Overton, (1977) used 53 of the 112 items (47%); Lambert and Harrington (1990) chose 28 of 56 original questions; whilst Yaghi (2006) selected randomly 20 of the 74 items. In order to conduct t-tests and according to Yaghi (2006), the researcher used fifty early respondents and the same number of late respondents. The t-tests results showed that for most of items (85%) there was no significant difference between the late and early respondents ( $p > .05$ ) and between the early and late respondents (see the Table 7.1). These results do not rule out the possibility of non-response bias, but they suggest that non-response may not be a problem.

**Table 7.1: Tests the difference between early and late respondents**

<b>Items</b>	<b>T-test</b>	<b>Sig. (two tailed)</b>
Our bank acquire employees with suitable knowledge and competences	0.101	0.923
Our bank develops talent through programmes such as formal job training.	1.164	0.247
Our bank retains the most talented employees who have a suitable educational level	<b><u>2.199</u></b>	<b><u>0.030</u></b>
Our employees can share their knowledge with their Colleagues.	1.579	0.118
Our bank has an effective management process	1.281	0.203
Our bank culture is supportive and comfortable to innovation	1.172	0.215
Our top management team regards employees as the source of innovation	0.832	0.407
Employee avoids making demands that can seriously damage the interests of the other.	1.118	0.267
Our colleagues always keep their promises to us.	0.358	0.721
Our colleagues clearly understand the goals / values in our bank.	1.076	0.285
Our colleagues share the same ambitions.	0.207	0.837
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	-.108	0.914
Our customers would indicate that they are generally satisfied with our bank.	1.911	0.6
Our bank tries to offer the best service to customers in the banking industry.	<b>2.097</b>	<b>0.04</b>
We get lots of feedback out of our customers' wants.	<b>2.255</b>	<b>0.03</b>
We strive to meet with customers' wants.	0.650	.518
Our bank is heavily market oriented.	1.288	.201
We are confident of our future with customers.	0.874	0.384

Our bank develops its services speedily.	<b>2.105</b>	<b>0.05</b>
Our services are innovatively designed.	1.839	0.07
Our bank is able to replace obsolete service.	0.845	0.40
Our bank innovates many services like packaged accounts/ services for target market.	1.483	0.142
Our bank is able to absorb the basic technologies of business.	0.617	0.539
Our bank has valuable knowledge for technological process- innovation.	0.499	0.619
Our bank continually develops programs to reduce service costs	-483	0.630
Our bank organizes its service processes efficiently.	0.827	0.411
Our bank assigns resources to the service processes efficiently.	1.909	0.06
Our bank is able to maintain a low level service process without impairing the service.	-457	0.64
Our bank uses databases of best practices.	.808	0.421
Our bank implements practices for employee development.	1.403	0.164
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	1.320	0.190
Our bank emphasizes creative capability when recruiting staff.	1.496	0.138
The new staff recruitment system adopted by our bank is effective.	1.157	0.250
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	1.765	0.08
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	<b>2.529</b>	<b>0.013</b>
<b>Notice:</b>		
<b>Bold</b> figures denote that these items are significant.		

### 7.1.1.3 Common Method Bias

Common method bias assumes that a single factor explains the majority of variance. Researchers rely on the same respondent who provides information about all the variables (Podsakoff, MacKenzie and Podsakoff, 2012). Common method bias is a problem because it is considered to be a main source of measurement error which has a negative effect on the validity of the measure (Podsakoff, MacKenzie, Lee and Podsakoff, 2003). Due to the method bias, correlations are inflated (Meade, Watson, and Kroustalis, 2007). This study had to investigate this method because of using one questionnaire to measure all constructs including HC, SC, OC, CC; and product, process and organisational innovation. The study employed Harman's one-factor test to evaluate common method bias (Podsakoff et al., 2003). The un-rotated factor analysis showed that the first factor accounted for 45% of the total variance. Therefore, the results suggested that there were no common variable (its value was not above 50%) to threaten the data to be analyzed further (see Table 7.2).

**Table 7.2: Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.440	46.971	46.971	16.440	45.12	45.12
2	1.883	5.380	52.351			
3	1.553	4.437	56.787			
4	1.218	3.479	60.267			
5	1.013	2.893	63.160			
6	.993	2.838	65.998			
7	.894	2.554	68.552			
8	.879	2.511	71.063			
9	.757	2.162	73.226			
10	.708	2.023	75.248			
11	.671	1.917	77.165			
12	.605	1.728	78.893			
13	.585	1.673	80.566			

14	.555	1.585	82.150			
15	.549	1.568	83.718			
16	.510	1.456	85.174			
17	.472	1.348	86.522			
18	.464	1.326	87.848			
19	.420	1.200	89.048			
20	.393	1.123	90.171			
21	.370	1.057	91.228			
22	.352	1.006	92.234			
23	.323	.924	93.158			
24	.305	.871	94.029			
25	.287	.821	94.850			
26	.259	.739	95.589			
27	.252	.721	96.310			
28	.223	.637	96.948			
29	.213	.610	97.557			
30	.209	.597	98.154			
31	.179	.511	98.665			
32	.159	.454	99.119			
33	.147	.419	99.538			
34	.132	.376	99.913			
35	.030	.087	100.000			
Extraction Method: Principal Component Analysis.						

### 7.1.2 Assessing the quality of data

- **Assessing missing data**

In social science research, missing (or incomplete) pieces of data are a common problem. There are many reasons for the occurrence of missing data which, usually, are beyond the researcher's control. As example, the respondent forgot to answer some items in the questionnaire and he/she was absence on the day of data collection or some questions were sensitive for the respondent (Kline, 1998; Tsiriktsis, 2005). Sometimes, this issue happens because of the design of the questionnaire, for instance, a questionnaire is excessively long (Kline, 1998). On the other hand, missing data may cause the following two negative effects on the research results: (1) it may produce biased estimates' and (2) it reduces the model's fit.

Hair et al., (2010) reported that variables or cases ought to be omitted if they had 50% or more missing data. Therefore, the researcher omitted 11 cases. The number of responses was reduced from 209 to 198 usable questionnaires; these were enough for EFA, CFA and path analysis.

- **Assessing outliers**

Outliers are aberrant or so extreme values which are either on one or a set of variables (Tinsley and Brown, 2000). Outliers can cause negative effects on data analysis. For example, data can contain collinearities and non-normality which can lead to negative variance estimates (e.g. an indicator error less than zero) (Brown, 2006). These effects can deform statistical results which cannot be generalised. Outliers can occur as “a result of an error in the data file (e.g., entry of an incorrect value), a programming error (e.g., an error in recoding or transforming variables or a failure to identify missing data values correctly), or the presence of a valid but exceptional data point” (Tinsley and Brown, 2000). Outliers can be univariate related to cases with an extreme value on a single variable or these values exist in cases of two or more variables (multivariate outliers) (Kline, 2005).

In order to find univariate outliers, researchers use the frequency distributions of z scores. If the z score is greater than 3.29 with  $p < .001$ , it indicates that there is an univariate outlier (Tinsley and Brown, 2000). Accordingly, based on the previous rule, there were some outlier cases in this study. There are many available ways to address outliers. For example, the questionnaires were reviewed to ensure that the data of outliers' cases was entered correctly and there were no data entry errors. On the other hand, when the researcher cancelled these cases from the original data, he found that there were now outliers' cases. Therefore, the

study had to leave out the outliers' cases. Furthermore, the robust technique of covariance/correlation matrices, such SEM, can be employed to handle this issue in the multivariate outliers (Kline, 2005).

- **Assessing Normality**

Normality focuses on the extent to which the sample data distributes according to normal distribution (Hair et al., 2010). The researcher used skewness and kurtosis to evaluate the normality of the observed items. Skewness is “a measure of the asymmetry of the probability distribution of a real-valued random variable”. On the other hand, kurtosis refers to “the peaked or flatness of the distribution compared to the normal distribution” (Landau and Everitt, 2003). Values of these methods, which can be positive and negative, centre around zero. Therefore, skewness's value, which is zero, indicates a perfectly symmetrical distribution, whilst a positive skewness value indicates that the tail on the right side is longer. On the contrary, a negative value refers to left-tailed. On the other hand, a kurtosis value is zero for normal distributions, whilst it is negative for flat distributions (low kurtosis) and a positive value for peaked distributions (high Kurtosis). As a rule of thumb, the values of skewness and kurtosis should be between -1 and +1 in order to obtain a reasonably normal distribution (Bachman, 2004).

The study examined the indicators' univariate kurtosis and skewness (see Table 7.3). In social science research, it is difficult (or impossible) to obtain a completely normally distributed whereas it should be close to normal distribution. The values of skewness and kurtosis values were well within their respective rule-of-thumb ranges which provided support for univariate normality. In terms of Multivariate normality, this will be examined later in the SEM.

**Table 7.3: Assessment of the normality of the items**

	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Our bank acquire employees with suitable knowledge and competences	-.690	.173	-.070	.344
Our bank develops talent through programmes such as formal job training.	-1.272	.173	2.087	.344
Our bank retains the most talented employees who have a suitable educational level	-.526	.173	-.560	.344
Our employees can share their knowledge with their Colleagues.	-.620	.173	-.121	.344
Our bank has an effective management process	-.752	.173	.030	.344
Our bank culture is supportive and comfortable to innovation	-.735	.173	.199	.344
Our top management team regards employees as the source of innovation	-.680	.173	-.072	.344
Employee avoids making demands that can seriously damage the interests of the other.	-.595	.173	-.236	.344
Our colleagues always keep their promises to us.	-.289	.173	-.272	.344
Our colleagues clearly understand the goals / values in our bank.	-.730	.173	.647	.344
Our colleagues share the same ambitions.	-.490	.173	-.478	.344
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	-.716	.173	-.072	.344
Our customers would indicate that they are generally satisfied with our bank.	-.828	.173	.728	.344
Our bank tries to offer the best service to customers in the banking industry.	-1.120	.173	1.739	.344
We get lots of feedback out of our customers' wants.	-.784	.173	.504	.344
We strive to meet with customers' wants.	-1.077	.173	1.160	.344
Our bank is heavily market oriented.	-.837	.173	.497	.344
We are confident of our future with customers.	-.972	.173	.722	.344
Our bank develops its services speedily.	-.926	.173	.453	.344
Our services are innovatively designed.	-.676	.173	.220	.344
Our bank is able to replace obsolete service.	-.894	.173	.933	.344
Our bank innovates many services like packaged accounts/ services for target market.	-.583	.173	-.212	.344

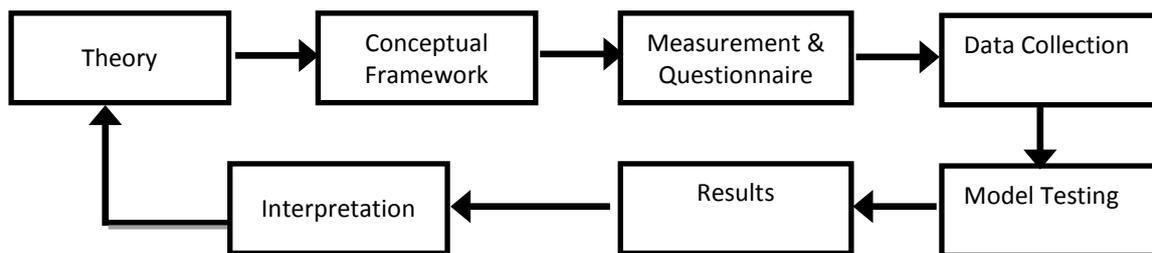
Our bank is able to absorb the basic technologies of business.	-.662	.173	.281	.344
Our bank has valuable knowledge for technological process- innovation.	-.662	.173	.281	.344
Our bank continually develops programs to reduce service costs	-.881	.173	.743	.344
Our bank organizes its service processes efficiently.	-.738	.173	.328	.344
Our bank assigns resources to the service processes efficiently.	-.817	.173	.637	.344
Our bank is able to maintain a low level service process without impairing the service.	-1.038	.173	1.358	.344
Our bank uses databases of best practices.	-.886	.173	.369	.344
Our bank implements practices for employee development.	-.784	.173	.240	.344
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	-.549	.173	-.422	.344
Our bank emphasizes creative capability when recruiting staff.	-.373	.173	-.735	.344
The new staff recruitment system adopted by our bank is effective.	-.472	.173	-.430	.344
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	-.711	.173	.014	.344
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	-.596	.173	-.051	.344

## 7.2 Data Analysis: Assessing the Measurement Model

### 7.2.1 Introduction

Structural equation modelling (SEM) is defined as “a statistical method that takes a confirmatory (i.e., hypothesis-testing) approach to the analysis of a structural theory bearing on some phenomenon”. This theory represents “causal” processes which generate observations on multiple variables (Byrne, 2010). SEM aims to test the relationships between

one or more independent and dependent variables by assessing the extent to which the hypothetical constructs are suitable or fit with the obtained data. These variables may be measured (manifest or observed) or latent. The observed variable, such as income, heart rate or weight, is measured directly whilst the latent variable is not measured directly but through two or more observed variables, for instance, buying behaviour or personality (Kline, 2005). In achieving the results, a SEM analysis has many stages (see Figure 7.1).



**Figure 7.1:** The process of SEM results

SEM is employed increasingly in psychology and social sciences since it is considered to be an important technique for these fields. Due to using confirmatory methods, SEM presents inclusive tools for evaluating and adapting theoretical models. Therefore, it proposes a value prospective for furthering theory development. SEM has some advantages. When researches have complex relationships with multi-dimensions, SEM can test all these relationships simultaneously. SEM is considered to be the only statistical technique to perform this analysis (Hair et al., 2010). SEM is used to test a theory. SEM cannot work properly without prior knowledge. This means that a conceptual framework or relationships between variables must be built based on an extensive literature review (Tabachnick and Fidell, 2001). Therefore, if goodness-of-fit is enough, this indicates that the research model's relationships are acceptable.

This study used Partial Least Squared (PLS) which produced a measurement model and paths analysis. PLS is a variance based SEM analysis method. PLS is employed for theory development. PLS analyses and validates exploratory models since it estimates complex models with several observed and latent variables (Chin and Newsted, 1999). PLS has no need for normality and a large sample size. PLS has the ability to deal with linear and nonlinear relationships (Gefen et al., 2000; Henseler, Ringle, and Sinkovics, 2009). PLS has concerned with addressing the issues of both formative and reflective relationships between the variables. Reflective latent shows that “the indicators are affected by the same underlying concept” (Chin, 1998). The indicators are “functions of the latent variable whereas changing in the latent variable is reflected in changing the observable indicators” (Diamantopoulos and Siguaw, 2006). Sometimes, the indicators might be viewed as “causing rather than being caused by the latent variable measured by the indicators which are known as formative (or causal)” (MacCallum and Browne, 1993). Therefore, the changes, which are in the indicators, lead to changes in the latent.

On the other hand, PLS analysis is divided into the following two parts: the measurement model identifies the relationship between the observed variables and their latent whilst the structural model is concerned with the relationships between the latent variables (Loehlin, 2004). Before the study presents these models, it displays, firstly, the EFA is by using SPSS.

### **7.2.2 Factor Analysis**

Factor analysis is the oldest and best-known statistical technique for explaining the relationship between a set of observed and construct variables (Tinsley and Brown, 2000; Byrne, 2010). Factor analysis can be used for different purposes. Firstly, through calculating

the factor loading, factor analysis can be employed for evaluating the validity of measurements. Secondly, factor analysis can be used to confirm or develop a theory through investigating the observed variables which belong to latent ones (unobserved variables). Thirdly, factor analysis is used to produce a smaller group of latent variables which consist of a larger set of observed variables (manifest variables) (Thompson, 2004; Albright and Park, 2009; Field, 2009).

Factor analyses are divided into two types. Firstly, Exploratory Factor Analysis (EFA) is described as the early stages of research to discover the interrelationships between a set of variables (Carrington, 2009). EFA is designed to explore the relationship between observed and latent variables when this relationship is uncertain or unknown. Therefore, it aims to determine the degree to which the observed variables are linked to their fundamental factors (latent). It is designed only to suggest and not to confirm groups or dimensions. Secondly, Confirmatory Factor Analysis (CFA) is a more complex set of techniques than EFA which is used to confirm specific hypotheses when the researcher knows that these measures correlate with the latent variable (Carrington, 2009). Based on a theory, the researcher suggests relationships (hypothesized structure) between the observed items and their factors which are tested statistically (Byrne, 2010).

#### **7.2.2.1 Exploratory Factor Analysis (EFA)**

EFA aims to obtain a set of dimensions (factors) which explain the structure of the interrelationships (correlations) between items which should relate to each other for the purpose of producing an appropriate structure model (Hair et al., 2010). The EFA's primary objectives are to find the factors, which consist of a set of measures; to discover the strength of the relationship between each factor and each observed measure; and to reduce a data set

to a more manageable size whilst retaining as much of the original information as possible (Field, 2009). Using SPSS version 19.00, this study performed EFA and reliability analysis.

According to the results of the univariate analysis, which mentioned all univariate kurtosis and skewness values and supported the univariate normality, the researcher used the principal components method for factor extraction and used Variamax rotation to carry out factor interpretation.

#### **7.2.2.1.1 Initial Analysis**

The correlation matrix provides the correlation coefficients between a single variable and the other variables. In this study, the diagonal of this matrix contained 1 because it reflected the correlation between a variable and itself. All correlation coefficients were less than 0.90 and were significant ( $p < 0.05$ ). Therefore, multicollinearity did not cause a problem for these data. At this stage, there was no need for the study to omit any questions.

There were, also, two SPSS generated statistical measures to evaluate the factorability of the data. These were: Kaiser-Meyer-Olkin (KMO); and Bartlett's test of Sphericity (Pallant, 2003). The KMO measure of overall sampling adequacy assesses the degree to which indicators are valid or appropriate for factor analysis. A KMO value is between 0 (Factor analysis is likely to be inappropriate) and 1 (Factor analysis yield reliable factors).

Kaiser (1974) recommended that the KMO value might be excellent, great, good, middling and unacceptable (above 0.9, between 0.8 and 0.9, between 0.7 and 0.8, between 0.5 and 0.7 and less 0.5, respectively). In this study, Table 7.4 showed that KMO was 0.945 (superb) indicating that this data was suitable for conducting factor analysis or this sample was factorable. Moreover, Bartlett's test of Sphericity tests a null hypothesis; this supposed that

the population correlation matrix was an identity matrix. This test depended on the assumption of normality which was proved above. Table 7.4 reported that Chi-Square was 5047.941 with (df = 595,  $p < 0.001$ ). The null hypothesis was rejected or the variables were related to one another. Therefore, the study was able to continue to complete the remaining steps of the factor analysis.

**Table 7.4: KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.945
Bartlett's Test of Sphericity	Approx. Chi-Square	5047.941
	df	595
	Sig.	.000

### **7.2.2.1.3 Factor Extraction**

Factor extraction is concerned with finding “the smallest numbers of factors that can be used to best represent the inter-relations among the set of variables” (Pallant, 2003). The two methods for this issue are as follows.

### **7.2.2.1.2 Communalities**

For any variables, the variances can be divided into two components. These are called common variances which are shared with other variables and the unique variance which is specific to that measure. The communality was interested in common variances (Field, 2009). Therefore, the communality related to how much of the variance in the variables had been explained or was accounted for by the extracted factors. Through the common source with others, the communality estimates a part of the variance in a variable. Low communality may lead to its variable being omitted (Thompson, 2004). Table 7.5 shows communality before

and after extraction. Principal component analysis starts with 35 variables and common factors. Initially, it assumes that all variances are common. Hence, the Communalities equal 1 before extraction. This means that there are common factors which, after extraction, represent the common variance in the data structure. For example, 70.2%, of the variance in the second item, related to common or shared variance. This meant that some information was lost or some factors were useless. The communalities after extraction represented the amount of variance in each variable which could be explained by the retained factors.

**Table 7.5: Communalities**

Items	Initial	Extraction
Our bank acquire employees with suitable knowledge and competences	1.000	.547
Our bank develops talent through programmes such as formal job training.	1.000	.702
Our bank retains the most talented employees who have a suitable educational level	1.000	.670
Our employees can share their knowledge with their Colleagues.	1.000	.623
Our bank has an effective management process	1.000	.832
Our bank culture is supportive and comfortable to innovation	1.000	.705
Our top management team regards employees as the source of innovation	1.000	.741
Employee avoids making demands that can seriously damage the interests of the other.	1.000	.692
Our colleagues always keep their promises to us.	1.000	.736
Our colleagues clearly understand the goals / values in our bank.	1.000	.655
Our colleagues share the same ambitions.	1.000	.723
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	1.000	.621
Our customers would indicate that they are generally satisfied with our bank.	1.000	.656
Our bank tries to offer the best service to customers in the banking industry.	1.000	.746
We get lots of feedback out of our customers' wants.	1.000	.610
We strive to meet with customers' wants.	1.000	.744
Our bank is heavily market oriented.	1.000	.753
We are confident of our future with customers.	1.000	.711

Our bank develops its services speedily.	1.000	.718
Our services are innovatively designed.	1.000	.664
Our bank is able to replace obsolete service.	1.000	.649
Our bank innovates many services like packaged accounts/ services for target market.	1.000	.493
Our bank is able to absorb the basic technologies of business.	1.000	.798
Our bank has valuable knowledge for technological process-innovation.	1.000	.787
Our bank continually develops programs to reduce service costs	1.000	.575
Our bank organizes its service processes efficiently.	1.000	.668
Our bank assigns resources to the service processes efficiently.	1.000	.628
Our bank is able to maintain a low level service process without impairing the service.	1.000	.613
Our bank uses databases of best practices.	1.000	.649
Our bank implements practices for employee development.	1.000	.660
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	1.000	.699
Our bank emphasizes creative capability when recruiting staff.	1.000	.789
The new staff recruitment system adopted by our bank is effective.	1.000	.731
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	1.000	.779
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	1.000	.625
Extraction Method: Principal Component Analysis.		

#### 7.2.2.1.4 Total Variance Explained

Table 8.6, called total variance, sets out, by using Eigenvalues (Kim and Mueller, 1978), the aims in determining the number of factors which explain most variances in the data. Eigenvalues indicate the amount of variance explained by each factor. Eigenvectors are the weights which can be used to calculate factor scores which are called loads. From this table, initial principal components (with 35 Eigenvalues) were produced. Instead of using all items (35), the first seven components explained 68.55 % variance or most information, about

68.55%, existed in seven unrelated factors. The researcher used Varimax rotation to conduct this analysis.

#### **7.2.2.1.5 Factor Rotation**

Table 7.7 contains the rotated factor loadings which related to the correlations between each item and its construct. The researcher used the option blank (0.35) in order to let SPSS to print only the values greater than 0.35 (Field, 2005). Moreover, this technique divided the factors into 7 factors. These groups were consistent with the previous studies whereas, with the exception of groups 1 and 7, groups 2, 3,4,5,6 represented organisational innovation, CC, SC, OC and HC except for. The first group included the items of product and process innovation whilst the last one contained an item which belonged to HC and another one related to CC. Based on the innovation literature, this study divided group 1 into two groups called product innovation and process innovation whilst group 7 distributed its items to their original groups.

**Table 7.6: Total Variance Explained**

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.440	46.971	46.971	16.440	46.971	46.971	5.156	14.731	14.731
2	1.883	5.380	52.351	1.883	5.380	52.351	4.753	13.581	28.312
3	1.553	4.437	56.787	1.553	4.437	56.787	3.936	11.246	39.557
4	1.218	3.479	60.267	1.218	3.479	60.267	3.502	10.005	49.563
5	1.013	2.893	63.160	1.013	2.893	63.160	2.959	8.455	58.017
6	.993	2.838	65.998	.993	2.838	65.998	2.182	6.236	64.253
7	.894	2.554	68.552	.894	2.554	68.552	1.505	4.299	68.552
8	.879	2.511	71.063						
9	.757	2.162	73.226						
10	.708	2.023	75.248						
11	.671	1.917	77.165						
12	.605	1.728	78.893						
13	.585	1.673	80.566						
14	.555	1.585	82.150						
15	.549	1.568	83.718						
16	.510	1.456	85.174						
17	.472	1.348	86.522						
18	.464	1.326	87.848						
19	.420	1.200	89.048						
20	.393	1.123	90.171						
21	.370	1.057	91.228						
22	.352	1.006	92.234						

23	.323	.924	93.158						
24	.305	.871	94.029						
25	.287	.821	94.850						
26	.259	.739	95.589						
27	.252	.721	96.310						
28	.223	.637	96.948						
29	.213	.610	97.557						
30	.209	.597	98.154						
31	.179	.511	98.665						
32	.159	.454	99.119						
33	.147	.419	99.538						
34	.132	.376	99.913						
35	.030	.087	100.000						
Extraction Method: Principal Component Analysis.									

**Table7.7: Rotated Component Matrix<sup>a</sup>**

	Component						
	1 (PCI and PDI)	2 (OI)	3 (CC)	4 (SC)	5 (OC)	6 (HC)	7 (HC and CC)
Our bank is able to absorb the basic technologies of business.	.780						
Our bank has valuable knowledge for technological process- innovation.	.763						
Our bank is able to replace obsolete service.	.613						
Our bank organizes its service processes efficiently.	.607						
Our bank is able to maintain a low level service process without impairing the service.	.578						
Our bank continually develops programs to reduce service costs	.560						
Our services are innovatively designed.	.536						
Our bank assigns resources to the service processes efficiently.	.522						
Our bank innovates many services like packaged accounts/ services for target	.479						

market.							
Our bank develops its services speedily.	.477						
Our bank emphasizes creative capability when recruiting staff.		.765					
The new staff recruitment system adopted by our bank is effective.		.728					
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.		.715					
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.		.697					
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.		.657					
Our bank uses databases of best practices.		.536					
Our bank implements practices for employee development.		.531					
Our bank tries to			.757				

offer the best service to customers in the banking industry.							
We strive to meet with customers' wants.			.703				
Our bank is heavily market oriented.			.663				
We are confident of our future with customers.			.628				
We get lots of feedback out of our customers' wants.			.600				
Our colleagues always keep their promises to us.				.780			
Employee avoids making demands that can seriously damage the interests of the other.				.678			
Our colleagues share the same ambitions.				.656			
People in our department are enthusiastic about pursuing the collective goals of the whole bank.				.608			
Our colleagues clearly understand the goals / values in our bank.				.556			
Our bank has an effective management process					.707		
Our top management team regards employees as the source of innovation					.675		

Our bank culture is supportive and comfortable to innovation					.582		
Our bank acquire employees with suitable knowledge and competences						.666	
Our bank retains the most talented employees who have a suitable educational level						.650	
Our bank develops talent through programmes such as formal job training.						.595	
Our employees can share their knowledge with their Colleagues.							.517
Our customers would indicate that they are generally satisfied with our bank.							.500
Extraction Method: Principal Component Analysis.							
Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 8 iterations.							

### 7.2.3 Measurement Model

A measurement model is employed to evaluate individual, construct reliability, convergent and discriminant validity to discover the extent to which the measures have adequate internal consistency.

### 7.2.3.1 Individual Item Reliability

The researcher evaluated the individual item reliability through combined loadings and cross loadings. The loadings were from a structure matrix (un-rotated) which included Pearson correlations between indicators and latent variables. The cross-loadings were from a pattern matrix (rotated) whereas cross-loading contained all the 24 observed items; this was loaded on the specified latent variables. These values were always between -1 and 1 (Kock, 2013). Hair et al. (2010) recommended that the loadings ought to be 0.50 or above and P values related to the loadings should be lower than 0.05. Table 7.8 shows that, compared to other latent variables, the factor loadings loaded higher on their theoretical specific latent variable. With the exception of some items which were omitted, the loading all items exceeded 0.50 ( $p < 0.001$ ). These results indicated that these measurement items were satisfied according to these criteria and they had individual item reliability.

**Table 7.8: Combined Loadings and Cross-loadings**

	HC	OC	SC	CC	PDI	PCI	OI	SE	P value
HC2	<b>0.783</b>	0.192	-0.055	0.007	-0.229	0.101	0.023	0.106	<0.001
HC3	<b>0.844</b>	-0.293	-0.050	0.033	0.038	-0.058	0.165	0.054	<0.001
HC4	<b>0.733</b>	0.132	0.116	-0.045	0.201	-0.041	-0.214	0.086	<0.001
OC1	0.037	<b>0.922</b>	-0.061	0.063	0.126	-0.072	-0.109	0.057	<0.001
OC2	-0.157	<b>0.869</b>	0.100	0.035	0.011	-0.060	0.097	0.066	<0.001
OC4	0.116	<b>0.885</b>	-0.035	-0.100	-0.142	0.133	0.018	0.052	<0.001
SC5	-0.097	0.157	<b>0.860</b>	-0.002	0.121	-0.037	0.024	0.068	<0.001
SC6	-0.025	-0.155	<b>0.872</b>	-0.035	0.213	-0.174	0.012	0.051	<0.001
SC7	0.125	0.000	<b>0.837</b>	0.038	-0.346	0.219	-0.037	0.066	<0.001
CC6	-0.182	0.156	0.120	<b>0.820</b>	-0.214	0.191	-0.112	0.070	<0.001
CC4	-0.185	0.047	-0.118	<b>0.831</b>	0.022	0.071	0.098	0.074	<0.001
CC1	0.116	-0.154	0.210	<b>0.678</b>	0.258	-0.488	0.172	0.092	<0.001
CC2	0.050	0.020	-0.089	<b>0.819</b>	0.075	-0.069	-0.176	0.085	<0.001
CC3	-0.010	-0.109	-0.101	<b>0.779</b>	0.270	0.028	0.087	0.065	<0.001
CC5	0.228	0.006	0.011	<b>0.836</b>	-0.346	0.179	-0.036	0.065	<0.001
PDI1	0.159	-0.248	0.051	0.036	<b>0.833</b>	0.287	0.001	0.083	<0.001
PDI3	-0.042	0.097	0.043	-0.100	<b>0.880</b>	-0.099	-0.088	0.062	<0.001
PDI4	-0.107	0.137	-0.090	0.065	<b>0.892</b>	-0.170	0.086	0.061	<0.001
PCI3	-0.097	-0.002	0.031	0.112	0.142	<b>0.877</b>	-0.053	0.068	<0.001
PCI7	0.097	0.002	-0.031	-0.112	-0.142	<b>0.877</b>	0.053	0.085	<0.001
OI2	0.176	0.085	-0.043	0.195	-0.086	0.047	<b>0.818</b>	0.069	<0.001

OI4	0.044	-0.194	0.154	-0.057	-0.012	0.002	<b>0.850</b>	0.052	<0.001
OI5	-0.068	-0.046	-0.040	-0.178	0.115	0.092	<b>0.887</b>	0.045	<0.001
OI6	-0.142	0.160	-0.070	0.055	-0.025	-0.142	<b>0.854</b>	0.053	<0.001
Note: P values < 0.05 are desirable for reflective indicators									

The loadings and cross-loadings were extracted from a pattern matrix (rotated). By using the loadings and cross-loadings (see Table 7.9), researchers can determine visually mismatches between indicators and their latent variables. These mismatches happened when these values were low loadings and high cross-loadings whereas the loadings of some cases were above 1 which meant that two or more latent variables were collinear (Rencher, 1998; Kock, 2013). The researcher had no need to use these measures since Warp PLS provided output related to collinearity between latent variables though VIFs which are presented later.

**Table 7.9: Pattern Loadings and Cross-loadings**

	HC	OC	SC	CC	PDI	PCI	OI
HC2	<b>0.764</b>	0.192	-0.055	0.007	-0.229	0.101	0.023
HC3	<b>0.966</b>	-0.293	-0.050	0.033	0.038	-0.058	0.165
HC4	<b>0.614</b>	0.132	0.116	-0.045	0.201	-0.041	-0.214
OC1	0.037	<b>0.928</b>	-0.061	0.063	0.126	-0.072	-0.109
OC2	-0.157	<b>0.853</b>	0.100	0.035	0.011	-0.060	0.097
OC4	0.116	<b>0.895</b>	-0.035	-0.100	-0.142	0.133	0.018
SC5	-0.097	0.157	<b>0.728</b>	-0.002	0.121	-0.037	0.024
SC6	-0.025	-0.155	<b>0.964</b>	-0.035	0.213	-0.174	0.012
SC7	0.125	0.000	<b>0.876</b>	0.038	-0.346	0.219	-0.037
CC6	-0.182	0.156	0.120	<b>0.859</b>	-0.214	0.191	-0.112
CC4	-0.185	0.047	-0.118	<b>0.878</b>	0.022	0.071	0.098
CC1	0.116	-0.154	0.210	<b>0.556</b>	0.258	-0.488	0.172
CC2	0.050	0.020	-0.089	<b>0.947</b>	0.075	-0.069	-0.176
CC3	-0.010	-0.109	-0.101	<b>0.650</b>	0.270	0.028	0.087
CC5	0.228	0.006	0.011	<b>0.844</b>	-0.346	0.179	-0.036
PDI1	0.159	-0.248	0.051	0.036	<b>0.608</b>	0.287	0.001
PDI3	-0.042	0.097	0.043	-0.100	<b>1.031</b>	-0.099	-0.088
PDI4	-0.107	0.137	-0.090	0.065	<b>0.954</b>	-0.170	0.086
PCI3	-0.097	-0.002	0.031	0.112	0.142	<b>0.762</b>	-0.053
PCI7	0.097	0.002	-0.031	-0.112	-0.142	<b>0.992</b>	0.053
OI2	0.176	0.085	-0.043	0.195	-0.086	0.047	<b>0.555</b>
OI4	0.044	-0.194	0.154	-0.057	-0.012	0.002	<b>0.906</b>
OI5	-0.068	-0.046	-0.040	-0.178	0.115	0.092	<b>0.971</b>
OI6	-0.142	0.160	-0.070	0.055	-0.025	-0.142	<b>0.963</b>

Table 7.10 shows that structure loadings and cross-loadings were from a structure matrix (i.e., un-rotated). This matrix was not useful for collinearity, like Pattern loadings, since it included Pearson correlations between indicators and latent variables. The researcher employed these loadings for validity and reliability test criteria. This table can be used for convergent validity through the loadings of items; this should be equal to or above 0.5 (Hair et al., 2010). This rule satisfied these loadings.

**Table 7.10: Structure Loadings and Cross-loadings**

	HC	OC	SC	CC	PDI	PCI	OI
HC2	0.783	0.567	0.412	0.474	0.516	0.460	0.506
HC3	0.844	0.475	0.411	0.495	0.551	0.431	0.535
HC4	0.733	0.543	0.446	0.471	0.551	0.458	0.448
OC1	0.638	0.922	0.551	0.613	0.682	0.603	0.597
OC2	0.542	0.869	0.591	0.585	0.627	0.561	0.623
OC4	0.604	0.885	0.507	0.522	0.607	0.618	0.592
SC5	0.486	0.602	0.860	0.613	0.613	0.514	0.576
SC6	0.422	0.462	0.872	0.551	0.539	0.404	0.511
SC7	0.467	0.519	0.837	0.565	0.495	0.479	0.519
CC6	0.422	0.542	0.577	0.820	0.536	0.518	0.478
CC4	0.464	0.535	0.533	0.831	0.583	0.525	0.554
CC1	0.453	0.406	0.525	0.678	0.492	0.300	0.487
CC2	0.481	0.499	0.497	0.819	0.551	0.450	0.440
CC3	0.519	0.516	0.526	0.779	0.626	0.521	0.551
CC5	0.568	0.556	0.559	0.836	0.552	0.519	0.527
PDI1	0.601	0.563	0.548	0.600	0.833	0.668	0.593
PDI3	0.584	0.630	0.562	0.579	0.880	0.615	0.574
PDI4	0.597	0.671	0.562	0.644	0.892	0.621	0.647
PCI3	0.501	0.598	0.518	0.582	0.677	0.877	0.557
PCI7	0.497	0.569	0.435	0.467	0.601	0.877	0.539
OI2	0.625	0.634	0.553	0.632	0.633	0.568	0.818
OI4	0.518	0.518	0.563	0.519	0.569	0.505	0.850
OI5	0.526	0.574	0.509	0.488	0.619	0.578	0.887
OI6	0.490	0.583	0.510	0.533	0.554	0.481	0.854

Table 7.11 shows indicator weight. All cross-weights were zero because of the way they were calculated through PLS regression. Each latent variable score was calculated as an exactly linear combination of its indicators, whereby the weights were multiple regression

coefficients linking the indicators to the latent variable (Kock, 2013). P values were provided for weights associated with all latent variables as the result of a confirmatory factor analysis. Weights with P values were lower than 0.05, VIFs were provided, also, for the indicators of all latent variables whereas VIFs ought to be less than 3.3 (Kock, 2013). As shown in Table 7.11, the P value was lower than 0.05 ( $p < 0.001$ ) and the maximum value of VIFs was 2.94.

**Table 7.11: Indicator Weights**

	HC	OC	SC	CC	PDI	PCI	OI	SE	P value	VIF
HC2	0.421	0.000	0.000	0.000	0.000	0.000	0.000	0.045	<0.001	1.385
HC3	0.453	0.000	0.000	0.000	0.000	0.000	0.000	0.041	<0.001	1.537
HC4	0.393	0.000	0.000	0.000	0.000	0.000	0.000	0.053	<0.001	1.266
OC1	0.000	0.386	0.000	0.000	0.000	0.000	0.000	0.028	<0.001	2.937
OC2	0.000	0.364	0.000	0.000	0.000	0.000	0.000	0.025	<0.001	2.103
OC4	0.000	0.371	0.000	0.000	0.000	0.000	0.000	0.027	<0.001	2.359
SC5	0.000	0.000	0.391	0.000	0.000	0.000	0.000	0.026	<0.001	1.861
SC6	0.000	0.000	0.396	0.000	0.000	0.000	0.000	0.033	<0.001	1.948
SC7	0.000	0.000	0.381	0.000	0.000	0.000	0.000	0.029	<0.001	1.699
CC6	0.000	0.000	0.000	0.216	0.000	0.000	0.000	0.021	<0.001	2.204
CC4	0.000	0.000	0.000	0.219	0.000	0.000	0.000	0.022	<0.001	2.303
CC1	0.000	0.000	0.000	0.178	0.000	0.000	0.000	0.023	<0.001	1.532
CC2	0.000	0.000	0.000	0.216	0.000	0.000	0.000	0.021	<0.001	2.147
CC3	0.000	0.000	0.000	0.205	0.000	0.000	0.000	0.025	<0.001	1.928
CC5	0.000	0.000	0.000	0.220	0.000	0.000	0.000	0.022	<0.001	2.346
PDI1	0.000	0.000	0.000	0.000	0.368	0.000	0.000	0.032	<0.001	1.710
PDI3	0.000	0.000	0.000	0.000	0.389	0.000	0.000	0.034	<0.001	2.145
PDI4	0.000	0.000	0.000	0.000	0.394	0.000	0.000	0.031	<0.001	2.260
PCI3	0.000	0.000	0.000	0.000	0.000	0.570	0.000	0.057	<0.001	1.407
PCI7	0.000	0.000	0.000	0.000	0.000	0.570	0.000	0.047	<0.001	1.407
OI2	0.000	0.000	0.000	0.000	0.000	0.000	0.281	0.020	<0.001	1.888
OI4	0.000	0.000	0.000	0.000	0.000	0.000	0.292	0.021	<0.001	2.131
OI5	0.000	0.000	0.000	0.000	0.000	0.000	0.305	0.022	<0.001	2.666
OI6	0.000	0.000	0.000	0.000	0.000	0.000	0.294	0.023	<0.001	2.284

### 7.2.3.2 Reliability Assessment

As mentioned previously, reliability expresses the extent to which a measure produces the same results on different occasions. The reliability can be evaluated through several methods such as internal consistency; this refers to a set of items in measuring a latent construct which

is composed of a set of reflective indicators. Examining internal consistency allows the researcher to compare results across and between items within a single instrument (Colton and Covert, 2007). Traditionally, Cronbach's alpha coefficient is the most commonly used measure of scale reliability (Cronbach, 1951 cited in Ketchen and Bergh, 2009). Furthermore, reliability, in SEM, can be assessed by using construct or Component Reliability (CR) which addresses the internal consistency. As a rule of thumb, alpha and CR should be at least 0.7 to reach internal reliability (deVaus, 2002). Table 7.12 shows that Cronbach's alpha coefficients and composite reliability coefficients were equal to and greater than 0.70. Therefore, this measure has an internal consistency

**Table 7.12: Reliability Assessment**

<b>Latent variables</b>	<b>HC</b>	<b>OC</b>	<b>SC</b>	<b>CC</b>	<b>PDI</b>	<b>PCI</b>	<b>OI</b>
<b>Cronbach's alpha coefficients</b>							
	0.693	0.872	0.818	0.883	0.837	0.700	0.874
<b>Composite reliability coefficients</b>							
	0.830	0.921	0.892	0.912	0.902	0.869	0.914

### **7.2.3.3 Validity Assessment - Convergent Validity**

Validity refers to the ability of an instrument to measure what it is intended to measure (Colton and Covert, 2007). Convergent validity is a measure of how well the items in a scale converge or 'load together,' on a single latent construct (Ketchen and Bergh, 2009). The researcher evaluated Average Variance Extracted (AVE) which was the mean variance extracted for the items loading on a construct (Hair et al., 2010). AVE should be greater than 0.50. Table 7.13 demonstrates that, for each latent variable, the AVE is greater than 0.50. Hence, this measure is consistent with the rule of convergent validity.

**Table 7.13: Average Variances Extracted**

Latent variables	HC	OC	SC	CC	PDI	PCI	OI
	0.621	0.796	0.733	0.633	0.755	0.769	0.727

#### 7.2.3.4 Validity Assessment - Discriminant Validity

Discriminant validity refers to the extent to which each construct differs from other constructs (Tanaka, 1987; Tarling, 2009; Hair et al., 2010.). Discriminant validity exists if there is no strong relationship between the constructs (Colton and Covert, 2007). Discriminant validity is evaluated by the square root of the AVE, which must be greater than the correlations between the constructs (Fornell and Larcker, 1981). If the AVE for each construct is greater than its shared variance (which is the amount of variance that a variable (construct) is able to explain in another variable) with any other construct, discriminant validity is supported. Table 7.14 shows that the square root of the AVE is greater than the correlations between the constructs (Fornell and Larcker, 1981). This condition is satisfied for all constructs. The correlation matrix reported, also, that there were significant correlations ( $P < 0.001$ ) between the constructs are significant.

**Table 7.14: Factor Correlation Matrix with Square Roots of AVE**

	HC	OC	SC	CC	PDI	PCI	OI
HC	<b>0.788</b>	0.668*	0.535*	0.609*	0.683*	0.569*	0.632*
OC	0.668*	<b>0.892</b>	0.616*	0.642*	0.716*	0.665*	0.676*
SC	0.535*	0.616*	<b>0.856</b>	0.673*	0.642*	0.543*	0.625*
CC	0.609*	0.642*	0.673*	<b>0.796</b>	0.700*	0.598*	0.635*
PDI	0.683*	0.716*	0.642*	0.700*	<b>0.869</b>	0.729*	0.696*
PCI	0.569*	0.665*	0.543*	0.598*	0.729*	<b>0.877</b>	0.625*

OI	0.632*	0.676*	0.625*	0.635*	0.696*	0.625*	<b>0.853</b>
Note: Square roots of average variances extracted (AVE's) shown on diagonal.							
* P value <0.001.							

### 7.2.3.5 Full collinearity VIFs and Q-squared Coefficients Assessment

Warp PLS produces full collinearity Variance Inflation Factors (VIFs) for all latent variables (see Table 7.15). It is used to measure discriminant validity and overall collinearity. VIFs are evaluated based on a full collinearity test which helps the identification of not only vertical but, also, lateral collinearity. It enables the testing of collinearity involving all latent variables in a model (Kock, 2013). “Vertical, or classic, collinearity is predictor-predictor latent variable collinearity in individual latent variable blocks. Lateral collinearity is a new term that refers to predictor-criterion latent variable collinearity; a type of collinearity that can lead to particularly misleading results” (Kock and Lynn 2012). A rule of thumb of full collinearity VIFs is 3.3 or lower to suggest no multicollinearity in the model (Kock, 2013). Table 7.15 shows that, for all latent variables, the full collinearity VIFs was lower than 3.3. Hence, the latent variables had no problem of multicollinearity and there was discriminant validity for these variables.

On the other hand, Q-squared coefficient is used to evaluate the predictive validity of the model’s endogenous latent variable. In order to obtain acceptable predictive validity, a Q-squared coefficient should be above zero whilst the Q-squared coefficient of less than 0 means that the model is poor in predictive validity (Hair et al., 2010; Roldan and Sanchez-Franco, 2012). In this study, the Q-squared coefficients for OC, PDI, PCI and OI were 0.588,

0.722, 0.559 and 0.589 respectively. Therefore, the model contributed to support predictive validity.

**Table 7.15: Full Collinearity VIFs and Q-squared Coefficients Assessment**

	HC	OC	SC	CC	PDI	PCI	OI
VIFs	2.264	2.780	2.204	2.537	3.501	2.413	2.517
Q-squared coefficients		0.592			0.716	0.551	0.585

### 7.3 8.3 Data Analysis: Assessing the structural model

A structural model is described as causal relationships between latent variables. The structural model aims to test the hypothesized research model. Firstly, the overall fit of the model fit indices was evaluated by using the following three measures: Average Path Coefficient (APC); Average R-squared (ARS) and Average Variance Inflation Factor (AVIF). Kock (2012) recommended that APC and ARS were significant ( $P < 0.05$ ) whilst the AVIF value ought to be below 5. Table 7.16 reports that these measures were in the range of the fitting model and, therefore, there was a good fit model.

**Table 7.16: Model Fit Indices**

Fit measure	Actual Values	P values	Accepted fit
APC	0.203	$P < 0.001$	$P < 0.05$
ARS	0.610	$P < 0.001$	$P < 0.05$
AVIF	2.346		Good if AVIF < 5
General model elements: Algorithm used in the analysis: Warp3 PLS regression Resampling method used in the analysis: Bootstrapping Number of data resamples used: 999 Number of cases (rows) in model data: 198 Number of latent variables in model: 7 Number of indicators used in model: 24 Number of iterations to obtain estimates: 6 Range restriction variable type: None Range restriction variable: None Range restriction variable min value: 0.000			

Range restriction variable max value: 0.000  
 Only ranked data used in analysis? No

In this study, the researcher used the Bootstrapping re-sampling method. It was likely to produce more stable resample path coefficients which were more reliable P values. Kock, (2012) stated that it was preferable not to use this method when the sample sizes were small (lower than 100).

Secondly, Table 7.17 summarizes the path coefficients and the significant levels. The researcher used effect sizes ( $f^2$ ) to assess the extent to which the predictor latent variable affected the dependent variable. He employed the following formula to calculate the effect size for each path coefficient.

**Table 7.17: The Path Coefficients**

H	Exogenous variables	Mediator variable	Endogenous variables	Path coefficients	P-value	Results	Type of the mediating effects
Direct effects							
H1	SC		OC	0.284	0.001	supported	
H2	HC		OC	0.411	0.001	supported	
H3	CC		OC	0.197	0.015	supported	
H4	OC		PDI	0.122	0.037	supported	
	OC		PCI	0.300	0.002		
	OC		OI	0.270	0.001		
H5	SC		PDI	0.107	0.038	Partially supported	
	SC		PCI	0.067	<b><u>0.198</u></b>		
	SC		OI	0.239	0.002		
H6	HC		PDI	0.189	0.007	Partially supported	
	HC		PCI	0.115	<b><u>0.089</u></b>		
	HC		OI	0.229	0.002		
H7	CC		PDI	0.174	0.007	supported	
	CC		PCI	0.210	0.046		
	CC		OI	0.158	0.011		
H8	OI		PCI	0.114	0.035	supported	
H9	OI		PDI	0.084	0.049	supported	
H10	PCI		PDI	0.219	0.001	supported	
Indirect effects							
H11	SC	OC	PDI	0.083	0.023	Supported	Partial mediator
	SC	OC	PCI	0.126	0.004		Full mediator
	SC	OC	OI	0.076	0.019		Partial mediator

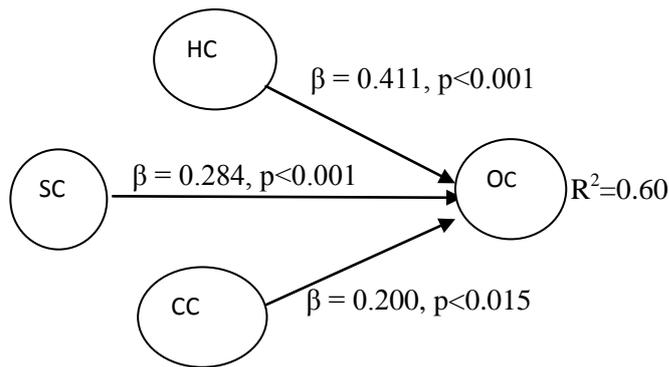
H12	HC	OC	PDI	0.111	0.008	supported	Partial mediator
	HC	OC	PCI	0.162	0.001		Full mediator
	HC	OC	OI	0.110	0.002		Partial mediator
H13	CC	OC	PDI	0.105	0.009	supported	Partial mediator
	CC	OC	PCI	0.086	0.006		Partial mediator
	CC	OC	OI	0.053	0.050		Partial mediator

The values of effect sizes may be 0.02, 0.15, and 0.35; this indicates that, respectively, the effect of a predictor latent variable on an endogenous variable is small, medium, or large (Cohen, 1988). The results were divided into the following four groups.

$$f^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

### 8.3.1 The Interactions between the Components of Intellectual Capital

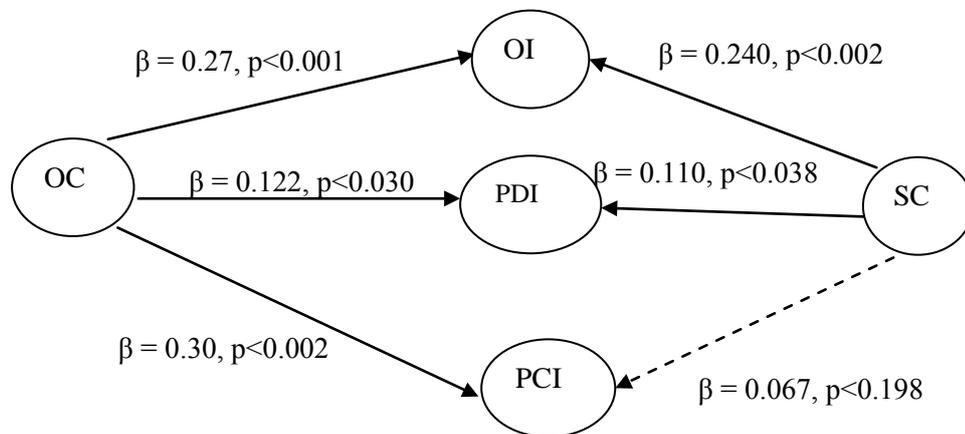
The largest effect size was associated with the positive effect of HC on OC ( $f^2 = 0.283$ ) with the path coefficient ( $\beta = 0.411, p < 0.001$ ) whereas there were significant medium effects from SC on OC ( $f^2 = 0.182; \beta = 0.284, p < 0.001$ ) and CC on OC ( $f^2 = 0.130; \beta = 0.200, p < 0.015$ ). All these actors explained 60% ( $R^2 = 0.60$ ) of the variety in OC whereas 40% were related to other variables (see Figure 7.2). Therefore, hypotheses H1, H2 and H3 were accepted.



**Figure 7.2:** the results of the interactions among the components of IC

### 7.3.2 The Direct Effects between Intellectual Capital and Innovation

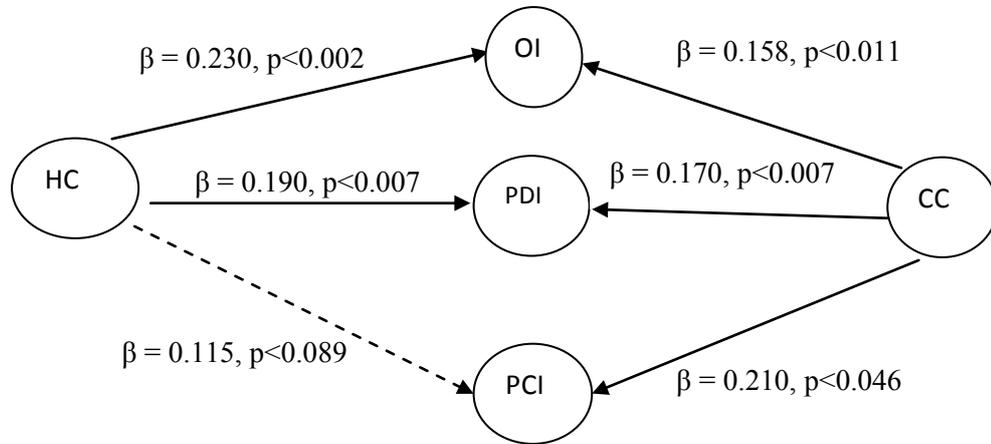
Notably, OC had a significant effect on product, process and organisational innovation ( $\beta = 0.122, p < 0.030$ ;  $\beta = 0.30, p < 0.002$ ;  $\beta = 0.27, p < 0.001$ , respectively), and its effect sizes were ( $f^2 = 0.090$ ;  $f^2 = 0.201$ ;  $f^2 = 0.183$ ). SC had a strong positive relationship with organisational innovation ( $f^2 = 0.160$ ) and its path coefficient was significant ( $\beta = 0.240, p < 0.002$ ). Although there was a significant path from SC to product innovation ( $\beta = 0.110, p < 0.038$ ), the relationship was weak ( $f^2 = 0.070$ ) and there was no significant path of SC and process innovation ( $\beta = 0.067, p < 0.198$ ) (see Figure 7.3).



**Figure 7.3:** results of the interactions between OC, SC and innovations

Furthermore, HC had a larger effect size on product innovation and organizational innovation ( $f^2 = 0.131$ ;  $f^2 = 0.150$ ). Both were significant ( $\beta = 0.190, p < 0.007$ ;  $\beta = 0.230, p < 0.002$ ) although there was a weak effect for HC and process innovation ( $f^2 = 0.070$ ); this was insignificant ( $\beta = 0.115, p < 0.089$ ). CC had a positive effect on product, process and organizational innovation ( $\beta = 0.170, p < 0.007$ ;  $\beta = 0.210, p < 0.046$ ;  $\beta = 0.158, p < 0.011$ , respectively) (see Figure 8.4), and their effect sizes were medium ( $f^2 = 0.128$ ;  $f^2 = 0.13$ ;  $f^2 =$

0.101). Therefore, these results supported hypothesis H4 whilst hypotheses H5 and H6 were accepted partially.



**Figure 7.4:** Results of the interactions between HC, CC and innovations

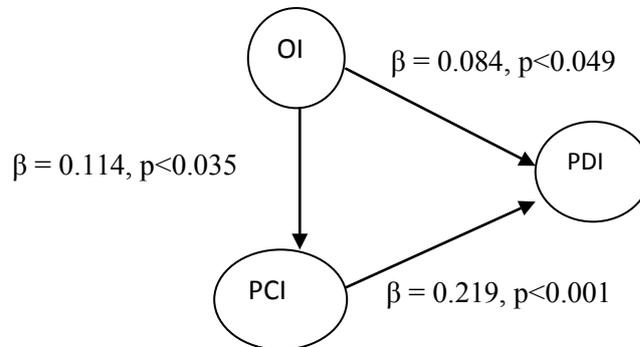
### 7.3.3 The Interactions among the Different Types of Innovation

Moreover, there were significant interactions between the types of innovations because organizational innovation had a positive effect on both process and product innovation ( $\beta = 0.114, p < 0.035$ ;  $\beta = 0.084, p < 0.049$ ) and there was a significant relationship between process innovation and product innovation ( $\beta = 0.219, p < 0.001$ ) (see figure 7.5). Based on the above results, hypotheses H7, H8, H9 and H10 were accepted.

### 7.3.4 The Indirect Effects between Intellectual Capital and Innovation via Organisational Capital

OC mediated partially the relationship between CC and product, process and organisational innovation ( $\beta = 0.105, p < 0.0009$ ;  $\beta = 0.086, p < 0.006$ ,  $\beta = 0.053, p < 0.050$ , respectively). Additionally, OC mediated partially the relationship between SC and both product and

organisational innovation ( $\beta = 0.083, p<0.023$ ;  $\beta = 0.076, p<0.019$ , respectively) and mediated fully the relationship with process innovation ( $\beta = 0.126, p<0.004$ ).



**Figure 7.5:** Results of the interactions among the types of innovations

Similarly, through OC, SC had an indirect effect on product, process and organisational innovation ( $\beta = 0.083, p<0.023$ ;  $\beta = 0.126, p<0.004$ ,  $\beta = 0.076, p<0.019$ , respectively). The results showed that OC mediates the relationship between HC and process innovation ( $\beta = 0.162, p<0.001$ ) and that, with HC through OC, there was a partial positive association between product and organisational innovation ( $\beta = 0.111, p<0.008$ ;  $\beta = 0.110, p<0.002$ , respectively). Consequently, hypotheses H11, H12 and H13 were supported. Finally, this model explained 71%, 59% and 55% respectively of the varieties in product, organisational and process innovation.

### 8.3.5 Test the Research Model in Private and Public Banks.

In this section, the researcher presents some results which were obtained from further analyses. This part shows, in terms of the research model (see Table 7.18) the differences between the public and private banks.

**Table 7.18: The Comparison between Public and Private Banks in terms of Path Coefficients**

Hypothesis	Public Subsample (n=121)		Private Subsample (n=77)		T-test	P -value
	PC & (P-Value)	SE	PC & (P-Value)	SE		
<b>Direct effects</b>						
HC → CC	0.652(0.001)	0.058	0.55(0.001)	0.113	0.80305	0.42
HC → OC	0.377(.001)	0.110	0.57(0.001)	0.127	-1.14871	0.25
CC → OC	0.455(0.001)	0.101	0.29(0.010)	0.129	1.007109	0.31
OC → PDI	0.208(0.017)	0.098	0.27(0.010)	0.116	-0.40828	0.68
OC → PCI	0.316(0.004)	0.116	0.38(0.006)	0.145	-0.34466	0.73
HC → PDI	0.125(0.09)	0.096	0.15(0.14)	0.137	-0.14944	0.88
HC → PCI	0.041(0.321)	0.088	0.29(0.01)	0.130	-1.58615	0.11
CC → PDI	0.254(0.002)	0.089	0.28(0.006)	0.107	-0.18681	0.85
CC → PCI	0.453(0.001)	0.135	0.22(.008)	0.154	1.138	0.25
PCI → PDI	<i>0.357(0.001)</i>	<i>0.086</i>	0.23(.03)	0.121	0.856	0.39
<b>Indirect effects</b>						
HC → OC → PDI	0.26(0.001)	0.079	0.38(0.001)	0.100	-0.942	0.34
HC → OC → PCI	0.41(0.001)	0.094	0.33(0.001)	0.088	0.621	0.53
CC → OC → PDI	0.25(0.001)	0.067	0.13(0.04)	0.073	1.211	0.22
CC → OC → PCI	0.15(0.020)	0.069	0.11(0.04)	0.062	0.431	0.66
<i>PC points out path coefficient and SE is standard division</i>						

As shown in Table 7.18 , most findings confirmed that all path coefficients of the public and private banks were significant and the results showed, also, that, in the path coefficients ( $P > 0.05$ ), there were no significant differences between the public and private banks. The effect size of OC on product and process innovation in the private banks ( $f^2 = 0.20$ ;  $f^2 = 0.28$ ) was substantially greater than in the public banks ( $f^2 = 0.15$ ;  $f^2 = 0.21$ ). In contrast with the previous studies, the positive effect size of CC on product and process innovation through OC in public banks ( $f^2 = 0.19$ ;  $f^2 = 0.10$ ) was greater than the same relationship in private banks ( $f^2 = 0.09$ ;  $f^2 = 0.07$ ).

#### 7.4 Summary

This chapter aims to statistically test the research hypotheses which answer the research questions. Before examining these hypotheses, the researcher analyses non-response bias and

common method bias. This study has confirmed that a sample size is suitable for performing EFA, CFA and the structural model. The results also suggest that non-response may not be a problem and there are no common variables or common method bias. Similarly, the research handled some issues related to missing data, outliers and normality to evaluate the quality of the data. Finally, this study used PLS to test the research hypotheses. PLS produces a measurement model and paths analysis. The results of the measurement model show that this measure has an internal consistency as reliability and convergent validity are accepted. Furthermore, the condition of discriminant validity is satisfied for all constructs. The research findings have confirmed all hypotheses are accepted except for the direct relationships between SC, HC and process innovation.

## **Chapter8: Discussion**

## **8.1 Introduction**

This chapter highlights the main empirical findings which are contained in the previous chapter and in detail presents the results of analysis conducted to test the research hypotheses. These discussions relate to findings based on previous studies and the context of the study. This chapter begins by revising the research questions, followed by a discussion of the results of testing the proposed hypothesised relationships by means of a SEM analysis.

## **8.2 Research Questions Revisited**

The research questions in this study are divided into four groups (Q1, Q2, Q3 and Q4 - see Section 1.6). The first group of research questions aims to empirically test the interactions between the actors of IC in order to identify the extent to which these actors worked together as part of a team. The second group aims to empirically study the direct effects of OC (focal actor), SC, HC and CC on product, process and organisational innovation in the service sector. The third group aims to investigate the relationships between the types of innovations which show that firms developed their administrative and process tools not for themselves but to support final product or service innovation. The fourth group aims to test, through an analysis of simultaneous relationships in a structural equation model, the OC's mediating role in affecting the relationship between HC, SC and CC, as well as the different types of innovations. Therefore, the first stage of ANT (problematization) was used to justify the research model as it highlights the interactions between the actors which play a key role in supporting innovations. Moreover, the focal actor (OC)'s mediating role in reinforcing the relationships between the other actors and innovations.

This study employs an exploratory quantitative method to answer the research questions sufficiently. This method helps to measure the magnitude of all available relationships to IC and innovations. As previously stated, after addressing the research questions, the study will discuss the research results in order to understand IC's direct and indirect role in supporting innovations.

### **8.3 The Interactions between the Actors of IC**

Using PLS, the findings of the structural equation modelling analysis show that three hypotheses (H1: SC → OC; H2: HC → OC; H3: CC → OC) are empirically supported. This means that the actors of IC play an important role in supporting a formal organisation or OC in the service sector. All these actors have explained that 60% ( $R^2=0.60$ ) of the variety in OC whereas 40% were related to other variables.

#### **8.3.1 H1: Social Capital has a Direct Positive Effect on Organisational Capital.**

There is a significant statistical relationship between SC and OC. SC affects OC (standardised regression coefficient is 0.284 at  $p<0.001$ ) positively with medium effect size ( $f^2 = 0.182$ ). Based on Yang and Lin's (2009) study, this study developed an instrument to measure OC in the banking context. The measure included four items related to knowledge management, top management support, organisational culture and an effective management process.

It seems that positive informal relationships encourage employees to exchange and store their knowledge in a formal organisation. SC is a facilitator of knowledge sharing amongst employees in supporting OC. An organisation, which works in an environment of higher SC, may sustain IC. SC is a catalyst for IC (Nahapiet and Ghoshal, 1998) and is more beneficial

in developing OC (Wu et al., 2008). SC is an important resource which provides access to information and influence in an organisation and as well as a key actor in enabling employees to be involved in knowledge sharing. SC fixes unconnected resources between units through which knowledge flows (Reiche, 2012). Network ties are related to effective knowledge transfer (Hansen, 2002). In addition, information channels, provided by social relationships, help organisations to reduce time and effort required to acquire knowledge. The mutual trust and strong connections between employees facilitate knowledge acquisition. The high level of trust encourages employees to engage in cooperative interactions which create a suitable atmosphere for increased knowledge sharing (Chang and Chuang, 2011). Employees, who have good relationships with their colleagues, recognize the greater social demands to share their knowledge (Chow and Chan, 2008). Social factors are the most important factors in order to obtain a successful implementation of KM. Therefore, through supporting the SC dimensions, managers can perform essential developments in KM practices (Monavvarian, Asgari, Akhavan and Ashena, 2013). In summary, SC contributes to knowledge management because the interpersonal interactions encourage knowledge integration, knowledge creation, knowledge sharing within a firm, as well as knowledge transfer between firms (Hsu and Sabherwal, 2012).

Through facilitating the sharing of knowledge, SC supports the development of a cohesive team which consists of individuals with diverse backgrounds (Tansley and Newell, 2006). SC has an importance role in leadership development because the trust can lead to a reduced need for monitoring of partners (McCallum and O'Connell, 2008). On the other hand, Fu (2004) reports that SC plays an essential role in reducing management transaction costs which supports the effectiveness of the management process and facilities, as well as

coordination to reach desired goals (Leana and Buren, 1999). Social ties, which exist within the organisation, provide employees with the abilities to respond easily to management control systems (Chenhall, Hall and Smith, 2010). These SC advantages can be achieved if a firm keeps a reasonable level of trust amongst its employees.

### **8.3.2 H2: Human Capital has a Direct Positive Effect on Organisational Capital.**

It is clear that the greatest positive effect of size is associated with HC's effect on OC ( $f^2 = 0.283$ ). There is a statistically significant relationship between SC and OC ( $\beta = 0.411$ ,  $p < 0.001$ ). A bank has the ability to transform individuals' knowledge into organisational knowledge. Managers ought to persuade their employees to codify their knowledge in order to make it available to their colleagues (Kim et al., 2012). Moreover, employees' competence is considered a valuable element which offers returns for business processes; organisational culture; and overall OC (Chen et al., 2009). Such skills give more flexibility to adapt to an increasingly competitive and uncertain environment. The OC's efficiency relies on the extent to which a firm possesses highly competent employees (Kim et al., 2012).

The integration between IC and knowledge management serves a key role in maintaining the enterprise's well-being and long-term viability (Wiig, 1997). If firms try to oblige the workforce to accept a model of knowledge creation, firms will fail. Therefore, it is important to recognise people's attitudes in designing the knowledge management system which accommodates the requirements of employees either individually or as groups (Marr, Gupta, Pike and Roos, 2003). HC facilitates knowledge management because employees can develop suitable and required knowledge management processes. Additionally, insight can be employed to develop knowledge management (Hsu and Sabherwal, 2012). Furthermore, HC is organised as a "knowledge community" which has a common goal (Huang, 1998) with the

ability to manage organisational routines and processes efficiently and effectively (Hsu, 2006). Education is the foundation which supports more effectively dealing with a firm's internal processes (Watsona, Stewart and BarNira, 2003).

### **8.3.3 H3: Customer Capital has a Direct Positive Effect on Organisational Capital.**

There is a statistically significant relationship between CC and OC. With a medium effect size ( $f^2 = 0.130$ ), CC affected OC positively ( $\beta = 0.200$ ,  $p < 0.015$ ). CC plays an important role in supporting OC because it is an important source of customer knowledge which improves the efficiency of business processes which reflects positively on service quality. Customers ought to be proactive in providing suggestions (and in some cases, complaints) as this might improve bank processes and routines. This is consistent with Shih et al (2010) who observes that customers' loyalty and satisfaction has a positive effect on OC.

It is important for firms recognise the importance of customer engagement in knowledge management and in the twenty-first century, they can no longer afford to ignore this role. Customers are considered a main source of free knowledge acquisition through their feedback or complaints, whilst simultaneously, customers feel valued because they can see their ideas being implemented (Chua and Banerjee, 2013). Customer relationship management offers an initial starting point for the process-oriented application of knowledge management (Gebert, Geib, Kolbe and Brenner, 2003). A market orientation which relates to the collection of information about customers and competitors has shown strong inter-functional coordination, which is an essential element of the knowledge dissemination component (Darroch and McNaughton, 2003).

## **8.4 The Direct and Indirect Relationships between Intellectual Capital and Innovation**

### **8.4.1 H4: Organisational Capital has a Direct Positive Effect on the Three Types of**

## Innovations

The research results have revealed that, since the effect size is large ( $f^2 = 0.090$ ;  $f^2 = 0.201$ ;  $f^2 = 0.183$ ). OC has a positive effect on product, process and organisational innovations (H4a: OC  $\rightarrow$  PDI; H4b: OC  $\rightarrow$  PCI; H4c: OC  $\rightarrow$  OI). Furthermore, it is clear that these relationships are significant ( $\beta = 0.122$ ,  $p < 0.030$ ;  $\beta = 0.30$ ,  $p < 0.002$ ;  $\beta = 0.27$ ,  $p < 0.001$ , respectively). Therefore, hypothesis H4 is supported empirically. This means that it is imperative for banks to develop OC to reinforce not only product innovation, as mentioned by Tesluk et al. (1997) and Chen et al. (2006), but also organisational and process innovation. Firms ought to address OC appropriately. This contains codified knowledge and experience to be transferred into practices for new products, processes and managerial concepts or innovation success. Innovations require OC to provide products more effectively and efficiently (Carmona-Lavado et al., 2010). By developing effective processes, organisational culture, knowledge management and top management support, banks can create a high level of innovation (Wu et al., 2008).

Knowledge becomes more active when firms apply it to create values (Huang and Li, 2009). If new knowledge cannot adjust or develop a new organisational behaviour, it may not produce any added value for the organisation (Sheng and Chang, Teo and Lin, 2013). The innovative efforts are the result of investment in knowledge management (Carneiro, 2000). Knowledge management makes a unique contribution to innovation through facilitating not only internal collaboration amongst different departments within an organisation but, also, external collaboration cross organisational boundaries. This knowledge, which is relevant to an organisation's innovation process, becomes available and accessible.

Acquiring knowledge, gained from collaboration is considered an efficient and effective technique for successful innovation (Plessis, 2007). Knowledge transfer assumes that, through using a diversity of transfer mechanisms, knowledge should reach each member of the organisation. Knowledge transfer facilitates the firm's ability to achieve a higher level of innovation through problem definition, alternative generation and evaluation, as well as the ultimate choice of transferred knowledge (Sheng and Chang, Teo and Lin, 2013). Through the transformation of tacit knowledge into codified or explicit knowledge (Ju, Li and Lee, 2006), managers should do their best to assist knowledge integration (absorption, sharing and application of knowledge) which reflects positively on product and process innovation. Knowledge management is seen as a facilitator of successful innovation. Access and contact to a range of knowledge may assist employees to develop recognition of opportunities, create new methods to solve problems and inspire additional innovation activities. Knowledge sharing increases the opportunity for new combinations of current and innovative knowledge which could result in either improving or creating new processes or products (Huang and Li, 2009).

Top management's diversity enhances innovation because they reflect different educational, functional, and organisational backgrounds which facilitate the strategic decisions that place an emphasis on innovative activities. Furthermore, the differences in information and knowledge can improve their creative thinking. This provides greater variance in decision-making alternatives which improves problem-solving capabilities to better understand market developments which are translated into product or process innovation (Talkea, Salomob and Rost, 2010). More top management diversity fosters exploratory innovations whereas less diversity supports exploitative innovations. In addition, it helps facilitate the establishment of

new channels for organisational learning which creates new knowledge that is a main source of innovation (Heyden, Sidhu, Bosch, and Volberda, 2012).

In the process of innovation, top management members are key actors or champions because they are responsible for developing and implementing innovation. Top manager expertise is an important source of product and administrative innovations. Having relevant external expertise (marketing) may be likely to reinforce product innovation, whereas others who have personal expertise, may have more impact on organisational innovation (Hoffman and Hegarty, 1993). The influence top management on organisational innovations is rather different from their influence on product/market innovations. Often, through formulating and communicating a convincing image, top managers resolve uncertain positions in organisational innovation (Elenkov and Manev, 2005).

Regarding organisational culture, previous studies have confirmed the importance of an organisation's culture for innovation (Higgins and McAllaster, 2002; Lau and Ngo, 2004; Chang and Lee, 2007). Organisational culture increases an organisation's ability's to respond to change (Jaskyte and Dressler, 2005). Developmental culture which is concerned with creativity, entrepreneurship and risk taking is a key source for product and process innovations. On the other hand, hierarchy culture supports imitative orientation since it focuses on formal structures, policies and procedures (Naranjo-Valencia, Jiménez-Jiménez and Sanz-Valle, 2011). There are some values and norms which are recognised as characteristic of innovative organisations. Examples of these include freedom to in act change, teamwork, sharing common goals, open sharing of information, flexibility and adaptability, autonomy, risk taking, results-orientation, creativity, stimulation, challenge, future orientation, cohesiveness, a sense of family, commitment, acceptance of mistakes, dynamism and entrepreneurship (Jaskyte and Dressler, 2005). By focusing on the

development of culture between values and product innovation, a more shared view of innovation can be produced amongst organisational members (Lau and Ngo, 2004). Flexibility values promote stable routines which facilitate the operators' roles of resolving problems during process innovation (Khazanchi, Lewis and Boyer, 2006). Therefore it can be seen that organisational values have a positive effect on process innovation (Škerlavaj, Song and Leec, 2010).

#### **8.4.2 The Relationship between Social Capital and Innovation**

This relationship has the following two main hypotheses.

##### **8.4.2.1 H5: Social Capital has a Direct Positive Effect on the Three Types of Innovations**

SC has a strong positive relationship with organisational innovation ( $f^2 = 0.160$ ) and its path coefficient is significant ( $\beta = 0.240$ ,  $p < 0.002$ ). Although there is a significant path from SC to product innovation ( $\beta = 0.110$ ,  $p < 0.038$ ), the relationship was weak ( $f^2 = 0.070$ ). Additionally there is an insignificant path between SC and process innovation ( $\beta = 0.067$ ,  $p < 0.198$ ). Therefore, hypothesis H5 is partially supported.

##### **8.4.2.2 H11: Organisational Capital mediates the Relationship between Social Capital and the Three Types of Innovations**

OC partially mediated the relationship between SC and both product and organisational innovation ( $\beta = 0.083$ ,  $p < 0.023$ ;  $\beta = 0.076$ ,  $p < 0.019$ , respectively). However, it fully mediated the relationship with process innovation ( $\beta = 0.126$ ,  $p < 0.004$ ). Hence, hypothesis H11 is accepted.

Based on the above results, it can be concluded that SC plays both a direct and indirect role in supporting organisational and product innovation, whilst through OC it can only indirectly impact process innovation. This finding has not reduced the importance of SC in process innovation, but only changes the nature of this influence. In this sense, due to its positive effect on OC, it can be said that SC indirectly contributes to the improvement of process innovation. Collaborative effort amongst employees improves innovations and SC especially supports product and organizational innovation when employees share goals, responsibilities and ambiguous and complex knowledge. Additionally, OC creates a context which contributes to enhanced cooperation; knowledge sharing; and exchanging tacit experience and team practice in the bank. These areas reflect the three types of innovations positively. Therefore, the results indicate that in these circumstances SC reinforces process innovation. Banks which operate in highly coordinated and interactive environments and encourage information sharing, facilitate a climate of innovation (Wu et al., 2008).

Knowledge networks are a new form of collaboration network. The social network has many challenges related to how firms transform information into knowledge which is converted into new or developed products or processes. SC's contribution to innovation is accomplished by reducing information, decision, and implementation costs. This has further been extended to persuading reliable information to be volunteered; making agreements to be honoured; and facilitating employees to share tacit knowledge (Landry, Amara and Lamari, 2002). The network members, who have close interactions (strong ties) and better accessibility and excitement to cooperate with others, produced valuable knowledge for innovation (Carmona-Lavado, Cuevas-Rodríguez and Cabello-Medina, 2010). Team members promote creativity and innovation by informally exchanging varied viewpoints along with their supportive environmental work (De Dreu and West, 2001). The SC's cogitative dimension encourages

teams to have common responsibilities and goals which sustain progress in their innovative activities (Gu, Wang and Wang, 2013).

A social structure of interaction facilitates information exchange and creates outlets for resources which can support the firm's ability to reduce uncertainty and risk, in order to avoid poor decision making. This cooperation is important for building the firm's innovative activity. Social relationships boost productive resource exchange and thus encourage product innovations. A high degree of social interaction between the team members will generate and then implement new ideas (Gu, Wang and Wang, 2013, Petrou and Daskalopoulou, 2013).

Trust-based-relationships hasten knowledge flow between partners whereby they are more likely to pool their resources and share their knowledge with partners. Trust generates security in terms of confidence that partners would not exploit the opportunity to steal their colleagues' knowledge. Spreading trust amongst employees represents an informal safeguard in reinforcing the innovation process (Pérez-Luño, Medina, Lavado and Rodríguez, 2011). A high level of trust encourages a depth of challenge experienced in the development of new products (Tidd, 1995). This increases their willingness to cooperate within the firm to convince other partners not only of innovation, but also of radical innovation (Adler and Kwon, 2002).

#### **8.4.2.3 H6: Human Capital has a Direct Positive Effect on the Three Types of Innovations**

HC has a greater size effect on product innovation and organisational innovation ( $f^2 = 0.131$ ;  $f^2 = 0.150$ ). Both are insignificant ( $\beta = 0.190$ ,  $p < 0.007$ ;  $\beta = 0.230$ ,  $p < 0.002$ ). There is a weak effect for HC and process innovation ( $f^2 = 0.070$ ) and it is insignificant ( $\beta = 0.115$ ,  $p < 0.089$ ). Hence, hypothesis H6 is partially supported.

#### **8.4.2.4 H12: Organisational Capital mediates the Relationship between Human Capital and the Three Types of Innovations**

The results show that OC fully mediates the relationship between HC and process innovation ( $\beta = 0.162$ ,  $p < 0.001$ ) and that, through OC, there is a partial positive association between product and organisational innovation and HC ( $\beta = 0.111$ ,  $p < 0.008$ ;  $\beta = 0.110$ ,  $p < 0.002$ , respectively). Therefore, hypothesis H11 is accepted.

Dependent on the above results, HC has direct and indirect positive effects on both product and organisational innovation. It seems that HC has no direct influence on process innovation. This result has not reduced HC's value for process innovation. This can be explained due to the fact that banks have suffered from shortage in technical skills. Meanwhile, knowledge obtained from education, focuses mainly on managerial skills and service skills rather than those of process. Therefore, when OC is used as a mediator, this relationship becomes significant since it provides the technical skills required to produce the service. Moreover, in services, process innovations relates primarily to supporting activities (e.g. purchasing, invoicing, accounts) and not to essential functions. This might explain why HC does not have a significant effect on process innovation.

In this sense, through its positive effect on OC, HC contributes indirectly to the improvement of process innovation. This clearly suggests that banks ought to create an appropriate organisational infrastructure to enhance their employees' capabilities and to encourage creativity and innovation. HC was the main source of new ideas which evolved into innovation. Employees' individual skill-sets, training and education are a driving force for boosting innovation and these characteristics become innovative tools if they are extended to the organisational level.

Innovation is a function of new knowledge. Employees can gain new information and knowledge through education which increases an employee's stock of skills. Employees need these skills to be aware and successfully hunt an entrepreneurial opportunity for radical innovation. Therefore a high educational level of employees' HC makes a firm more innovative (Marvel and Lumpkin, 2007; Winne and Sels, 2010). This finding is consistent with Bontis (1998) who suggests that the quality of the employee's HC is a key source of innovation. From the opposite perspective, Freel (2000) confirms that a lack of qualified employees is considered one of the most important barriers to innovation.

The integration of the different types of skills including marketing, investment, finance, research, and design and development are a strong skill-base for supporting innovations (Leiponen, 2005). Skills are critical inputs not only for what goods and services (product innovation) a firm produces but, also for how they are produced (process innovation) (Toner, 2011). Skilled employees can facilitate the acquisition of client-specific knowledge. They can support the transfer of knowledge within the firm or between firms. Additionally, they can facilitate the acquisition of client-specific knowledge. Hence, these skills can follow different methods to achieve innovative outcomes (Jones and Grimshaw, 2012).

It has been proven that when firm introduces a good training programme to its employees, they are more skilful in being able to complete the job. Training improves the employees' competencies and knowledge in introducing and delivering the new services (Atuahene-Gima and Li, 2006). Training programmes improve practical or creative thinking which is an important loop in innovation processes (Akgu, Lynn, and Byrne, 2006).

#### **8.4.2.5 H7: Customer Capital has a Direct Positive Effect on the Three Types of Innovations**

With medium effect sizes ( $f^2 = 0.128$ ;  $f^2 = 0.13$ ;  $f^2 = 0.101$ , respectively), CC has a positive effect on product, process and organizational innovation ( $\beta = 0.170$ ,  $p < 0.007$ ;  $\beta = 0.210$ ,  $p < 0.046$ ;  $\beta = 0.158$ ,  $p < 0.011$ ). Hence, hypothesis H7 is supported.

#### **8.4.2.6 H13: Organisational Capital mediates the Relationship between Customer Capital and the Three Types of Innovations**

Additionally, OC partially mediates the relationship between CC and product, process and organisational innovation ( $\beta = 0.105$ ,  $p < 0.0009$ ;  $\beta = 0.086$ ,  $p < 0.006$ ,  $\beta = 0.053$ ,  $p < 0.050$ , respectively). Consequently, H13 is accepted.

Based on the previous results, this study has explored the CC's direct positive effects on product, process and organizational innovations. A firm can obtain important information from customers to support new product development. This information helps organisations to understand their customers' needs and to recognise opportunities to introduce new products or services (Chen et al., 2006). Banks ought to accept that customers' knowledge plays an important role in supporting organizational and process innovation. Increasingly, many service businesses are self-service. For example, by using ATMs, banks modified their tellers handling transactions into ones of self-service technologies. Customers can contribute to the production of the service (Sampson and Spring, 2012). This connection between customers and the processes of service provides knowledge which reinforces the process of innovation. Often, customers have a vital role in the earliest stages of the process of innovation due to two facts. Firstly, they are considered the main beneficiaries of the innovation as well as the fact that they inspired through their feedback a main source of innovative ideas for

motivating new products. Consequently, the collaboration between a firm and its customers allows access to this knowledge (Lau, Tang, and Yam, 2010; Foss, Laursen and Pedersen, 2011). As the research results have shown, these relationships between customers and firms has a positive effect on product innovation. Successful product innovation requires profound knowledge about the needs of the firm's customers which defines product characteristics. Firms work hard to access perspectives because they believe that customer-needs assessment activities will produce useful information for the early stages of product innovation. Additionally, these are considered a main guideline for other phases of product innovation. When the innovation management process incorporates customer needs, this guarantees a good fusion between customers' needs and technology (Karkkainen, Piippo and Tuominen, 2001).

Rohrbeck et al. (2010) state that, as initiators share their actual needs or complaints during the design of the innovation, customers might provide active input into an innovation project. Customers' knowledge could reduce resistance to innovation in the market. Firms ought to listen closely to the customers' voices; this acts as an essential condition of successful innovation. Through placing more emphasis on customers' suggestions or complains in order to gain the value of their knowledge (Fuchs and Schreier, 2010), firms encourage customers to change their role from passive consumers to active partners in developing or creating new products or service. This study has additionally found OC's mediating effects on the relationship between CC and innovations. OC has the ability to absorb and codify information regarding customers and, therefore, benefit different types of innovations.

Customer orientation, which focuses on the culture of innovation, provides a greater capacity for adoption and innovation. Customer orientation is essential in creating an optimal

environment for innovation (Baker and Sinkula, 1999). This finding is consistent with Lukas and Ferrell (2000); Lado and Maydeu-Olivares (2001) and Ngo and O’Cass (2012) who have confirmed that customer orientation has a significant effect on innovation. Therefore, customer orientation is a key source in discovering new opportunities for targeting customers to facilitate innovations (Nasution, Mavondo, Matanda and Ndubisi, 2011).

#### **8.4.3 The Interrelationship between the Three Types of Innovations**

H8: There is a positive effect between organisational innovation and process innovation.

H9: There is a positive effect between process innovation and product innovation.

H10: There is a positive effect between organisational innovation and product innovation.

The study has shown that there are significant interactions between different types of innovations. Organisational innovation has a positive effect on both process and product innovation ( $\beta = 0.114$ ,  $p < 0.035$ ;  $\beta = 0.084$ ,  $p < 0.049$ ) and there is a significant relationship between process innovation and product innovation ( $\beta = 0.219$ ,  $p < 0.001$ ). Based on the above results, hypotheses H8, H9 and H10 are accepted. In other words, the correlation analysis posits a strong and positive relationship between all variables. Hence, it can be suggested that higher organisational innovation is associated with increased process innovation which, in turn, is correlated with greater product innovation. In addition, correlation analysis indicates a strong association between the organisational innovation and the product innovation.

In fact, the analysis is consistent with the studies of Zahra and Covin, (1994) and Gunday et al. (2011) who confirm a positive relationship between organisational and process innovations (Zahra and Covin, 1994; Gunday et al., 2011). Damanpour et al. (1989) explains that organisational innovation acts as “a means of preparing an internal environment

conducive to technical innovations”. In this respect, Sisaye and Birnberg (2012) explain that an organisational change involves, at all levels of the organisation the employees’ full participation, acceptance and commitment towards the process changes. Secondly, the findings support the interaction between the process and product innovations (Li et al. 2007). The findings indicate that process innovation enables the firm to reduce its costs and thus to invest more in product innovation (Rosenkranz, 2003). In addition, it has been stated that process innovation contributes to better coordination between the manufacturing and the marketing and sales departments and enabled the firm to develop successful new products (Davenport, 1993). Similarly, Parthasarthy and Hammond (2002) indicate that innovation and improvement of such processes reduce the product development time and consequently increased the frequency of innovation. Thirdly, the study has revealed that organisational innovations do not prepare only the environment for other innovations but, also, directly affect and strengthen the firm’s product innovation (Maidique and Zirger, 1984; Kotabe and Swan, 1995). Wischnevsky et al. (2011) explains that administrative innovation enables a more effective use of the resources which facilitates forthcoming product development.

#### **H14 There are no Significant Differences between Private and Public Banks in Terms of the Relationship between IC and Innovations**

This study has confirmed that H14 is supported. Hence, both types of banks are likely to pay similar attention to managing the relationship between IC and innovations. This means that there is severe competition between the two types of banks in adopting new products and processes in order to retain their current customers or to attract new ones. In private banks, the effect size of OC on product and process innovation is substantially greater than in public banks due to the fact that public banks have a lot of routine which hinders innovation and, compared to the private banks, the work environment may discourage creativity at work

(Kakoli Sen, 2013). The private banks' processes and organisational structures are more flexible enabling rapid changes and OC provided better facilities for adopting new technology or meeting customers' needs. Compared to those in public banks, private banks experience a relatively greater effect sizes of HC on product and process innovation via OC. Although public banks benefit from developed recruitment processes, selection and compensation systems to keep and attract skilled employees, private banks' systems benefit from superior pay. They operate reward systems for long term, skilled and high educated employees. For these reasons, private banks are considered more attractive to talented employees who work in the public banks (Sen, 2013). In the Egyptian private banks subsample, most managers (88%) have advanced study degrees compared to 26 % in the other banks. Unlike, through OC, the positive effect size of CC on public banks' product and process innovation is greater than the same relationship in private banks. The researcher has taken into account that from the perspective of public banks, private banks have recently appeared to be leading the competition in the Egyptian financial market. Therefore, in order to remain in the league public banks have to adopt new banking technology tools, such as online transactions and ATMs, and create a pool of products, such as special savings accounts. Public banks have long relationships with their customers since customers' trust of public banks is considered a major advantage which ought to be employed in developing the promotional activities and products (Kaura, 2013). This means that public banks have a good relationship with their huge client base with an unparalleled treasury of trust. Furthermore, they understand that customer satisfaction is key to being successful in a competitive environment.

## **8.5 Summary**

This chapter has discussed the research results in the light of findings from previous studies in order to examine the extent to which both results are consistent. Most of these findings are in line with those found in previous studies. For example, OC has a positive effect on innovation and it is a facilitator to mediate the relationships between HC, SC and CC and innovations.

## **CHAPTER 9: CONCLUSIONS AND FUTURE RESEARCH**

## **9.1 Introduction**

This chapter discusses the contributions of this research, its limitations and suggests avenues for future research. In order to investigate how a firm builds a network to support innovation, this thesis has developed a model illustrating the direct and indirect relationships between the actors of IC (i.e. SC, HC, CC and OC), and in the service sector based on actor network theory. The three types of innovations are product, process and organisational innovation. The study mainly employed a quantitative method to explore these actors' roles and that of the focal actor in reinforcing innovations.

This chapter will commence by presenting the study conclusions, the theoretical and managerial contributions, and will be followed by a discussion of the limitations and direction for future research.

## **9.2 Conclusions**

The banking industry has witnessed great changes over the last decades and banks have existed in a highly uncertain and competitive environment. Banks have suffered from financial crisis and in the event of depreciation, some developed countries' banks even declared bankruptcy. Many fast growing economies experienced this crisis in some cases leading to collapse of the economy. Therefore banks adopted a variety of innovative tools to accommodate to and to survive in this environment. By searching for the most significant resources in the knowledge based economy, this study found that intangible assets, such as IC, played an important role in reinforcing innovations.

Previous studies have tested the direct relationships between: HC, OC, CC or SC, and incremental, radical product innovation, new product development performance or innovation in the manufacturing sector. Hence, this study mainly aims to investigate the direct and

indirect relationships between the four components of IC and product, process and organisational innovations in the service sector. The research employed in the first phase of actor network theory was problematisation. This stage was concerned with identifying the focal actor, other actors that support the network's aim known innovations.

This study adopted a positivist philosophy. A deduction approach and quantitative method were also suitable for this study. A questionnaire was delivered to Egyptian banks' managers and 198 usable questionnaires were collected (with a response rate of 54%). This study used PLS to test the research hypotheses. The measurement model has confirmed that the measure indicates accepted reliability and validity. Based on the research results, most hypotheses are accepted. This means that the components of IC are appropriate resources in supporting the different types of innovation.

This study has confirmed that HC has the greatest path coefficient, followed by SC, then CC with their effects on OC ( $\beta= 0.411$ ,  $\beta= 0.284$ ,  $\beta= 0.197$ , respectively). These actors account for 60% ( $R^2=0.60$ ) of the variety in OC whereas 40% is related to other variables. Therefore, employees' competence is a valuable component which positively affects business processes, organisational culture and overall OC. The OC's efficiency relies on the extent to which a firm possesses highly competent employees. In order to provide a suitable formal organisational environment, the managers of banks should give more attention to encouraging employees to codify their knowledge. Education provides the knowledge base which supports more effectively dealing with a firm's internal processes. In terms of SC, knowledge sharing among employees in their social relationships supports OC. These relationships encourage employees to exchange and store their knowledge in a formal organisation. The informal channels reduce time and effort required to acquire knowledge. Social ties provide employees with the opportunity to easily respond to management control systems. On the other hand,

customers are considered a main source of external knowledge acquisition without cost through their feedback or complaints. Customer relationship management offer an initial starting point for the process-oriented application of knowledge management. Customer knowledge which improves the efficiency of business processes positively reflects on service quality.

In terms of the relationships between OC and innovations, the managers of banks believe that OC plays an important role in supporting product, process and organisational innovations. Additionally, they consider OC a facilitator for the relationship between other actors and innovations through its mediating role. Therefore, the manager must show salient concern for providing an effective management processes; innovative culture; and effective knowledge management systems. Top management team also regards employees as the source of innovation. For example, top management supports the development of new channels for organisational learning which creates new knowledge which acts a main source for innovation. Furthermore, organisational culture which is concerned with creativity, entrepreneurship and risk taking supports product and process innovation. Knowledge transfer also facilitates the ability of a bank to achieve a higher level of innovation.

The managers of banks believe that HC has both a direct and indirect positive effect on product and organisational innovations while process innovation is indirectly associated with HC through OC. Therefore, they emphasise greater effort to acquire and to retain employees who have acceptable knowledge, competencies and educational level. They should develop talents through job training. Banks ought to create an appropriate organisational infrastructure to enhance their employees' capabilities and to encourage creativity and innovation. This illustrates how a lack of qualified employees is considered one of the most important barriers

to innovation. On the other hand, this study has confirmed that SC directly and indirectly plays a key role in reinforcing product and organisational innovation and that SC has indirect effect on process innovation via OC. The banks' managers should support informal relationships among employees. These relationships foster some important characteristics that support innovations such as: their tendency to keep their promises, clearly understand and pursue their colleagues to adopt the bank's goals/values, and their avoidance of making demands which could seriously damage the interests of others. Additionally, CC has a direct and indirect effect on product, process and organisational innovations through OC. This result suggests that banks present acceptable customer service in the service industry and they do their best to meet the customer's needs. Also managers get much feedback about their customers' needs and they are concerned with market orientation. Hence, customers are satisfied with bank's process organisational and product innovations.

Finally, the research has shown that banks innovate new administrative concepts and process systems in order to reinforce product innovation. This study suggests that higher administrative innovation is associated with increased process innovation which, in turn is correlated with greater product innovation.

### **9.3 Theoretical Contributions**

This is the first study using ANT in the service sector which has investigated the direct and indirect relationships between the actors of IC (HC, CC, SC and OC) and the different types of innovations (product, process and administrative innovation). Hence, it contributes to the body of existing literature as follows.

### **9.3.1 Intellectual Capital Literature**

As shown in Chapter 5, previous studies have tested these relationships to collect knowledge about employees' skills, education, and training (HC), knowledge related to organisational culture, knowledge management, internal processes and top management (OC), as well as knowledge produced from the relationship between firm and customers (CC). In order to enrich this area, the research is considered a natural extension of the previous studies of IC as it contributes to the theory through adding to the components of IC another actor named SC. It has further tested these interactions in a knowledge-based context which was the service sector. More specifically, it provides empirical evidence for the role of informal relationships in supporting OC whereby it is considered a facilitator for exchanging and storing employees' knowledge in a formal organization. Consequently, SC helps organisation to reduce the time and effort required to acquire knowledge. The research results have demonstrated that these positive cooperative interactions (these actors explained 60% of the variety in OC) could create a suitable atmosphere to achieving a common aim for actors' network. Hence, this study provides a comprehensive view about the internal interactions of IC.

### **9.3.2 Innovation Literature**

Investigating the interactions between innovation types made interesting contributions to innovation research literature. With the exception of Gunday, Ulusoy, Kilic and Alpan (2011) which examined these types in the Turkish manufacturing industry, there was no study tested the relationships between administrative, process and product innovation in the service sector. Hence, this study benefits innovation researchers through providing an inclusive understanding of these relationships in the service sector. Additionally, it compares both

results to incorporate the differences between the types of innovations in the manufacturing and service sectors.

### **9.3.3 Intellectual Capital and Innovation Literature**

This study's main contribution is the comprehensive IC-innovation analysis based on empirical data. This research contributes to both IC and innovation literature. Firstly, most previous studies have investigated the direct relationship between three components of IC and innovations, specifically incremental and radical innovation; and new product development performance (see Chapter 5). This suggests that these studies focused only on the IC's direct effect on product innovation in the manufacturing sector. In context, this research tested not only direct effects but, also, indirect effects of HC, CC, SC and OC on product, process and organisational innovations in the service sector. This research has presented a rich and detailed account of the antecedents of the different types of innovations in the service sector. It shows empirically that there are many actors affecting product, process, and organisational innovations. These areas are as follows:

- The identification of the importance of OC as a focal actor, facilitates the role of other actors (HC, SC and CC) in reinforcing product, process, and organizational innovations.
- It includes two actors (HC and SC) which have direct and indirect effects on product and organizational innovations whilst, via OC, they correlate only indirectly with process innovation.
- This study sheds light on the significant importance of the relationship with customers not only on product innovation but, also, on process and organisational innovations.

Therefore, this study has provided a comprehensive illustration of how the role of internal knowledge relates to individuals, groups, formal organisation and external knowledge such as the relationship with customers in supporting innovations.

#### **9.3.4 Actor Network Theory Literature**

This research is the first study to employ the first stage of ANT, which is also called problematisation, to justify the research model in the quantitative study. It determines human (HC, SC, CC) and non-human actors (OC) which are considered a focal actor. OC chose these actors based on their role in supporting a network's aim (innovation) and they performed their jobs as members of a team (effective relationships among actors). This research presents empirical evidence for the first phase in building an IC-innovation network.

#### **9.3.5 Measurements**

By using exploratory and confirmatory factor analysis, this study has developed a measurement model to certify validity and reliability in a developing country. This model includes internal consistency, discriminant and convergent validity, as well as freedom from response bias. It could be valuable for academics when they carry out further research related to IC and innovation in a service sector. This study has shown that this measurement model is applicable to the service sector since it is also used in the manufacturing sector in previous studies.

#### **9.4 Managerial Contributions**

With respect to managerial contributions, this study has provided many benefits for bank managers to view IC as a catalyst for the different types of innovations. This study has resulted in several recommendations. Banks should maintain and promote social connections

amongst their employees to support innovation and to foster the cohesion of informal organisations. Next, they should provide resources for informal groupings to encourage group members to generate new ideas, and to spread trust amongst the group members by strengthening the interactions within the social network to facilitate co-operation and knowledge transfer. These are key requirements for innovation. Furthermore, banks should manage a knowledge repository of valuable acquired knowledge to generate new ideas, to improve business processes and organisational routines and adopt a developmental culture. It is paramount for banks to recruit and retain employees who have good skills, a high education level and the competence to generate and apply new ideas. Particularly, banks should build long-term relationships with customers by focusing on their customers, understanding customers' needs, maintaining customer satisfaction and designing training programmes for customers when the bank wants to introduce a new product. Finally, bank managers should emphasise all types of innovations since these are closely interrelated and dependent on each other and should therefore, be developed in simultaneously. In fact, managers intending to introduce new services or change existing ones should take advantage of the considerable changes in both technological and administrative processes.

### **9.5 Limitations and Future Research**

This study has a number of limitations to be discussed. Firstly, it has only tested the research model in the Egyptian banks and consequently other researchers could validate the model in developed countries. Secondly, this study tested hypotheses with a questionnaire survey that provided only cross-sectional data, yet it did not gather longitudinal data to observe changes in intellectual capital throughout the innovation process. Therefore, future studies can develop a longitudinal study to find IC differences in the innovation process. Thirdly, future studies may try to examine other mediators such as knowledge management in the

relationship between IC and the different types of innovation, increasing our understanding of how intellectual capital affects innovations. Fourthly, the study suggests testing the benefits of innovations for employees, customers, formal and informal organisations.

Finally, the present study only makes use of the first stage of ANT. However, this thesis recommends that the other stages (interessement, enrollment and mobilisation) can be used in future quantitative studies.

- **Interessement**

After an analysis of the former stage, the focal actor (OC) recognises that these actors (HC, CC SC) may play a key role in reinforcing innovations. Therefore, OC or focal actor does its best to convince these actors to adopt the network's aim through explaining the benefits that are gained from supporting their innovations network. Innovations achieve a lot of benefits for employees, customers, formal and informal organisations. Firstly, innovation improves the firm's growth and employee job satisfaction. It supports personal ambition to obtain a desirable professional position and status. Moreover, it develops the knowledge stock of employees (e.g. West and Farr, 1990; Adams, 2003). Additionally, Marqués et al., (2006) state that incremental and radical innovations have a positive effect on HC. West (1989) reports that innovation results in some changes in a job whereby (1) it presents new work objectives or develops the current objectives; and (2) employees learn new skills. Secondly, it is additionally important to highlight the effect of innovations on structural capital. Marqués et al., (2006) asserts that both incremental and radical innovations have a key role in supporting structural capital such as developing a firm's rules; databases; knowledge management and spreads an innovative culture within the organization. Thirdly, CC has a greater effect on incremental and radical innovations than on other elements of IC (Marqués et al., 2006). This means that an organisation thoroughly understands customers' needs. For

instance, innovation reflects positively on customers by (1) developing customers' lives; (2) enabling customers to find new ways to satisfy their needs; and (3) supporting the customers' abilities to perform a new task or an existing task in a new way (Michel et al., 2008). Fourthly, it is expected that innovation develops interactions amongst employees and fosters an element of mutual trust through encouraging employees to perform their jobs as a team.

- **Enrollment**

Once the focal actor analysed the role of the actors in supporting innovations (problematization) and identified the interests gained by actors due to their supporting innovations (interessement), the enrollment moment could not be completed. If returns from joining the network are greater than their efforts in achieving the network's aims the actors accept this stage. Therefore, researchers should compare the statistic results of the first stage to those in the second stage. The enrollment moment encourages the actors to create and interchange new ideas with other actors and to adopt innovations (e.g. Potts, 2009; Rhodes, 2009). The focal actor should improve an appropriate working environment and thereby enable these actors to support product and process innovation. This activity led to the next moment.

- **Mobilization**

In the mobilisation stage, the current actors attempt to encourage others to participate in the innovations network. Mobilisation sees each actor as a spokesperson which convinces new actors to join innovation networks (Potts, 2009). Based on previous studies, this study suggests adding a new variable named innovation capital to the innovation network.

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## Appendix (A)

### English Questionnaire Form

School of Management  
Plymouth Business School  
University of Plymouth  
Plymouth  
United Kingdom  
Email: Ahmed.elsetouhi@Plymouth.ac.uk



### QUESTIONNAIRE

Investigating the Effect of Intellectual Capital on Innovations in the Egyptian Banks: The Mediating Role of Organisational Capital

Dear Sir/Madam

I am a PhD candidate at School of Management – University of Plymouth. I am conducting a study to examine the perception of bank's employees toward (1) the role of intellectual capital to support innovation within bank (2) as well as to investigate the relationships among the components of intellectual capital (3) moreover, to test the interactions among the different types of innovation.

I thank you for participation. I understand that your time is valuable, but I would appreciate it if you would spend some minutes to complete this questionnaire. Your completion of the questionnaire is critical to my study. Please complete and return the questionnaire as soon as possible. Let me emphasise that your participation in this study is voluntary and please be assured that all information you provide will be kept strictly confidential. Your participation represents a valuable contribution to this research, and I thank you again for your cooperation.

Sincerely Yours,

Ahmed Elsetouhi

Doctoral Candidate of School of Management

**Part A (Intellectual Capital)**

Intellectual capital is an integral part of intangible assets that is captured and utilized effectively to create values or competitive advantages. It consists of three components namely; human capital, organizational capital and relational capital which includes social and customer capital.

Please use the following scale to describe the intellectual capital in your bank: 5= Strongly Agree (SA), 4= Agree (A), 3= Neutral (N), 2= Disagree (D) and 1= Strongly Disagree (SD).

		SA	A	N	D	SD
1	Our bank acquires employees with suitable knowledge and competences.	5	4	3	2	1
2	Our bank develops talent through programmes such as formal job training.	5	4	3	2	1
3	Our bank retains the most talented employees who have a suitable educational level.	5	4	3	2	1
4	Our employees can share their knowledge with their Colleagues.	5	4	3	2	1
5	Employees can work brightly.	5	4	3	2	1
6	Employees have skills for creation innovations.	5	4	3	2	1
7	Our bank has an effective management process					
8	Our bank culture is supportive and comfortable to innovation					
9	Our bank has an effective knowledge management system					
10	Our top management team regards employees as the source of innovation					
11	Employees often exchange information informally.					
12	Our bank is characterized by personal friendship among the colleagues at multiple levels.	5	4	3	2	1
13	Employee avoids making demands that can seriously damage the interests of the other.	5	4	3	2	1
14	Our colleagues always keep their promises to us.	5	4	3	2	1
15	Our colleagues clearly understand the goals / values in our bank.	5	4	3	2	1

16	Our colleagues share the same ambitions.	5	4	3	2	1
17	People in our department are enthusiastic about pursuing the collective goals of the whole bank.	5	4	3	2	1
18	Our customers would indicate that they are generally satisfied with our bank.	5	4	3	2	1
19	Our bank tries to offer the best service to customers in the banking industry.	5	4	3	2	1
20	We get lots of feedback out of our customers' wants.	5	4	3	2	1
21	We strive to meet with customers' wants.	5	4	3	2	1
22	Our bank is heavily market oriented.	5	4	3	2	1
23	We are confident of our future with customers.	5	4	3	2	1

**Part B (Innovation)**

Innovation is an intentional integrated activity to create and adopt of a new product, process and administrative method for bank.

Please use the following scale to describe the innovation in your bank: 5= Strongly Agree (SA), 4= Agree (A), 3= Neutral (N), 2= Disagree (D) and 1= Strongly Disagree (SD).

**1- Product innovation**

5		S	A	N	D	SD
		A				
1	Our bank is able to replace obsolete service.	5	4	3	2	1
2	Our bank innovates many services like packaged accounts/ services for target market.	5	4	3	2	1
3	Our services are innovatively designed.	5	4	3	2	1
4	Our bank develops its services speedily.	5	4	3	2	1
5	Our bank is able to manage a portfolio of technological methods.	5	4	3	2	1
6	Our bank is able to absorb the basic technologies of business.	5	4	3	2	1
7	Our bank has valuable knowledge for technological process- innovation.	5	4	3	2	1
8	Our bank continually develops programs to reduce service costs	5	4	3	2	1
9	Our bank organizes its service processes efficiently.	5	4	3	2	1
10	Our bank assigns resources to the service processes efficiently.	5	4	3	2	1
11	Our bank is able to maintain a low level service process without impairing the service.	5	4	3	2	1
12	Our bank uses databases of best practices.	5	4	3	2	1
13	Our bank implements practices for employee development.	5	4	3	2	1
14	Our bank uses quality-management systems.	5	4	3	2	1
15	The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	5	4	3	2	1

16	Our bank emphasizes creative capability when recruiting staff.	5	4	3	2	1
17	The new staff recruitment system adopted by our bank is effective.	5	4	3	2	1
18	The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	5	4	3	2	1
19	The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	5	4	3	2	1

**Part (C) Personal and job information**

Please tick where appropriate.

**1- My bank is**

- Public sector banks
- Private sector banks
- Private and Joint venture banks.

**2- What is the highest level of education that you have completed?**

- Bachelor Degree
- Advanced studies after Bachelor Degree

**3- Gender**

- Male
- Female

**Many thanks for taking the valuable time to complete and return this questionnaire.**

## Arabic Questionnaire Form



## جامعة المنصورة كلية التجارة

### قائمة استقصاء

دراسة اثر رأس المال الفكري على الابتكارات في البنوك المصرية : توسط رأس المال التنظيمي.

عزيزي الفاضل /الفاضلة.....

تحية طيبة وبعد

اعمل مدرس مساعد بكلية التجارة -جامعة المنصورة وأقوم بدراسة الدكتوراه بجامعة بليموث -بالمملكة المتحدة. وفي هذه المرحلة أقوم بجمع البيانات اللازمة لاستكمال الدراسة التطبيقية الخاصة بالدكتوراه من السادة رؤساء ومديري ونواب البنوك التي تعمل في جمهورية مصر العربية.

وتمثل إجاباتهم وتهدف الدراسة إلى تحليل اثر مكونات رأس المال الفكري على الأنواع المختلفة للابتكارات في البنوك. احد الدعائم الأساسية للبحث وما يسفر عنه من نتائج. ويؤكد الباحث أن كل ما تقدمونه من آراء سوف يحظى بالسرية التامة ولن تستخدم إلا في أغراض البحث العلمي فقط.

ويشكر الباحث لسيادتكم مقدما لتعاونكم معه في هذا البحث، كما يعتذر لسيادتكم عن ما قد يسببه ذلك من مشقة راجيا المولى عز وجل أن يجزيكم عنه خير الجزاء.

الباحث

احمد محمد السطوحى

كلية التجارة -جامعة المنصورة

### الجزء الاول راس المال الفكرى

راس المال الفكرى يمثل جزء متكامل من الاصول المعنوية (الغير ملموسة) التي تستخدم لتحقيق الميزة التنافسية. ويتكون راس المال الفكرى من ثلاث مكونات هي : راس المال البشرى, راس المال التنظيمى , راس المال العلاقتى و الذى يتضمن كلا من العلاقات بين الموظفين (راس المال الاجتماعى) و العلاقة بين المنظمة و عملائها (راس المال المتعلق بالعميل).

(الرجاء التأكد من اجابة كل سؤال ووضع دائرة حول الجواب الذى تراه مناسباً حيث ان: (5= اوافق بشدة , 4= اوافق , 3= محايد , 2= لا اوافق , 1= لا اوافق بشدة).

لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة	العبارة
1	2	3	4	5	يحصل البنك على المواهب ذات المعرفة والقدرات المناسبة
1	2	3	4	5	يقوم البنك بتنمية المواهب من خلال العديد من البرامج مثل ( برامج التدريب الوظيفى) .
1	2	3	4	5	يحتفظ البنك بالموظفين ذوى مستوى التعليم العالى.
1	2	3	4	5	يشارك الموظف معلوماته مع زملائه.
1	2	3	4	5	يعمل الموظفون بشكل متقن
1	2	3	4	5	يمتلك الموظفون المهارات التي تساعدهم على خلق الابتكارات
1	2	3	4	5	يمتلك البنك عمليات إدارية فعالة
1	2	3	4	5	ثقافة البنك داعمة للابتكار
1	2	3	4	5	يمتلك البنك نظام فعال لإدارة المعرفة
1	2	3	4	5	تعتبر الإدارة العليا أن الموظفين مصدر للابتكار
1	2	3	4	5	يتبادل الموظفون المعلومات - فى اغلب الاحيان - بشكل غير رسمى.
1	2	3	4	5	تسود روح الصداقة بين موظفى البنك على مختلف المستويات الادارية.
1	2	3	4	5	يتجنب الموظف المطالبة بالاشياء التي تضر بمصالح زملائه.
1	2	3	4	5	يفى زملائنا دائماً بوعودهم لنا.
1	2	3	4	5	لدى زملائنا فهم واضح لاهداف / قيم البنك.
1	2	3	4	5	يشارك موظفوا البنك نفس الطموحات.
1	2	3	4	5	يسعى موظفوا القسم الى تحقيق الاهداف الجماعية للبنك ككل.
1	2	3	4	5	يؤكد العملاء على انهم راضون عن خدمات البنك بوجه عام
1	2	3	4	5	يسعى البنك الى تقديم افضل الخدمات لعملائه فى الصناعة المصرفية.
1	2	3	4	5	يحصل البنك على قدر كبير من التغذية المرتجعة حول رغبات المستهلكين .
1	2	3	4	5	يبدل البنك الكثير من الجهد لاشباع رغبات المستهلكين .
1	2	3	4	5	تتميز خدمات البنك بانها موجهة للسوق بشكل كبير .
1	2	3	4	5	نحن على ثقة من مستقبلنا مع عملائنا.

## الجزء الثاني - الابتكار

الابتكار هو نشاط متكامل و هادف لخلق وتبني المنتجات , العمليات والنظم الجديدة فى البنك.

لا وافق بشدة	لا وافق	محا يد	وافق	وافق بشدة	العبارة
1	2	3	4	5	يمتلك البنك القدرة على استبدال الخدمات القديمة بخدمات مميزة.
1	2	3	4	5	يبتكر البنك العديد من الخدمات مثل "حسابات ذات منافع متعددة" للسوق المستهدف.
1	2	3	4	5	يطور البنك خدماته بشكل سريع.
1	2	3	4	5	بشكل ابتكاري. - يصمم البنك خدماته
1	2	3	4	5	يمتلك البنك القدرة على ادارة مجموعة من الاساليب التكنولوجية .
1	2	3	4	5	يستطيع البنك استيعاب التكنولوجيا الاساسية لنشاطه.
1	2	3	4	5	يمتلك البنك معرفة ذات قيمة للابتكارات التكنولوجية الخاصة بعملياته.
1	2	3	4	5	يطور البنك باستمرار برامج لتقليل تكاليف انتاج الخدمة.
1	2	3	4	5	يدير البنك عمليات انتاج خدماته بكفاءة.
1	2	3	4	5	يخصص البنك الموارد اللازمة لعمليات انتاج خدماته بكفاءة.
1	2	3	4	5	يستطيع البنك ان يحافظ على مستوى منخفض من عمليات انتاج خدماته دون الاضرار بمستوى الخدمة .
1	2	3	4	5	يستخدم البنك قواعد البيانات لافضل الممارسات الادارية.
1	2	3	4	5	يطبق البنك الممارسات اللازمة لتطوير العاملين
1	2	3	4	5	يستخدم البنك نظم ادارة الجودة
1	2	3	4	5	يزود نظام التحفيز الذى يتبناه البنك العاملين بحوافز مناسبة
1	2	3	4	5	يؤكد البنك على مراعاة القدرات الابتكارية عند تعيين الموظفين
1	2	3	4	5	يتسم نظام تعيين العاملين فى البنك بالفاعليه
1	2	3	4	5	تساعد نظم تقييم الاداء فى البنك الرؤساء على معرفة دور الموظفين فى تحقيق اهداف البنك
1	2	3	4	5	يتبنى البنك نظام مالى جديد يمكنه من رصد فعال الاختلاف بين الاداء الفعلى الاداء المستهدف.

### معلومات شخصية وظيفية وبنكيه (الرجاء اختار ما تراه مناسباً)

1- اعمل في بنك:

عام  خاص  مشترك

2- ما هو أعلى مؤهل لك:

درجة البكالوريوس  دراسات عليا بعد مرحلة البكالوريوس

3- النوع:

ذكر  أنثى

شكراً لسيادتكم على حسن تعاونكم

## Appendix (B)

### Exploratory Factor analysis output (SPSS)

FACTOR

```

/VARIABLES HC1 HC2 HC3 HC4 OC1 OC2 OC4 SC3 SC4 SC5 SC6 SC7 CC1 CC2 CC3 CC4 CC5 CC6
PDI4 PDI3 PDI1 PDI2 PCI2 PCI3 PCI4 PCI5 PCI6 PCI7 OI1 OI2 OI4 OI5 OI6 OI7 OI8
/MISSING PAIRWISE
/ANALYSIS HC1 HC2 HC3 HC4 OC1 OC2 OC4 SC3 SC4 SC5 SC6 SC7 CC1 CC2 CC3 CC4 CC5 CC6
PDI4 PDI3 PDI1 PDI2 PCI2 PCI3 PCI4 PCI5 PCI6 PCI7 OI1 OI2 OI4 OI5 OI6 OI7 OI8
/PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO EXTRACTION ROTATION
/FORMAT SORT BLANK(.40)
/PLOT EIGEN
/CRITERIA FACTORS(7) ITERATE(25)
/EXTRACTION PC
/CRITERIA ITERATE(25)
/ROTATION VARIMAX
/METHOD=CORRELATION.

```

### Factor Analysis

Notes		
Output Created		09-AUG-2013 02:29:14
Comments		
Input	Data	C:\Users\Mariam\Desktop\Final Ahmed Thesis\Final thesis\198 private and public managers\xxx 198 private and public managers.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	198
Missing Value Handling	Definition of Missing	MISSING=EXCLUDE: User-defined missing values are treated as missing.
	Cases Used	PAIRWISE: Correlation coefficients for each pair of variables are based on all the cases with valid data for that pair. The factor analysis is based on these correlations.
Syntax		FACTOR /VARIABLES HC1 HC2 HC3 HC4 OC1 OC2 OC4 SC3 SC4 SC5 SC6 SC7 CC1 CC2 CC3 CC4 CC5 CC6 PDI4 PDI3 PDI1 PDI2 PCI2 PCI3 PCI4 PCI5 PCI6 PCI7 OI1 OI2 OI4 OI5 OI6 OI7 OI8 /MISSING PAIRWISE /ANALYSIS HC1 HC2 HC3 HC4 OC1 OC2 OC4 SC3 SC4 SC5 SC6 SC7 CC1

		CC2 CC3 CC4 CC5 CC6 PDI4 PDI3 PDI1 PDI2 PCI2 PCI3 PCI4 PCI5 PCI6 PCI7 OI1 OI2 OI4 OI5 OI6 OI7 OI8 /PRINT UNIVARIATE INITIAL CORRELATION SIG DET KMO EXTRACTION ROTATION /FORMAT SORT BLANK(.40) /PLOT EIGEN /CRITERIA FACTORS(7) ITERATE(25) /EXTRACTION PC /CRITERIA ITERATE(25) /ROTATION VARIMAX /METHOD=CORRELATION.
Resources	Processor Time	00:00:01.48
	Elapsed Time	00:00:01.45
	Maximum Memory Required	141380 (138.066K) bytes

[DataSet1] C:\Users\Mariam\Desktop\Final Ahmed Thesis\Final thesis\198 private and public managers\xxx  
198 private and public managers.sav

Descriptive Statistics				
	Mean	Std. Deviation	Analysis N	Missing N
Our bank acquire employees with suitable knowledge and competences	3.6313	1.06653	198	0
Our bank develops talent through programmes such as formal job training.	4.0960	.90452	198	0
Our bank retains the most talented employees who have a suitable educational level	3.7121	1.10511	198	0
Our employees can share their knowledge with their Colleagues.	4.1919	.75638	198	0
Our bank has an effective management process	3.8788	.98489	198	0
Our bank culture is supportive and comfortable to innovation	3.8535	.97364	198	0
Our top management team regards employees as the source of innovation	3.7626	1.04187	198	0
Employee avoids making demands that can seriously damage the interests of	3.9545	.91405	198	0

the other.				
Our colleagues always keep their promises to us.	3.6970	.86035	198	0
Our colleagues clearly understand the goals / values in our bank.	3.7475	.89378	198	0
Our colleagues share the same ambitions.	3.6970	1.01216	198	0
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	3.9242	.93403	198	0
Our customers would indicate that they are generally satisfied with our bank.	3.7727	.90339	198	0
Our bank tries to offer the best service to customers in the banking industry.	4.1566	.82519	198	0
We get lots of feedback out of our customers' wants.	3.8737	.93939	198	0
We strive to meet with customers' wants.	4.0505	.91100	198	0
Our bank is heavily market oriented.	3.9596	.95502	198	0
We are confident of our future with customers.	3.9596	1.01680	198	0
Our bank develops its services speedily.	3.9040	1.00551	198	0
Our services are innovatively designed.	3.7273	.94324	198	0
Our bank is able to replace obsolete service.	3.9848	.82768	198	0
Our bank innovates many services like packaged accounts/ services for target market.	3.9545	.86262	198	0
Our bank is able to absorb the basic technologies of business.	3.8535	.85125	198	0
Our bank has valuable knowledge for technological process- innovation.	3.8535	.85125	198	0
Our bank continually develops programs to reduce service costs	3.8788	.90428	198	0
Our bank organizes its service processes efficiently.	3.8384	.95276	198	0
Our bank assigns resources to the service processes efficiently.	3.7828	.93890	198	0
Our bank is able to maintain a low level service process without impairing the service.	3.9091	.89091	198	0

Our bank uses databases of best practices.	3.9192	.98904	198	0
Our bank implements practices for employee development.	3.8838	.95675	198	0
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	3.6111	1.07829	198	0
Our bank emphasizes creative capability when recruiting staff.	3.5253	1.12961	198	0
The new staff recruitment system adopted by our bank is effective.	3.5051	1.11176	198	0
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	3.6717	1.06552	198	0
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	3.7121	.97322	198	0

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.945
Bartlett's Test of Sphericity	Approx. Chi-Square	5047.941
	df	595
	Sig.	.000

<b>Communalities</b>		
	Initial	Extraction
Our bank acquire employees with suitable knowledge and competences	1.000	.547
Our bank develops talent through programmes such as formal job training.	1.000	.702
Our bank retains the most talented employees who have a suitable educational level	1.000	.670
Our employees can share their knowledge with their Colleagues.	1.000	.623
Our bank has an effective management	1.000	.832

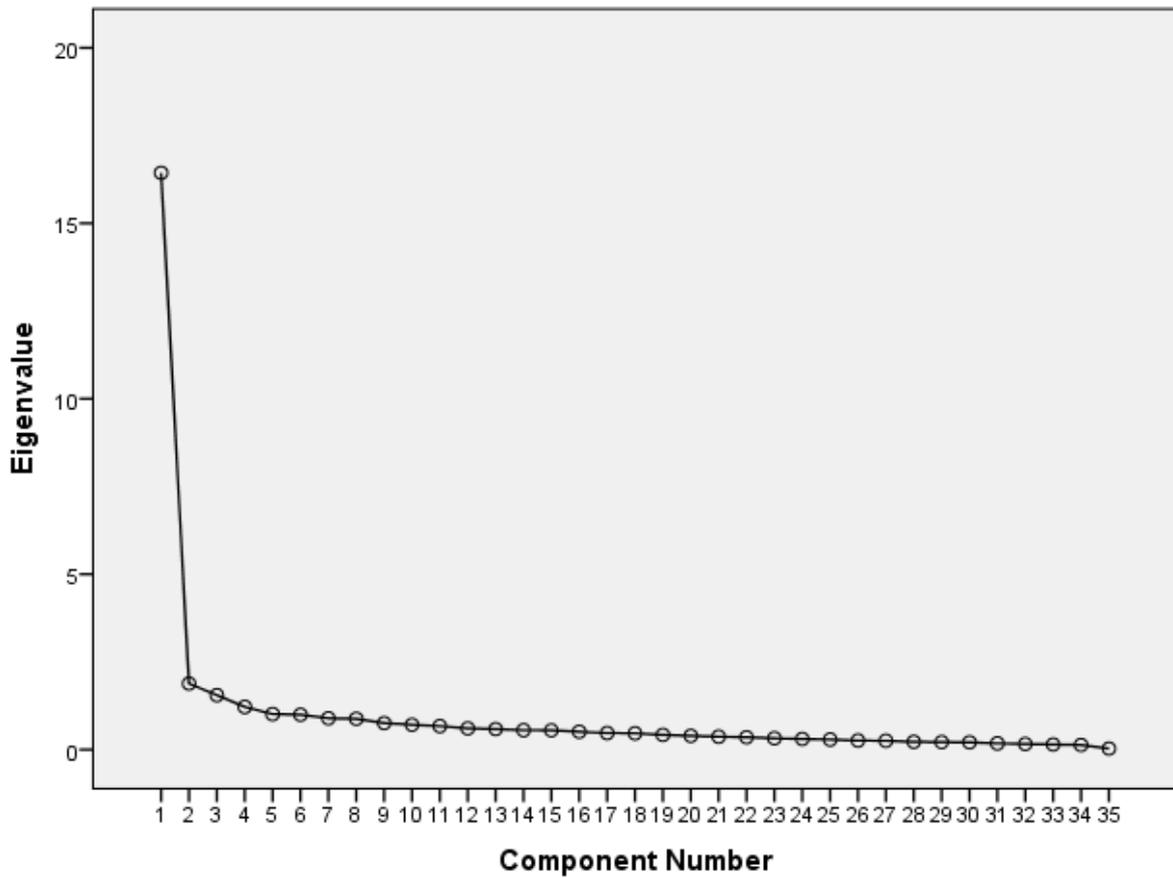
process		
Our bank culture is supportive and comfortable to innovation	1.000	.705
Our top management team regards employees as the source of innovation	1.000	.741
Employee avoids making demands that can seriously damage the interests of the other.	1.000	.692
Our colleagues always keep their promises to us.	1.000	.736
Our colleagues clearly understand the goals / values in our bank.	1.000	.655
Our colleagues share the same ambitions.	1.000	.723
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	1.000	.621
Our customers would indicate that they are generally satisfied with our bank.	1.000	.656
Our bank tries to offer the best service to customers in the banking industry.	1.000	.746
We get lots of feedback out of our customers' wants.	1.000	.610
We strive to meet with customers' wants.	1.000	.744
Our bank is heavily market oriented.	1.000	.753
We are confident of our future with customers.	1.000	.711
Our bank develops its services speedily.	1.000	.718
Our services are innovatively designed.	1.000	.664
Our bank is able to replace obsolete service.	1.000	.649
Our bank innovates many services like packaged accounts/ services for target market.	1.000	.493
Our bank is able to absorb the basic technologies of business.	1.000	.798
Our bank has valuable knowledge for technological process- innovation.	1.000	.787
Our bank continually develops programs to reduce service costs	1.000	.575

Our bank organizes its service processes efficiently.	1.000	.668
Our bank assigns resources to the service processes efficiently.	1.000	.628
Our bank is able to maintain a low level service process without impairing the service.	1.000	.613
Our bank uses databases of best practices.	1.000	.649
Our bank implements practices for employee development.	1.000	.660
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	1.000	.699
Our bank emphasizes creative capability when recruiting staff.	1.000	.789
The new staff recruitment system adopted by our bank is effective.	1.000	.731
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	1.000	.779
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.	1.000	.625
Extraction Method: Principal Component Analysis.		

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	16.440	46.971	46.971	16.440	46.971	46.971	5.156	14.731	14.731
2	1.883	5.380	52.351	1.883	5.380	52.351	4.753	13.581	28.312
3	1.553	4.437	56.787	1.553	4.437	56.787	3.936	11.246	39.557

4	1.218	3.479	60.267	1.218	3.479	60.267	3.50 2	10.005	49.563
5	1.013	2.893	63.160	1.013	2.893	63.160	2.95 9	8.455	58.017
6	.993	2.838	65.998	.993	2.838	65.998	2.18 2	6.236	64.253
7	.894	2.554	68.552	.894	2.554	68.552	1.50 5	4.299	68.552
8	.879	2.511	71.063						
9	.757	2.162	73.226						
10	.708	2.023	75.248						
11	.671	1.917	77.165						
12	.605	1.728	78.893						
13	.585	1.673	80.566						
14	.555	1.585	82.150						
15	.549	1.568	83.718						
16	.510	1.456	85.174						
17	.472	1.348	86.522						
18	.464	1.326	87.848						
19	.420	1.200	89.048						
20	.393	1.123	90.171						
21	.370	1.057	91.228						
22	.352	1.006	92.234						
23	.323	.924	93.158						
24	.305	.871	94.029						
25	.287	.821	94.850						
26	.259	.739	95.589						
27	.252	.721	96.310						
28	.223	.637	96.948						
29	.213	.610	97.557						
30	.209	.597	98.154						
31	.179	.511	98.665						
32	.159	.454	99.119						
33	.147	.419	99.538						
34	.132	.376	99.913						
35	.030	.087	100.000						
Extraction Method: Principal Component Analysis.									

**Scree Plot**



<b>Component Matrix<sup>a</sup></b>					
	Component				
	1	2	3	4	5
Our bank develops its services speedily.	.784				
Our bank implements practices for employee development.	.782				
Our bank organizes its service processes efficiently.	.771				
Our bank uses databases of best practices.	.769				
Our bank has an effective management process	.767				
Our bank culture is supportive and comfortable to innovation	.754				
Our bank assigns resources to the service processes efficiently.	.746				
Our bank is able to replace obsolete service.	.746				

Our services are innovatively designed.	.739				
Our bank has valuable knowledge for technological process- innovation.	.736			-0.405	
Our bank is able to absorb the basic technologies of business.	.733			-0.416	
Our bank emphasizes creative capability when recruiting staff.	.728				
Our colleagues clearly understand the goals / values in our bank.	.722				
Our bank is heavily market oriented.	.720				
Our top management team regards employees as the source of innovation	.716				
We strive to meet with customers' wants.	.713				
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.	.711				
The new staff recruitment system adopted by our bank is effective.	.698				
We get lots of feedback out of our customers' wants.	.695				
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.	.693				
We are confident of our future with customers.	.690				
Our bank continually develops programs to reduce service costs	.673				
People in our department are enthusiastic about pursuing the collective goals of the whole bank.	.663				
Our bank is able to maintain a low level service process without impairing the service.	.657				
Our colleagues share the same ambitions.	.650				
Our bank tries to offer the best service to customers in the banking industry.	.648				
Our bank develops talent through programmes such as formal job training.	.623				
The new financial management system adopted by our bank can effectively	.610				

monitor the actual difference between our performance and our goals.					
Our bank retains the most talented employees who have a suitable educational level	.609			.486	
Employee avoids making demands that can seriously damage the interests of the other.	.603	.491			
Our employees can share their knowledge with their Colleagues.	.602				
Our customers would indicate that they are generally satisfied with our bank.	.592				
Our bank innovates many services like packaged accounts/ services for target market.	.555				
Our colleagues always keep their promises to us.	.526	.408			
Our bank acquire employees with suitable knowledge and competences				.452	

Extraction Method: Principal Component Analysis.

a. 7 components extracted.

Rotated Component Matrix <sup>a</sup>							
	Component						
	1	2	3	4	5	6	7
Our bank is able to absorb the basic technologies of business.	.780						
Our bank has valuable knowledge for technological process- innovation.	.763						
Our bank is able to replace obsolete service.	.613						
Our bank organizes its service processes efficiently.	.607						
Our bank is able to maintain a low level service process without impairing the service.	.578						
Our bank continually develops programs to reduce service costs	.560						
Our services are innovatively designed.	.536						
Our bank assigns resources to the service processes efficiently.	.522						
Our bank innovates many services like packaged accounts/ services for target market.	.479						
Our bank develops its services speedily.	.477						

Our bank emphasizes creative capability when recruiting staff.		.765					
The new staff recruitment system adopted by our bank is effective.		.728					
The new performance assessment method adopted by our bank can enable department heads to know how far the staffs have achieved the bank's goals.		.715					
The new financial management system adopted by our bank can effectively monitor the actual difference between our performance and our goals.		.697					
The new staff welfare system adopted by our bank can effectively provide incentives to our staff.		.657					
Our bank uses databases of best practices.		.536					
Our bank implements practices for employee development.		.531					
Our bank tries to offer the best service to customers in the banking industry.			.757				
We strive to meet with customers' wants.			.703				
Our bank is heavily market oriented.			.663				
We are confident of our future with customers.			.628	.402			
We get lots of feedback out of our customers' wants.			.600				
Our colleagues always keep their promises to us.				.780			
Employee avoids making demands that can seriously damage the interests of the other.				.678			
Our colleagues share the same ambitions.				.656			
People in our department are enthusiastic about pursuing the collective goals of the whole bank.				.608			
Our colleagues clearly understand the goals / values in our bank.				.556			
Our bank has an effective management process					.707		
Our top management team regards employees as the source of innovation					.675		
Our bank culture is supportive and comfortable to innovation					.582		
Our bank acquire employees with suitable knowledge and competences						.666	
Our bank retains the most talented employees who have a suitable educational level						.650	
Our bank develops talent through programmes such as formal job training.						.595	
Our employees can share their knowledge with their Colleagues.					.420		.517

Our customers would indicate that they are generally satisfied with our bank.			.411				.500
Extraction Method: Principal Component Analysis.							
Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 8 iterations.							

**Component Transformation Matrix**

Component	1	2	3	4	5	6	7
1	.502	.467	.414	.368	.352	.256	.182
2	-.242	-.500	.518	.574	-.251	-.054	.170
3	-.619	.522	-.259	.396	-.145	.317	-.004
4	-.181	-.268	.160	-.401	.134	.786	.272
5	.296	-.364	-.683	.419	.151	.169	.294
6	.260	.219	-.029	-.161	-.741	-.008	.556
7	.344	-.087	-.013	.127	-.451	.431	-.685

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

## Appendix (C)

### Measurement and Structural model using PLS

#### General SEM analysis results

##### General project information

Version of WarpPLS used: 3.0

Project path (directory): C:\Users\Mariam\Desktop\related for journal of product innovation\

Project file: 999 direct and indirect managers.prj

Last changed: 29-Jun-2013 13:09:43

Last saved: 29-Jun-2013 13:09:54

Raw data path (directory): C:\Users\Mariam\Desktop\198 private and public managers\

Raw data file: xxx 198 private and public managers.dat

##### Model fit indices and P values

APC=0.203,  $P < 0.001$

ARS=0.610,  $P < 0.001$

AVIF=2.346, Good if  $< 5$

##### General model elements

Algorithm used in the analysis: Warp3 PLS regression

Resampling method used in the analysis: Bootstrapping

Number of data resamples used: 999

Number of cases (rows) in model data: 198

Number of latent variables in model: 7

Number of indicators used in model: 24

Number of iterations to obtain estimates: 6

Range restriction variable type: None

Range restriction variable: None

Range restriction variable min value: 0.000

Range restriction variable max value: 0.000

Only ranked data used in analysis? No

### **Path coefficients and P values**

Path coefficients

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.411		0.284	0.197			
SC							
CC							
PDI	0.189	0.122	0.107	0.174		0.299	0.117
PCI	0.115	0.299	0.067	0.210			0.173
OI	0.229	0.267	0.239	0.158			

### **P values**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	<0.001		0.001	0.015			
SC							
CC							
PDI	0.007	0.037	0.038	0.007		<0.001	0.049
PCI	0.089	0.002	0.198	0.046			0.035
OI	0.002	<0.001	0.002	0.011			

### **Standard errors for path coefficients**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.089		0.094	0.090			
SC							
CC							
PDI	0.076	0.068	0.060	0.070		0.065	0.071
PCI	0.085	0.101	0.079	0.125			0.095
OI	0.080	0.082	0.083	0.068			

### **Effect sizes for path coefficients**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.283		0.182	0.128			
SC							
CC							
PDI	0.131	0.087	0.070	0.124		0.219	0.084
PCI	0.068	0.201	0.037	0.130			0.110
OI	0.148	0.183	0.155	0.101			

### **Combined loadings and cross-loadings**

	HC	OC	SC	CC	PDI	PCI	OI	SE	P value
HC2	0.783	0.192	-0.055	0.007	-0.229	0.101	0.023	0.106	<0.001
HC3	0.844	-0.293	-0.050	0.033	0.038	-0.058	0.165	0.054	<0.001

HC4	0.733	0.132	0.116	-0.045	0.201	-0.041	-0.214	0.086	<0.001
OC1	0.037	0.922	-0.061	0.063	0.126	-0.072	-0.109	0.057	<0.001
OC2	-0.157	0.869	0.100	0.035	0.011	-0.060	0.097	0.066	<0.001
OC4	0.116	0.885	-0.035	-0.100	-0.142	0.133	0.018	0.052	<0.001
SC5	-0.097	0.157	0.860	-0.002	0.121	-0.037	0.024	0.068	<0.001
SC6	-0.025	-0.155	0.872	-0.035	0.213	-0.174	0.012	0.051	<0.001
SC7	0.125	0.000	0.837	0.038	-0.346	0.219	-0.037	0.066	<0.001
CC6	-0.182	0.156	0.120	0.820	-0.214	0.191	-0.112	0.070	<0.001
CC4	-0.185	0.047	-0.118	0.831	0.022	0.071	0.098	0.074	<0.001
CC1	0.116	-0.154	0.210	0.678	0.258	-0.488	0.172	0.092	<0.001
CC2	0.050	0.020	-0.089	0.819	0.075	-0.069	-0.176	0.085	<0.001
CC3	-0.010	-0.109	-0.101	0.779	0.270	0.028	0.087	0.065	<0.001
CC5	0.228	0.006	0.011	0.836	-0.346	0.179	-0.036	0.065	<0.001
PDI1	0.159	-0.248	0.051	0.036	0.833	0.287	0.001	0.083	<0.001
PDI3	-0.042	0.097	0.043	-0.100	0.880	-0.099	-0.088	0.062	<0.001
PDI4	-0.107	0.137	-0.090	0.065	0.892	-0.170	0.086	0.061	<0.001
PCI3	-0.097	-0.002	0.031	0.112	0.142	0.877	-0.053	0.068	<0.001
PCI7	0.097	0.002	-0.031	-0.112	-0.142	0.877	0.053	0.085	<0.001
OI2	0.176	0.085	-0.043	0.195	-0.086	0.047	0.818	0.069	<0.001
OI4	0.044	-0.194	0.154	-0.057	-0.012	0.002	0.850	0.052	<0.001
OI5	-0.068	-0.046	-0.040	-0.178	0.115	0.092	0.887	0.045	<0.001
OI6	-0.142	0.160	-0.070	0.055	-0.025	-0.142	0.854	0.053	<0.001

Note: P values < 0.05 are desirable for reflective indicators.

**Pattern loadings and cross-loadings**

	HC	OC	SC	CC	PDI	PCI	OI
HC2	0.764	0.192	-0.055	0.007	-0.229	0.101	0.023
HC3	0.966	-0.293	-0.050	0.033	0.038	-0.058	0.165
HC4	0.614	0.132	0.116	-0.045	0.201	-0.041	-0.214
OC1	0.037	0.928	-0.061	0.063	0.126	-0.072	-0.109
OC2	-0.157	0.853	0.100	0.035	0.011	-0.060	0.097
OC4	0.116	0.895	-0.035	-0.100	-0.142	0.133	0.018
SC5	-0.097	0.157	0.728	-0.002	0.121	-0.037	0.024
SC6	-0.025	-0.155	0.964	-0.035	0.213	-0.174	0.012
SC7	0.125	0.000	0.876	0.038	-0.346	0.219	-0.037
CC6	-0.182	0.156	0.120	0.859	-0.214	0.191	-0.112
CC4	-0.185	0.047	-0.118	0.878	0.022	0.071	0.098
CC1	0.116	-0.154	0.210	0.556	0.258	-0.488	0.172
CC2	0.050	0.020	-0.089	0.947	0.075	-0.069	-0.176
CC3	-0.010	-0.109	-0.101	0.650	0.270	0.028	0.087
CC5	0.228	0.006	0.011	0.844	-0.346	0.179	-0.036
PDI1	0.159	-0.248	0.051	0.036	0.608	0.287	0.001
PDI3	-0.042	0.097	0.043	-0.100	1.031	-0.099	-0.088
PDI4	-0.107	0.137	-0.090	0.065	0.954	-0.170	0.086
PCI3	-0.097	-0.002	0.031	0.112	0.142	0.762	-0.053
PCI7	0.097	0.002	-0.031	-0.112	-0.142	0.992	0.053
OI2	0.176	0.085	-0.043	0.195	-0.086	0.047	0.555
OI4	0.044	-0.194	0.154	-0.057	-0.012	0.002	0.906
OI5	-0.068	-0.046	-0.040	-0.178	0.115	0.092	0.971
OI6	-0.142	0.160	-0.070	0.055	-0.025	-0.142	0.963

**Structure loadings and cross-loadings**

HC	OC	SC	CC	PDI	PCI	OI
----	----	----	----	-----	-----	----

HC2	0.783	0.567	0.412	0.474	0.516	0.460	0.506
HC3	0.844	0.475	0.411	0.495	0.551	0.431	0.535
HC4	0.733	0.543	0.446	0.471	0.551	0.458	0.448
OC1	0.638	0.922	0.551	0.613	0.682	0.603	0.597
OC2	0.542	0.869	0.591	0.585	0.627	0.561	0.623
OC4	0.604	0.885	0.507	0.522	0.607	0.618	0.592
SC5	0.486	0.602	0.860	0.613	0.613	0.514	0.576
SC6	0.422	0.462	0.872	0.551	0.539	0.404	0.511
SC7	0.467	0.519	0.837	0.565	0.495	0.479	0.519
CC6	0.422	0.542	0.577	0.820	0.536	0.518	0.478
CC4	0.464	0.535	0.533	0.831	0.583	0.525	0.554
CC1	0.453	0.406	0.525	0.678	0.492	0.300	0.487
CC2	0.481	0.499	0.497	0.819	0.551	0.450	0.440
CC3	0.519	0.516	0.526	0.779	0.626	0.521	0.551
CC5	0.568	0.556	0.559	0.836	0.552	0.519	0.527
PDI1	0.601	0.563	0.548	0.600	0.833	0.668	0.593
PDI3	0.584	0.630	0.562	0.579	0.880	0.615	0.574
PDI4	0.597	0.671	0.562	0.644	0.892	0.621	0.647
PCI3	0.501	0.598	0.518	0.582	0.677	0.877	0.557
PCI7	0.497	0.569	0.435	0.467	0.601	0.877	0.539
OI2	0.625	0.634	0.553	0.632	0.633	0.568	0.818
OI4	0.518	0.518	0.563	0.519	0.569	0.505	0.850
OI5	0.526	0.574	0.509	0.488	0.619	0.578	0.887
OI6	0.490	0.583	0.510	0.533	0.554	0.481	0.854

**Indicator weights**

	HC	OC	SC	CC	PDI	PCI	OI	SE	P value	VIF
HC2	0.421	0.000	0.000	0.000	0.000	0.000	0.000	0.045	<0.001	1.385

HC3	0.453	0.000	0.000	0.000	0.000	0.000	0.000	0.041	<0.001	1.537
HC4	0.393	0.000	0.000	0.000	0.000	0.000	0.000	0.053	<0.001	1.266
OC1	0.000	0.386	0.000	0.000	0.000	0.000	0.000	0.028	<0.001	2.937
OC2	0.000	0.364	0.000	0.000	0.000	0.000	0.000	0.025	<0.001	2.103
OC4	0.000	0.371	0.000	0.000	0.000	0.000	0.000	0.027	<0.001	2.359
SC5	0.000	0.000	0.391	0.000	0.000	0.000	0.000	0.026	<0.001	1.861
SC6	0.000	0.000	0.396	0.000	0.000	0.000	0.000	0.033	<0.001	1.948
SC7	0.000	0.000	0.381	0.000	0.000	0.000	0.000	0.029	<0.001	1.699
CC6	0.000	0.000	0.000	0.216	0.000	0.000	0.000	0.021	<0.001	2.204
CC4	0.000	0.000	0.000	0.219	0.000	0.000	0.000	0.022	<0.001	2.303
CC1	0.000	0.000	0.000	0.178	0.000	0.000	0.000	0.023	<0.001	1.532
CC2	0.000	0.000	0.000	0.216	0.000	0.000	0.000	0.021	<0.001	2.147
CC3	0.000	0.000	0.000	0.205	0.000	0.000	0.000	0.025	<0.001	1.928
CC5	0.000	0.000	0.000	0.220	0.000	0.000	0.000	0.022	<0.001	2.346
PDI1	0.000	0.000	0.000	0.000	0.368	0.000	0.000	0.032	<0.001	1.710
PDI3	0.000	0.000	0.000	0.000	0.389	0.000	0.000	0.034	<0.001	2.145
PDI4	0.000	0.000	0.000	0.000	0.394	0.000	0.000	0.031	<0.001	2.260
PCI3	0.000	0.000	0.000	0.000	0.000	0.570	0.000	0.057	<0.001	1.407
PCI7	0.000	0.000	0.000	0.000	0.000	0.570	0.000	0.047	<0.001	1.407
OI2	0.000	0.000	0.000	0.000	0.000	0.000	0.281	0.020	<0.001	1.888
OI4	0.000	0.000	0.000	0.000	0.000	0.000	0.292	0.021	<0.001	2.131
OI5	0.000	0.000	0.000	0.000	0.000	0.000	0.305	0.022	<0.001	2.666
OI6	0.000	0.000	0.000	0.000	0.000	0.000	0.294	0.023	<0.001	2.284

Note: P values < 0.05 and VIFs < 2.5 are desirable for formative indicators.

### **Latent variable coefficients**

### **R-squared coefficients**

HC	OC	SC	CC	PDI	PCI	OI
	0.593			0.714	0.546	0.586

### **Composite reliability coefficients**

HC	OC	SC	CC	PDI	PCI	OI
0.830	0.921	0.892	0.912	0.902	0.869	0.914

### **Cronbach's alpha coefficients**

HC	OC	SC	CC	PDI	PCI	OI
0.693	0.872	0.818	0.883	0.837	0.700	0.874

### **Average variances extracted**

HC	OC	SC	CC	PDI	PCI	OI
0.621	0.796	0.733	0.633	0.755	0.769	0.727

### **Full collinearity VIFs**

HC	OC	SC	CC	PDI	PCI	OI
2.264	2.780	2.204	2.537	3.501	2.413	2.517

### **Q-squared coefficients**

HC	OC	SC	CC	PDI	PCI	OI
	0.592			0.716	0.551	0.585

## Correlations among latent variables

### Latent variable correlations

	HC	OC	SC	CC	PDI	PCI	OI
HC	0.788	0.668	0.535	0.609	0.683	0.569	0.632
OC	0.668	0.892	0.616	0.642	0.716	0.665	0.676
SC	0.535	0.616	0.856	0.673	0.642	0.543	0.625
CC	0.609	0.642	0.673	0.796	0.700	0.598	0.635
PDI	0.683	0.716	0.642	0.700	0.869	0.729	0.696
PCI	0.569	0.665	0.543	0.598	0.729	0.877	0.625
OI	0.632	0.676	0.625	0.635	0.696	0.625	0.853

Note: Square roots of average variances extracted (AVE's) shown on diagonal.

### P values for correlations

	HC	OC	SC	CC	PDI	PCI	OI
HC	1.000	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
OC	<0.001	1.000	<0.001	<0.001	<0.001	<0.001	<0.001
SC	<0.001	<0.001	1.000	<0.001	<0.001	<0.001	<0.001
CC	<0.001	<0.001	<0.001	1.000	<0.001	<0.001	<0.001
PDI	<0.001	<0.001	<0.001	<0.001	1.000	<0.001	<0.001
PCI	<0.001	<0.001	<0.001	<0.001	<0.001	1.000	<0.001
OI	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.000

### Block variance inflation factors

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	1.707		1.975	2.283			
SC							

CC							
PDI	2.342	2.908	2.308	2.532		2.164	2.849
PCI	2.245	2.646	2.110	2.206			2.708
OI	2.171	2.515	2.196	2.369			

Notes:

- These VIFs are for the latent variables on each column (predictors), with reference to the latent variables on each row (criteria).

### **Indirect and total effects**

#### **Indirect effects for paths with 2 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.111	0.121	0.083	0.105			0.052
PCI	0.162	0.046	0.126	0.086			
OI	0.110		0.076	0.053			

#### **Number of paths with 2 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	3	2	3	3			1

PCI	2	1	2	2
OI	1		1	1

**P values of indirect effects for paths with 2 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.008	<0.001	0.023	0.009			0.046
PCI	<0.001	0.074	0.004	0.006			
OI	0.002		0.019	0.051			

**Standard errors of indirect effects for paths with 2 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.046	0.038	0.041	0.044			0.030
PCI	0.050	0.032	0.047	0.034			
OI	0.039		0.036	0.032			

**Effect sizes of indirect effects for paths with 2 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							

OC							
SC							
CC							
PDI	0.077	0.087	0.054	0.075			0.037
PCI	0.096	0.031	0.070	0.053			
OI	0.071		0.049	0.034			

**Indirect effects for paths with 3 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.061	0.014	0.047	0.032			
PCI	0.019		0.013	0.009			
OI							

**Number of paths with 3 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	3	1	3	3			
PCI	1		1	1			
OI							

**P values of indirect effects for paths with 3 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.001	0.086	0.006	0.006			
PCI	0.065		0.121	0.169			
OI							

**Standard errors of indirect effects for paths with 3 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.020	0.010	0.019	0.013			
PCI	0.012		0.011	0.009			
OI							

**Effect sizes of indirect effects for paths with 3 segments**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.042	0.010	0.030	0.023			

PCI 0.011 0.007 0.006

OI

**Indirect effects for paths with 4 segments**

HC OC SC CC PDI PCI OI

HC

OC

SC

CC

PDI 0.006 0.004 0.003

PCI

OI

**Number of paths with 4 segments**

HC OC SC CC PDI PCI OI

HC

OC

SC

CC

PDI 1 1 1

PCI

OI

**P values of indirect effects for paths with 4 segments**

HC OC SC CC PDI PCI OI

HC

OC

SC

CC

PDI 0.081 0.132 0.164

PCI

OI

**Standard errors of indirect effects for paths with 4 segments**

HC OC SC CC PDI PCI OI

HC

OC

SC

CC

PDI 0.004 0.003 0.003

PCI

OI

**Effect sizes of indirect effects for paths with 4 segments**

HC OC SC CC PDI PCI OI

HC

OC

SC

CC

PDI 0.004 0.003 0.002

PCI

OI

**Sums of indirect effects**

HC OC SC CC PDI PCI OI

HC

OC

SC							
CC							
PDI	0.178	0.134	0.133	0.140			0.052
PCI	0.181	0.046	0.139	0.095			
OI	0.110		0.076	0.053			

**Number of paths for indirect effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	7	3	7	7			1
PCI	3	1	3	3			
OI	1		1	1			

**P values for sums of indirect effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	<0.001	<0.001	0.006	0.002			0.046
PCI	<0.001	0.074	0.004	0.008			
OI	0.002		0.019	0.051			

**Standard errors for sums of indirect effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.054	0.038	0.052	0.049			0.030
PCI	0.052	0.032	0.052	0.039			
OI	0.039		0.036	0.032			

**Effect sizes for sums of indirect effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC							
SC							
CC							
PDI	0.123	0.097	0.087	0.099			0.037
PCI	0.107	0.031	0.077	0.059			
OI	0.071		0.049	0.034			

**Total effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.411		0.284	0.197			
SC							
CC							
PDI	0.367	0.256	0.240	0.314		0.299	0.169

PCI	0.296	0.345	0.206	0.306			0.173
OI	0.339	0.267	0.315	0.210			

**Number of paths for total effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	1		1	1			
SC							
CC							
PDI	8	4	8	8		1	2
PCI	4	2	4	4			1
OI	2	1	2	2			

**P values for total effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	<0.001		0.001	0.015			
SC							
CC							
PDI	<0.001	<0.001	<0.001	<0.001		<0.001	0.012
PCI	<0.001	<0.001	0.016	0.008			0.035
OI	<0.001	<0.001	<0.001	<0.001			

**Standard errors for total effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.089		0.094	0.090			

SC							
CC							
PDI	0.070	0.074	0.067	0.086		0.065	0.074
PCI	0.093	0.093	0.096	0.126			0.095
OI	0.073	0.082	0.083	0.066			

**Effect sizes for total effects**

	HC	OC	SC	CC	PDI	PCI	OI
HC							
OC	0.283		0.182	0.128			
SC							
CC							
PDI	0.254	0.184	0.156	0.223		0.219	0.120
PCI	0.175	0.232	0.114	0.189			0.110
OI	0.219	0.183	0.204	0.134			