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Innovation networking and technological capability development in the Thai SME sector: the case of the Thai dessert industry

by

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Declaration of author's rights

Signed: Nattaka Yokakul Date: September, 2010

In memory of my beloved grandmother
Khun Yai Lamai Keawtipayanate (1928 - 2007)

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Nattaka Yokakul
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Abstract

This study explores the growth and evolution of firms through the empirical investigation of factors affecting technological capability development in the Thai dessert industry with particular focus on social capital and the role of policy interventions in the process of industrial development in general and technological capability development in particular. Other factors considered in the investigation include access to finance, competitive pressure, and risk taking behaviour.

The study highlights the importance of social capital and government interventions for technological capability development and innovation in SMEs through government-university-industry network. Public intermediary agencies are crucial for interfacing academic institutions and industry and for building the social capital base to promote strong sustainable relationship between all actors in the network. The study also discusses three cases from the Thai dessert industry to highlight the significance of social capital development and networking for cultivating the indigenous knowledge base of the Thai dessert industry.

The data for investigation in this study largely derive from a sample survey of 162 firms from the three categories of the Thai dessert industry - household-based, community-based and factory-based firms included in the sample to supplement the data obtained through questionnaire survey. This is the first time that a questionnaire survey on innovation networking was conducted specifically for this industry. In addition, interviews were conducted with the owners or managers of 22 of these firms. Interviews were also conducted with relevant government agencies and universities to elicit information on the policy mechanisms and instruments of intervention for promoting the development of SMEs through knowledge sharing and exchange.

This study contributes to knowledge in four major aspects: empirical research regarding the relationship between social capital and technological development; empirical study on technological capability development in the context of the Thai dessert industry; conceptual and empirical basis of the significance of traditional industry like the Thai dessert industry, as a carrier of indigenous knowledge that can be developed as ‘disruptive technologies’ suitable for local use; and the importance of public intermediary organisations as policy instrument for promoting technology development and sustainable innovation network in the SME sector, particularly in developing countries where ‘social capital deficit’ is preponderant.

Publications

- **From this thesis**

Yokakul, N., & Zawdie, G. (2009). The role of triple helix for promoting social capital, industrial technology and innovation in the SME sector in Thailand. *Science, Technology & Society, 14*(1), 93-117.

Yokakul, N., & Zawdie, G. (2010). Innovation network and technological capability development in the Thai SME sector: The case of the Thai dessert industry. *International Journal of Technology Management and Sustainable Development, 9*(1), 19-36.

Yokakul, N., & Zawdie, G. (2011). The knowledge sphere, social capital and growth of indigenous knowledge-based SMEs in the Thai dessert industry. *Science and Public Policy,* 38(1), 53-64.

- **Related to this thesis**

Yuwawutto, S., Smitinont, T., Charoenanong, N., **Yokakul, N.**, Chatratana, S., & Zawdie, G. (2010). A Triple Helix strategy for promoting SME development: the case of a dried banana community enterprise in Thailand. *Industry & Higher Education, 24*(3), 177-187.

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List of Abbreviations

DIP	The Department of Intellectual Property
DNA	Deoxyribonucleic acid
GDP	Gross Domestic Product
GHP	Good Hygiene Practices
GMP	Good Manufacturing Practices
GUI	Government-University-Industry
HACCP	Hazard Analysis and Critical Control Points
HEC	The Office of the Higher Education Commission
IDRC	The International Development Research Centre
IMD	The International Institute for Management Development
IMF	The International Momentary Fund
IP	Intellectual Property
IPRs	Intellectual Property Rights
IT	Information Technology
ITAP	The Industrial Technology Assistance Program
ITB	The Invigorating Thai Business scheme
JIT	The Just-in-Time System
KBS	Knowledge-Based Society
MAP	The Modified Atmospheric Packaging technology
MOI	The Ministry of Industry
MOST	The Ministy of Science and Technology
NCRT	The National Research Council of Thailand
NEC	The National Economic Council
NECTEC	The Electronics and Computer Technology Center
NESDB	The National Economic and Social Development Board
NESDP	The National Economic and Social Development Plan
NGO	Non-Governmental Organisation
NIS	National Innovation System
NSO	The National Statistic Office
NSTDA	The National Science and Technology Development Agency
NSTSP	The National Science and Technology Strategic Plan
OECD	The Organisation for Economic Co-operation and Development

OSMEP	The Office of Small and Medium Enterprises Promotion
OTOP	One Tambon One Product Scheme
R&D	Research and Development
RIS	Regional Innovation System
RTO	Research and Technology Organisation
S&T	Science and Technology
SBCGC	The Small Business Credit Guarantee Corporation
SCEB	The Secretariat Office of Community Enterprise Promotion Board
SME	Small and Medium-sized enterprise
SIS	Sectoral Innovation System
TCD	Technological Capability Development
TCI	The Thai Confections Company Limited
TH	Triple Helix System
TISTR	The Thailand Institute of Science and Technology Research
TMC	Technology Management Center
UNESCO	The United Nations Educational Scientific and Cultural organization
UNDP	The United Nations Development Programme
UNIDO	The United Nations Industrial Development Organisation

CHAPTER 1

Introduction

This study explores the conceptual and empirical aspects of networking of firms and technological capability development based on indigenous knowledge. It examines the factors that influence the innovative behaviour of firms in the Small and Medium-size Enterprise (SME) sector in Thailand with particular reference to the Thai dessert industry. The study draws on the significance of networking and social capital development for cultivating the indigenous knowledge base of the Thai dessert industry with the aim to improve prospects for the technological capability development and long-term growth of firms in the industry.

This chapter presents the background of the study and the research problem; the research aims and objectives; and a brief discussion of the procedures for investigation used in this research. It also discusses the significance of the study and outlines the structure of the thesis.

1.1 Background of the study and research problem

There is a growing body of literature on issues relating to the management of technology and innovation. Most contemporary studies on technology and innovation management have been done at different levels, albeit focusing on the organisational, sub-regional, pan-regional, national and international dimensions of the subject. The concept of ‘National Innovation System’ (NIS) emerged more than two decades and it has been widely acknowledged as a framework for contexualising the agenda for innovation and sustainable development at national- and, with necessary changes, made to it at regional-level in both developed and developing countries. NIS was first introduced as a concept by Lundvall in 1988 (Lundvall, 1988) based on Christopher Freeman’s 1985 (Freeman, 1985) study in which the latter argued that Western countries could learn from the Japanese experience in the coordination of science and technology policies at the national level. As it happened in Japan, players in the national system would know what is expected technologically to meet socio-economic needs and demands and political objectives.

The use of the nation as the basis for the study of innovation systems would appear somewhat arbitrary considering the globalisation of knowledge - particularly codified knowledge. Lundvall had, however, in mind the relationship between production and innovation systems. He thought that the inter-dependency between production and innovation would make it legitimate to take the national system of production as a standing point when defining a system innovation (Lundvall, 1988). NIS is thus understood as an interactive system of institutions, private and public firms, universities and government agencies, aiming at production, diffusion and exploitation of knowledge within national borders (Freeman, 1987; Lundvall, 1992; Nelson, 1993).

Interaction can be achieved through both market (economic) and non-market (political) mechanisms such as control and regulations, collaboration and long-term network arrangements. This would make the NIS concept a dynamically comprehensive framework for investigating, formulating, planning and positioning the national economic and social development by using technology and innovation as the main driving force (OECD, 1997). At the heart of NIS are the processes of organised knowledge production and knowledge use; and the speed and direction of these is implemented by the control and regulatory system of the nation state. But insofar as knowledge production is a global phenomenon, the essence of NIS would reduce the provision of a mechanism for the retention of wealth deriving from globalised knowledge.

Thailand is a developing country in transition from agricultural to knowledge-based economy. The country’s exposure to the rapid pace of globalisation has prompted it to focus on the generation and effective utilisation of knowledge in the course of industrialisation. However, the transition to knowledge and information-based economy has not been without problems insofar as Thailand has not made much headway in the development of infrastructure and capacity for innovation and technological progress, especially in the domain of small and medium-sized enterprises (SMEs), which constitute a large proportion of the industrial sector in Thailand. In Europe, SMEs account for about 80% of the total number of industrial enterprises (OECD, 2002); the corresponding figure for Thailand is 99% (OSMEP, 2006). Because of the preponderance of SMEs in the industrial sector of Thailand, the SME sector is considered to be very important for economic growth. Why then it may be asked, is the SME sector in Thailand characteristically weak in terms of technological capability development, particularly with respect to networking and the ability to adjust itself to advances in knowledge and technology systems?

The problem can largely be attributed to the fact that the innovation system involving the flux of communication of information and knowledge between players in the system in Thailand is yet at its infancy. It is weak and fragmented (Chairatana, 2006). Figure 1.1 explains the weakness of the innovation system at macro, meso, and micro levels in the context of Thailand. Weakness of the innovation system in Thailand is in large measure a result of the low level of social capital (see chapter 3), which has the effect of constraining communication at grassroots level, and policy implementation through bottom-up and top-down engagement in governance and network development, as would be expected by the NIS model.

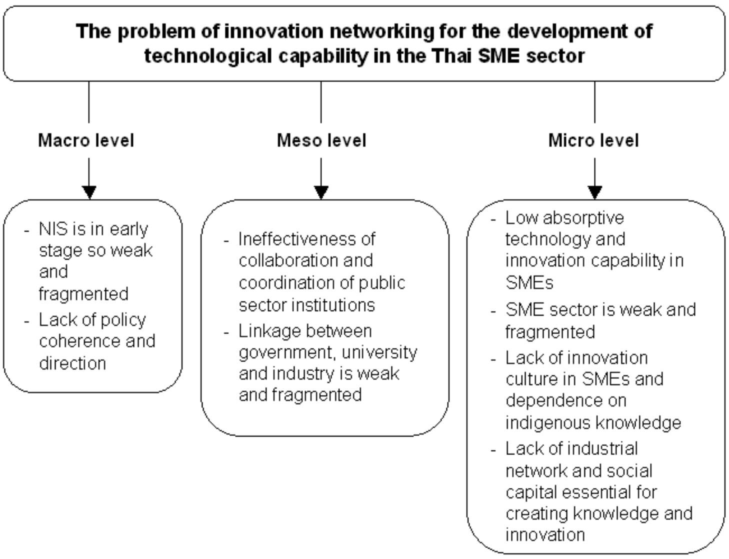


Figure 1.1 Schematic approach to the research problem
Source: Yokakul & Zawdie (2010, p. 25)

NIS is a process of social interaction that requires strong link and network development between actors. Where the network is incomplete, the scope for knowledge flux, innovation and growth is limited. This is the case in Thailand, where the NIS concept is adapted as a framework for the national S&T policy with the view to promoting industrial development, in general, and SMEs, in particular. Thai policy makers have recognised the problem that NIS in Thailand is weak and fragmented. The problem is confounded by a vicious circle in which the absence of a coherent network constrains policy implementation. Lack of policy coherence and direction in turn means that not much can be done to enhance network development and growth in the stock of social capital. The upshot of this is that there is ineffective coordination and collaboration between agencies and institutions in the public and private sectors of the economy. Not surprisingly, links between government, university and industry are weak and fragmented (Sevilla & Soonthornthada, 2000; Intarakumnerd et al., 2002). In principle, the NIS system is built bottom-up with government policy mechanism operating top-down as the system evolves. In the case of Thailand, however, the top-down operation is not complemented with the bottom-up process in that the latter lacks coherence and strength.

It may be asked why the innovation system is less effective in developing countries in terms of its impact on innovation. This study takes the position that the problem of innovation deficiency in developing countries can largely be accounted by the extent of the social capital stock that can be readily accessed. Growth in social capital stock would facilitate interaction between the various components of the innovation system. However, what is not so clear is the extent to which social capital affects the development of technological capability in Thai SMEs and how it functions.

The importance of social capital to economic growth is widely acknowledged by scholars and policy makers. Ever since Putnam (1993) popularised the concept of ‘social capital’ in collective terms as “stock of social trust”, many have sought to explain the paucity of innovation and economic growth in terms of the absence or else the weakness of the ‘social capital’ base and the failure in consequence of the major social and economic actors to interact and generate innovative ideas and economic growth (Grootaert, 1998). Social capital is vital in developing an efficient market economy as it reduces the cost of transactions by removing bureaucratic red tape, improving the scope for exchange of best practice and increasing the competitiveness of industry (Fukuyama, 2000).

The survival and growth of firms in an increasingly globalising world depends on their ability to innovate and achieve competitiveness. Successful innovation at the level of the firm requires internal and external resources - both tangible and intangible. Social capital is an intangible factor that helps firms to reduce transaction costs by facilitating access to information, knowledge and technology as well as to various types of finances.

Although linkages between SMEs, academia and government are crucial for assisting firms to network with other actors in the NIS - in particular financial organisations, professional bodies and trade associations - it is also important from the vantage point of social capital development and prospects for enhanced innovation capacity and business performance.

The particular problems associated with Thai SMEs are closely linked with the prevalence of industrial culture that is predominantly traditional and not forward looking. The government has made efforts to promote the SME sector, but to date, the effectiveness of this initiative has been rather limited. This is because policy initiatives, aimed at improving the situation of SMEs have been ad hoc, discontinuous, and not geared to promoting coordination and cooperation for long-term relationship and sustainable development.

Most of the SMEs in Thailand are family-based businesses, which are characteristically risk-averse, and are hence hardly innovative. Such SMEs would often apply old-fashioned, labour-intensive technologies (Arnold et al., 2000); and they also depend on the use of indigenous knowledge that is predominantly tacit in nature embedded in contexts but cannot be decontexualised as in the case of codified knowledge (Chew & Yeung, 2001). The challenge for SMEs is how to evolve based not only on tacit knowledge (individually embedded, undocumented such as personal know-how, skill and belief etc.), but also, equally importantly, on codified knowledge (e.g. manual, data, procedure, scientific formulae, and patents etc.).

SMEs based on use of traditional knowledge are generally inactive to link with external firms and organisations, preferring instead to go it alone. This is largely a reflection of their risk-averse behaviour and lack of trust, leading to low social network development. One consequence of this is to limit SME's access to credit facilities, as they do not have the required collateral in terms of fixed assets to be able to borrow from banks on a scale (Bank of Thailand, 2008) that would warrant expansion and growth. Nor has policy been effective in creating a suitable environment that could help grow social capital, encourage SMEs to build innovation network and facilitate knowledge transfer and sharing.

This study draws on the significance of SMEs for industrial and economic development and the importance of innovation for the competitiveness and long-term growth of industries. Although the importance of the role that SMEs play in the Thai economy is widely acknowledged, it is not clear as to how far the innovation culture is embedded in this sector. It would therefore be of interest and policy usefulness to establish the innovativeness of SMEs or their awareness about the significance of innovation and network development for their survival and growth. The importance of social capital for innovation networking and technological capability development in SMEs is also explored. Innovativeness of SMEs would, however, presuppose that the infrastructure for innovation (including the network of links between firms within and between industries and links with other organisations – government, academia and non-government organisations) will have to be developed and made to function on a sustainable basis.

1.2 Research aims and objectives

The major task of the research is to show how best indigenous knowledge could be cultivated incorporating more and better codified knowledge to underpin the growth of SMEs in the Thai dessert industry. Food production, as in the case of the Thai dessert industry, is considered to be one of the areas with a high potential of growth as a creative sector based on traditional and indigenous knowledge. Kaplinsky et al. (2009) note that this sector has a high opportunity to cater for a global demand for food if properly supported for capacity building through the mechanism of disruptive technologies. Sustaining disruptive technologies for long-term economic development would involve not only the transfer of technologies to indigenous people but also learning from these technologies. In this respect, the framework for national and regional innovation systems is crucial as it provides the institutional setting for strategic interventions to support the growth and development of indigenous knowledge-based industries.

The Thai dessert industry is selected for empirical investigation in this study. The choice is made for the following two reasons. First, the industry offers a convenient scope for investigating a case in which traditional or indigenous knowledge evolves through knowledge transfer and knowledge exchange processes. While the industry uses local raw materials, the application of new ideas would help to add value to local resources and improve the well-being of the community. Secondly, firms in this sector are SMEs, most of which operate as small family businesses. There are not many Thai dessert industries that run as large factory-based businesses.

The prospect of innovation in the Thai dessert industry can be explained in terms of factors, including the risk perception of firms; the nature of the market they face; firms' assets in terms of social capital and networking, transaction cost, access to finance and government interventions. The study aims to investigate the development of innovation culture in this sector in terms of these factors by looking into three broad categories of firms in the sector: household-based firms; community-based firms; and factory-based firms. This classification is based on the ground that the three categories of firms have different modes of management and organisation which would affect their social capital stock and innovativeness.

The objectives of the study are:

1) to show how three categories of firms perform in terms of their responses to changes in market and technology conditions, modes of management and organisation, and policy interventions that are intended to promote creativity and innovation in the industry;
2) to explore the extent of social capital for each category of firms and how this relates to the enterprise and innovative behaviour of firms in terms of

networking with other firms, with government and non-government agencies, and with academia;

3) to show how firms in the sector have evolved to date or tend to evolve; and

4) to determine empirically factors affecting the innovation prospect of firms.

To achieve these aims and objectives, the following issues are addressed:

1) Perception profiles of household-based, community-based and factory-based firms regarding risk and growth opportunities;
2) How community-based and factory-based firms compare in terms of creativity and innovation capability development operating subject to social capital constraints;
3) The role of the market in innovation (ie. extent of competitive pressure on SMEs to catching up and forging ahead); and
4) The role of policy with respect to research and development and innovation in the development of knowledge networks

1.3 Research methodology

The hypotheses of this study will be investigated using data at the macro, meso and micro levels of the economy, but relating to the Thai dessert industry. Data at the micro level will be largely of primary nature deriving from sample surveys of firms and interviews. Public policy, reports and relevant documentation are reviewed, discussed and summarised. At the meso or institutional level, semi-structure interview is employed to investigate the policy mechanism and instruments. The research methodology is fully discussed in Chapter 6.

1.4 Significance of the study

The results of the study would be expected to show (a) the significance of indigenous knowledge-based SMEs and network development among these for industrial innovation in Thailand; (b) the importance of the global market for the development of indigenous products and technological capability building in Thailand; and (c) the extent to which government has to intervene through provision of R&D and economic policy to promote innovation in Thailand.

There are many studies on innovation systems and policy for industrial promotion in Thailand, especially for hi-tech and advanced industries. However, innovation in SMEs in Thailand remains not well understood, particularly as this relates to the indigenous knowledge base of the industry. This calls for more research on the sector. The Thai dessert industry has long been overlooked for its potential to access global market on grounds that it is a traditional, low technology industry. The significance of this claim has, however, yet to be put to the test.

Accordingly, this study will show the social and economic significance of the Thai dessert industry and its potential to promote innovation and the growth of the industry through access to codified knowledge. The result of study is expected to reflect on the awareness of the Thai dessert firms and SMEs about their future growth prospects through network and technology development. Results of in-depth firm level investigation in this sector will provide new insights useful for the government to formulate appropriate policy and administrative mechanisms to promote the development of technology and innovation capability in SMEs. The results of this study could also provide lessons of experience for SME innovation elsewhere in the world.

1.5 Structure of the thesis

This thesis is organised into 10 chapters. Following on this chapter, Chapter 2 provides theoretical background and reviews the literature on innovation, technological progress and economic growth. Chapter 3 discusses issues relating to Small and Medium-sized Enterprise (SME) in the context of economic growth, social capital and the scope for innovation and growth in these firms.

Chapter 4 sets the context through a discussion of economic growth, technological and innovation policy and the innovation system in Thailand. Chapter 5 focuses on the SME sector in Thailand and the Thai dessert industry which is used to study in this research. Chapter 6 describes a research methodology and data analysis used in this study.

The result findings of the study are discussed in chapters 7, 8 and 9. Chapter 7 discusses findings relating to firm growth evolution in the Thai dessert industry. Chapter 8 assesses the relationship between social capital, technology development and innovation in the Thai dessert industry. Chapter 9 discusses the evidences relating to government initiatives for promoting industrial technology development and innovation in the industrial sector with particular focus on social capital and networking. Chapter 10 presents a synthesis of the empirical results of the study on the Thai dessert study; the implications of these for policy; and future research are addressed.

CHAPTER 2

Technological Progress, Innovation and Economic growth

According to Schumpeter and neo-Schumpeterians (Schumpeter, 1934; Nelson & Winter, 1982; Freeman, 1987; OECD, 1999a; Tidd et al., 2005; OECD, 2008b; Swann, 2009), technological progress based on creativity and accumulation of knowledge is at the heart of long-term competitiveness and economic growth. The large gap between developed and developing countries can be accounted mainly by effectiveness in the advancement in the former of technology through innovation. To be competitive in a knowledge-based economy, policy makers would need to focus on improving technological capability and innovation performance, particularly in the industrial sector. This would make countries competitive and hence attractive as destinations to direct foreign investment that would positively contribute to long-term economic growth.

This chapter, addressing the importance of technological progress and innovation to economic growth, is organised in five parts. The first part discusses innovation as a concept in general. In the second part, economic theories relating to growth, technological progress and competitiveness and the relationship between these are discussed. The discussion in the third part focuses on a model of technological progress known as Innovation System (IS) and its applications in terms of the national, regional, sectoral innovation systems and the triple helix system. National Innovation System (NIS) explains the institutional context, links and interactions between actors in the system and how it facilitates innovation diffusion through networking, fostering the growth of firms, regions and national economies (Nelson, 1993; Cooke, 1996; Edquist, 1997; OECD, 1997; Etzkowitz, 2002; Chairatana, 2006). The fourth part discusses the basic elements of innovation system focusing on institutions, organisations, knowledge and learning, linkage and networking as well as government policy. The fifth part provides a general framework linking innovation and technological progress to economic growth.

2.1 Innovation as a concept

Innovation is variously conceptualised in the literature and has become a common feature in the study of economic growth. According to the European Commission (1995), innovation refers to "*the successful production, assimilation, and exploitation of novelty*". OECD (1992; 1997; 2005) defines innovation as "*the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations"*. There are many aspects of innovation of which its novelty and marketability are significant. According to the Oslo Manual (OECD, 2005a), innovation is what is 'new to the firm, new to the market and new to the world'. Innovation can occur as a single important change (breakthrough or radical innovations) or a sequence of small changes which together constitute a significant change (incremental innovation). At firm level, those changes are considered to be innovation when they are put to use (as in process innovation) or marketed (product innovation). Central to the various definitions of innovation is the recognition of it as a systemic factor underlying the dynamics in the economy, society, politics, and culture.

Schumpeter's was a seminal work on innovation in relation to economic growth (Schumpeter, 1934). He conceptualised innovation championed by the entrepreneur as a process of 'creative destruction'. Creative destruction is a process through which new developments, far from being an extension of the past, represent a radical departure from it. It is a discontinuous process associated with Schumpeter's radical innovation and represents a total change in the state of the art and behavioural patterns - patterns relating to technology, organisation and society. At the heart of the Schumpeterian innovation process is the entrepreneur, the agent through whose activities innovation evolves as a system and brings forth economic change from within.

Schumpeter (1939) explained 'innovation' as 'invention' or new idea that is successfully applied in practice and is realised as a product or a process that is of social and economic significance. There is thus a trilogy to Schumpeter's understanding of innovation and technological progress, which involves progression from invention to innovation and their diffusion through commercialisation. An invention first occurs as a new idea, which if successfully implemented into the development of useful products and processes becomes innovation. For innovation to be complete, it has to be capable of diffusion or widely commercialised. Fagerberg (2005, p. 4) summarises the Schumpeterian scheme as an important distinction between invention and innovation, the former being the first occurrence of an idea for a new product or process, and the latter the first attempt to carry it out into practice. Sometimes, there is a close connection between innovation and invention, but not all innovation derives from invention and not all invention turns into innovation. The ultimate goal of innovation is to make things better and enhance the long term competitiveness of the firm and the economy both in qualitative and quantitative terms.

In Schumpeter's trilogy (Schumpeter, 1947; Stoneman, 1995), technological change involves three stages: invention, innovation and diffusion. The first and second are development and commercialisation stages. The last stage, diffusion, is an increase in wider application and implementation of innovation. Bell and Pavitt (1993) explain the distinction between 'innovation' and 'diffusion' in that diffusion of innovation involves more than technology acquisition and assimilation of know-how from set up of new machinery and product designs. Diffusion also involves eventual adaptation of those technologies and practices to suit specific conditions and achieve performance standards. Some firms who have bought new machines or obtain know-how from overseas, may only know how to operate it but not how to adapt and make any changes to meet their requirements or make further technological improvements. In such circumstances, firms would end up keeping those machines at pre-setting conditions or, in worse cases, would go back to use their previous, old technology after adoption of the new. This is the case of developing countries where the main problem is how to embed imported technology and innovation in local human resources and increase the speed of diffusion.

Innovation and diffusion always involve risk and uncertainty (Rosenberg, 1994). The risk associated with the innovation process increases with radical changes. Uncertainty varies by sectors and future of developments are unpredictable. Roger

(2003) addresses the basic characteristics of innovation affecting speed of diffusion and personal decision to adopt an innovation. These characteristics include: relative advantage, compatibility, complexity, trialability and observability. A measure of the relative advantage of innovation is the extent to which this innovation has improved the state of existing technologies and the net benefits thereof. Compatibility is the adaptive capability of innovation to personal life in terms of value creation and fulfilment of the needs of users. Complexity is a significant factor determining the adoption of innovation. If innovation is easy to use, it tends to be widely adopted. Trialability refers to testing and experimental ability of innovation prior to use. If innovation is highly visible or observable, it will have a wider social and economic impact.

According to OECD (2005a) and Tidd et al. (2005), there are four broad types of innovation: product innovation, process innovation, market innovation or position innovation, and paradigm innovation or organisational innovation. The first and second edition of the Oslo Manual (OECD), published in 1992 and 1997, covered only two types of innovation - product and process innovation - with the focus on technological innovation. Non-technological innovations were added as supplement in annexes. Later in the third edition published in 2005, two types of non-technological innovation were added to the list: organisational innovation and marketing innovation. The latest version covers all aspects of innovation applied in both manufacturing and service industries.

Firms would consider product innovation when the market is highly competitive. This often results in product differentiation (Weiss, 2003). Process innovation tends to occur when the market is less competitive and products are not very diverse. Process innovation involves changes and improvement of production process including investment in new machinery and equipment. Organisational innovation is a new way of management relating to changes in modes of management, such as implementation of new management practices or business process reengineering. Frequently, there is a close link between process innovation and organisational innovation when new management practices are implemented in processes relating to production such as Just-in-Time system (JIT) or lean technology. Organisational innovation is clearly defined when improvement of management process occurs solely in a service industry. For manufacturing and service industries, organisational innovation can be defined as improvement in the social system of an organisation which affects regulations, procedures, roles and arrangement relating to communication among people and the way to manage people and resources. A discrepancy of all types of innovation in an organisation may retard improvement in business performance in terms of competitiveness and growth (Damanpour & Evan, 1984).

Innovation can be categorised as radical innovation and incremental innovation. Schumpeter points out only the importance to radical innovation as a process of ‘creative destruction’. To him, the salient feature of innovation is its ability to radically transform the position of the economic agent, be it the economy (at macro level) or the firm (at micro level). So, ‘incremental innovation’ does not enter his lexicon. More recent work by neo-Schumpeterians, Freeman among others, however, show the significance of both types of innovation, and that incremental innovation indeed occurs more frequently than radical innovation.

Radical innovation often involves large amount of investment and resources and high degree of knowledge, risk and uncertainty; but, if successful, it yields high return of far reaching consequences (Damanpour, 1996). Incremental innovation, which occurs in product and process development, requires less knowledge embedded in organisations and it involves smaller changes and less risk than radical innovation. Incremental and radical innovations have different impacts affecting activities from component to system level. Figure 2.1 shows the characteristics of incremental and radical innovation dimensions.

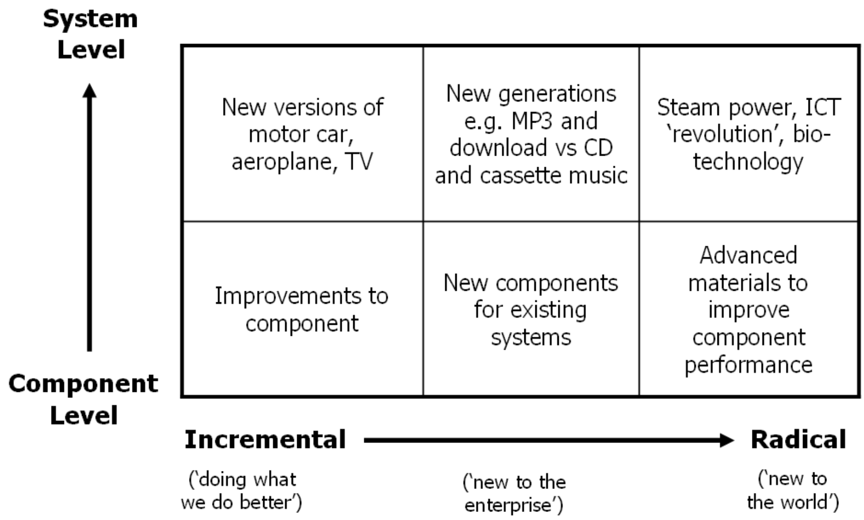


Figure 2.1 Dimensions of innovation

Source: Tidd, Bessant and Pavitt (2005, p. 12)

Based on an empirical study, Dewar and Dutton (1986) argue that large firms tend to have more radical innovations than small firms. This could be the advantage of being large and having economies of scale effect and higher market power. Small firms' access to limited resources and the limited risk they could bear would make them likely sources of incremental innovation. This does not, however, mean incremental innovation is exclusive to small firms. There are many factors including environmental and organisational complexity, such as age of chief executive officier, human factor and intra-firm linkage etc., that predict radical and incremental innovation in firms (Koberga et al., 2003). While 'radical innovation' creates a discontinuous change to existing state, and hence makes a radical departure from the existing state of product or process designs, 'incremental innovation' continuously builds on and hence complements with existing designs.

2.2 Conceptual schemes relating growth and innovation

This section discusses three major conceptual schemes explaining the importance of technological progress to economic development, including Schumpeter's explanation, the neo-classical scheme and the evolutionary growth theory.

2.2.1 Schumpeter's theory of economic development

Joseph Schumpeter is one of the pioneers in the study of innovation. He probably is the first economist who clearly captures the importance of technological progress in the process of economic development. In 1934, he published "The theory of economic development" that explained innovation and its agent, the entrepreneur, as the major dynamic force behind capitalism. This early work is often referred to as Schumpeter Mark I. Its focus is mainly on the individual entrepreneur, the agent of innovation. Schumpeter describes innovation as a 'wave of creative destruction' - a process which is discontinuous and involves progress happening not smoothly but in 'fits and starts', not building on existing schemes but replacing them all afresh. His study stands in sharp contrast to the neo-classical scheme which is conceived to function on the basis of marginal changes. For Schumpeter, creative destruction is the basis for effective and sustainable competition. Price competition and the monopolist can be defeated by 'the competition from the new commodity, the new technology, the new sources of supply, the new type of organisation' (Schumpeter, 1942). He indicates that innovation shapes the market structure and that entrepreneurs, having high innovation capability, can survive in a competitive market.

In his later work, referred to as Schumpeter Mark II, Schumpeter emphasises innovation in large firms. He believes that, in concentrated markets, large firms have more capability to be innovative than small firms. This is because large firms have more advantages than small firms -e.g. scale advantages (cost reduction at high volume of production), market power, financial stability, and marketing performance- to draw on research and development (R&D) on innovation. This concept is supported by Galbraith (1952), who indicates that conducting research and development is costly and involves high risks, not favoured by small firms. A large firm is in a better position than a small one to minimise R&D cost and make full use of R&D results. The work of Arrow (1962a) has given more support to Schumpeter and Galbraith but concentrated on the risk averse behaviour of small firms and intellectual property rights. He argues that small firms generally hesitate to invest in R&D because such an enterprise is costly and risky for them. In terms of property rights protection, it is more likely that small firms are less able to guard their inventions against product innovation which results in market loss. This would make the Schumpeterian hypothesis seem logically credible. However, to date, empirical support to this hypothesis has been few and far between, as shown by studies on firm size, market power and innovative capability (see Pavitt et al., 1987; Acs & Audretsch, 1988; Synreonidis, 1996). Chapter 3 discusses this further in relation to the scope for creativity and innovation in small and medium enterprises (SMEs).

Although Schumpeter is widely acknowledged for his seminal work on innovation, he is not without criticisms. In particular, his failure to recognise the significance of ongoing incremental changes diminishes the scope of innovation and belies the evidence of continuous technological change (Witt, 2002). Incremental innovation is generally associated with small-scale enterprises and is expressed in product/process improvements (Tidd et al., 2005). Moreover, Schumpeter did not provide a theory of innovation explaining the process of innovation (Fagerberg, 2003). Freeman and Carlota (1988) also point out that Schumpeter's analysis fails to acknowledge other essential facets of economic development, e.g. international knowledge transfer and diffusion, the techno-economic paradigm and government interventions.

While Schumpeter's work has gained much appreciation for being inspirational for further research, a lot of work has been undertaken to explain the innovation process and its impact on entrepreneurship, competitiveness and long-term economic growth. Schumpeter's work thus provided the seed for the development of research in endogenous or new growth theory and evolutionary economic theory. But it is also worth considering that most of the empirical and analytical work on innovation has arisen from a critique of the neo-classical model of economic growth.

2.2.2 From Neoclassical model of economic growth to New Growth Theory

Whereas in Schumpeter's scheme of technology with respect to growth is endogenous to the system, in the neo-classical system, technology is considered to be an exogenous factor. The growth model developed by the work of Robert Solow (1956, 1957) and Swan (1956) in neo-classical tradition, expounds the main driving forces of economic growth to be found in the physical factors of production function

– i.e. capital, labour, land and technology – which are endogenous. Technological progress is built into the neo-classical model as an exogenous factor. In other words, the contribution of technological progress to economic growth is independent of the model; and to the extent technological progress is exogenous, concern about innovation and technology policy would not make sense. The model is rather concerned about the quantum of physical resources – and growth occurs in proportion to the efficiency with which existing resources are employed, and also changes in quantity of availability of these resources (Mulder et al., 2001).

The neo-classical model can be illustrated by the following diagram showing output as a function of factors of production – capital and labour in this case – and technology is given.

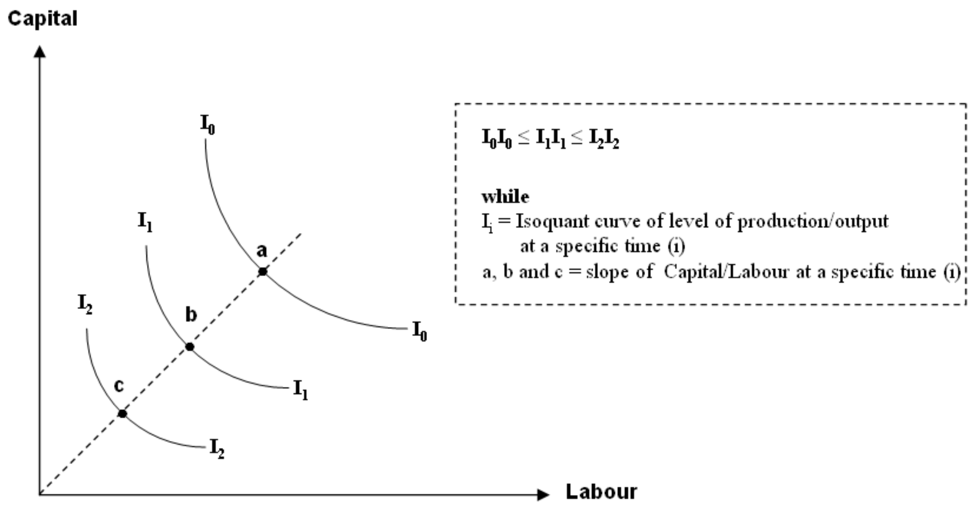


Figure 2.2 A Capital-labour isoquant graph and technological progress
Source: adapted from Salvatore (2006, p. 153)

The isoquant I_0I_0 represent a level of output which can be produced using different factor proportions – capital intensive or labour intensive. Factor prices set in the factor market would determine the choice of appropriate factor proportion. So if capital is expensive in relation to labour, the factor proportion would be represented by high labour intensity, and if labour is expensive in relation to labour, capital intensive technologies would prevail. The shift from I_0I_0 to I_1I_1 and I_2I_2...over times is, however, a result of technological progress which enables less and less of both resources to produce the same level of output or more (i.e. $I_0I_0 \leq I_1I_1 \leq I_2I_2$). But technological progress is assumed and not explained, and what happens during the shift from ‘a’ to ‘b’ and ‘c’ is not clear. What is clear, though, is that technological progress is associated with economic growth. In the neo-classical system of growth accounting, the proportion of growth rate that cannot be explained by changes in factor inputs including labour capital and natural resources, is attributed to the so-called ‘Solow residual’ or the rate of growth of total factor productivity. It is considered to be the rate of technological change in the economy which is referred to as the ‘ignorance part’ in Solow model (Abramovitz, 1956, 1993).

Another assumption of the neo-classical model is that static equilibrium exists in the economy. This contrasts with Schumpeter’s thought of ‘wave of creative destruction’ and evolutionary process based on the presumption that there is no equilibrium in market since it would anyway be disturbed by innovation. According to the neo-classical law of diminishing returns mentioned in Solow-Swan model, there is no reason to further invest in capital beyond the constant return to scale point since the output will decrease. This concept is different from the thought of Nelson and Phelps (1966) that highlights the importance of investment in human capital to economic growth. Investment in people or workers takes the form of education and training, which directly relate to technological progress and economic development. The Solow model also has many limitations from other assumptions such as the limitation of knowledge to codified sources; equal technological utilisation of firms; and no cost barrier to access knowledge and technology (Mytelka & Smith, 2001). This makes the model inadequate to explain the role of knowledge in economic growth.

The Solow model, however, prompted interest in endogenising knowledge and technology factors in explaining growth. In the neo-classical model, long-term growth is determined by assuming rather than explaining the rate of savings (as in the Harrod-Domar model) or the rate of technical progress (as in the Solow growth model) (Domar, 1964; Sato, 1964; Solow, 1994). What the endogenous growth model does is to explain sources of growth in general and the rate of technical progress in particular. Arrow’s seminal paper on ‘learning by doing’ (1962b), provided the basis of the so-called endogenous or new growth model developed within the neo-classical framework by Romer (1986) and Lucas (1988). While the traditional neoclassical growth model regards technical progress and knowledge as exogenous, the new growth model perceives knowledge to be endogenous. That is why the new growth model is referred to as 'endogenous growth model' and the study of endogenous growth perspectives as the 'neo-Schumpeterian approach' to growth (Mulder et al., 2001). Rather than categorising the contribution of technological progress as a residual, the new growth model treats technological change as one of main factors generating growth. According to Romer (1990), the model addresses that efficiency of the production process also results from collective learning and knowledge embedded in human capital. Knowledge is different from physical capital in that investment in its production and use can generate increasing returns to scale. Romer perceives that knowledge is open as a public good and is freely obtained from knowledge spillover through technology transfer. Knowledge can be applied to production (increasing returns) and research and development activities (generating innovation). The new growth model provides a comprehensive approach to growth by focusing on knowledge and human capital as sources of technological progress and growth. Although it is possible to construct endogenous growth model with perfect competition as the underlying assumption, as in the neo-classical model, in many endogenous growth models, the assumption of perfect competition is relaxed and an element of monopoly is introduced to make allowance for the occurrence of innovation. Endogenous growth theory also presumes that unlike in neo-classical theory, policy interventions - for instance in the form of subsidies for R&D initiatives – can have an impact on the long run growth rate of the economy by increasing the incentive to innovate (Shaw, 1992).

The endogenous growth model assumes constant marginal capital at the aggregate (macro) level; and that the limit of marginal product of capital does not approach zero at the economy level, even though at the firm (micro) level marginal product of capital is diminishing. This divergence between marginal product trends at macro and micro levels is attributed to the assumption of constant returns underlying perfect competition at the aggregate level, on the one hand, and market imperfection at the micro level, on the other. In other words, the endogenous growth model tends towards equilibrium solution, much in line with the neo-classical tradition, whereas the Schumpeterian position is one which keeps on moving away from equilibrium.

For instance, a firm which takes the lead in innovation would reap monopoly profit, but in the absence of patent rights, free entry would see monopoly rights due to the innovation competed away. In such circumstances staying on lead would require firms to invest profits made in innovation through R&D. This is very much in line with Schumpeter's position that innovation would keep the economy in a steady state of growth. What is not clear in either case, however, is the mechanism underlying the innovation process.

Neither the endogenous growth model nor Schumpeter's position, however, explain fully the innovation process let alone consider it as a complex systemic phenomenon. In the case of the endogenous growth model, unlike in Schumpeter's case, the convergence towards equilibrium is at odds with the character of the innovation process, which relates more to disequilibrium position. The new growth theory is unable to explain the institutional complexity and economic growth at the macro level as it is based more on the micro than on macro level. The inadequacy of the endogenous growth model to explain the innovation process has nonetheless prompted alternative approaches to elucidate the process of change, non-equilibrium market, and the institutional complexity of economic development. One of these approaches is the evolutionary theory of economic growth pioneered by Nelson and Winter (1974, 1982).

2.2.3 Evolutionary theory of economic growth

In evolutionary theory, technology or the innovation process is conceived as a system such that the pace and direction of technical change is influenced by institutional and social changes. Thus, the evolutionary theory of economic growth incorporates institutional changes and technical progress into mainstream economic analysis. The most influential work in this respect is that of Nelson and Winter (1982). Nelson and Winter's work was much inspired by Schumpeter's perspective of 'creative destruction' and non-equilibrium in economic development (Clark & Juma, 1988). The theory focuses on the dynamics of the innovation process and self-transformation at micro or firm level responding to changing market conditions and thrive to be able through competition (Nelson & Winter, 1982). Nelson and Winter explained how firms adapt to changes in the wider institutional environment through the process of search routine and selection. Routines are about capabilities and decision rules which change over time as a result of either deliberate problem solving efforts or external events. Search processes can modify the routines and occur in response to changes at the macro level such as regulating, governing, production, and the market. The search finishes with the selection of a particular technology or technology paradigm, which in turn modifies the routines and prompts adaptation to new institutional circumstances. Thus, in a constantly changing environment, firms that survive and grow within a population of firms are those with the higher ability to adapt to environmental changes. Why do some firms survive and grow and others do not? The routine processes define the 'genetic inheritance' of firms and hence their competitive characteristics and innovative capabilities. They also determine the searching processes. These characteristics of the firm persist over time and together with the influence of the cultural and institutional environment determine the behaviour of the firm. Over time, the firm evolves as a result of the search by new routines – i.e. adaptation to long-term changes. Innovation results from a kind of motivation (behaviour) that is radically different from the motivation to adopt traditional technologies.

In contrast to standard Neoclassical perspectives, features associated with innovation dynamics, namely the diversity at the micro level with respect to technological capability and behaviour, uncertainty and path dependency, are clearly explained in the evolutionary theory (Dosi & Orsenigo, 1988). The theory looks into the role of both codified and tacit knowledge at the level of the firm, learning by doing, and routines and skills, which are mainly embedded in human capital. Witt (1998) proposes to reconsider the role of the firm in evolutionary framework by adding imagination and leadership that are crucial for stimulating firm level innovation.

Responding to the critique challenging the theoretical adequacy of the evolutionary framework, Nelson (1994) points out the difficulty of modelling the co-evolution of various institutions in a real phenomenon. This is because of the complexity of institutions involved in the 'evolutionary process'. Fagerberg and Verspagen (2002) explain this complexity to be the result of the path dependent nature of innovation and technological progress.

The evolutionary perspective has been fundamental for studies relating to entrepreneurship, firm behaviour, innovation and economic development. Importantly, it provides a crucial framework for the study of an innovation system as a dynamic model of economic growth, as shown in the triple helix approach to innovation (see section 2.3.4).

2.3 Innovation as a systemic phenomenon

Following Schumpeter, a lot of work has been undertaken to explain the innovation process and its impact on competitiveness and long-term economic growth. But innovation was initially conceptualised as a linear process. The basic linear model of innovation, which draws on the Schumpeterian trilogy, involves basic research inputs at one end resulting in outputs in the form of product and process innovation at the other end. This, however, fails to take into account the importance of multiple knowledge sources and feedback loops. This limitation led to the emergence of non-linear, integrative models to explain innovation as a dynamic process.

The early generation innovation studies in the 1950s and the 1960s were based on a linear model that was driven either by technology push (first generation) or market-pull (second generation), as shown in Figure 2.3.

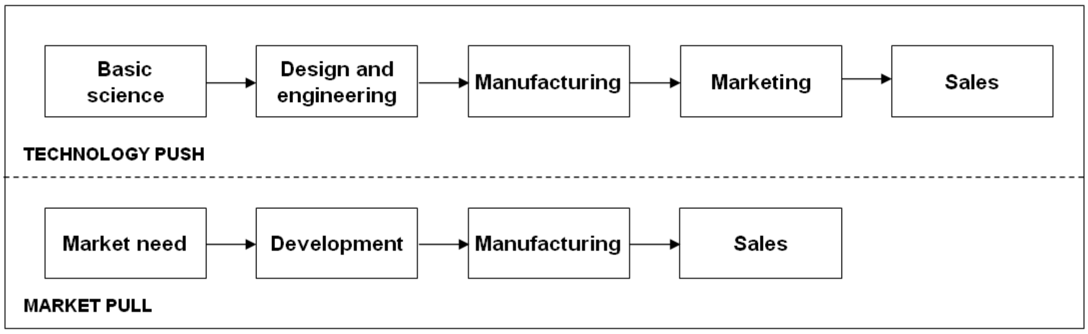
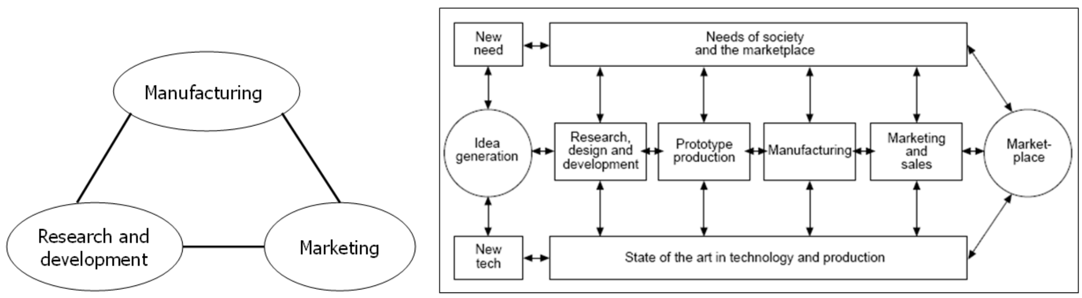


Figure 2.3 Technology push and market pull of innovation process
Source: Rothwell (1994, pp. 8-9)

The simple linear model of innovation is viewed as a traditional process composed of sequentially separable stages with no feedback loops, starting with basic science (in the case of science push) and market need (in the case of demand pull). The linear model, however, misrepresents the nature of the innovation process (Kline & Rosenberg, 1986), as innovation is a much more complex process than a straight line.

It involves creativity, knowledge accumulation and other important inputs from external sources like feedback from users. Lundvall (1985) viewed the two linear models to be no better than a black box as they failed to give full understanding of the innovation system underlying a production process. The limitations of the linear model of innovation system motivated the need to consider a non-linear model which is more complicated, but realistic.

Galbraith (1982) argues that whether it is driven by technology push or market pull, the innovation process involves knowledge of all major elements simultaneously coupled with interactive communication paths as seen in Figure 2.4. At organisation level, he perceived that innovation usually occurs in groups of knowledge specialists combined together rather than individuals. While the first and second generations are represented by the linear (pipeline) model, which limited inputs to the innovation process from multiple knowledge sources, the third generation studies (based on the Rothwell model) include feedback loops as communication paths generating internal input (idea generation, new technology, etc.) and external input (market needs, social needs etc.) for the innovation process. This is called 'the coupling model' in which all components connect as a complex, interactive network of technological capability, and market and social needs as shown in Figure 2.4.



(a) Simultaneous coupling of knowledge by Galbraith

(b) The third generation 'coupling model' of innovation by Rothwell

Figure 2.4 The third generation of innovation system – the coupling model
Source: adapted from Jay R. Galbraith (1982) and Rothwell (1994)

However, the coupling model does not provide information of external resources of knowledge deriving from business network and supply chain as seen in Japanese industry. So, a fourth generation emerged during the 1980s, depicting an integrated process centred on strategic business alliance as shown in Figure 2.5. The model integrates suppliers collaborating in new product design and development process as in the automotive or electronic industries in Japan (Dodgson et al., 2002).

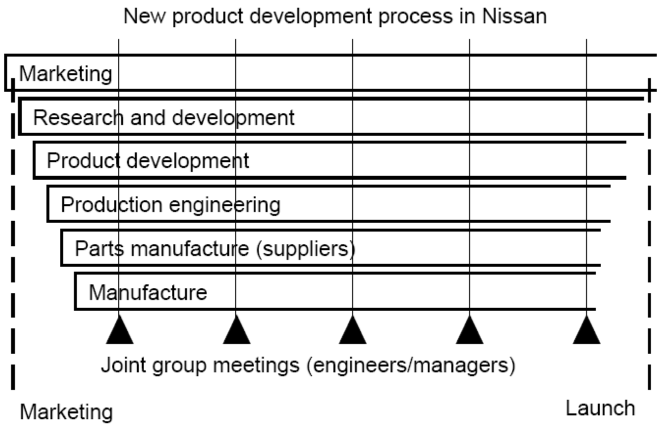


Figure 2.5 Example of the integrated (fourth generation) innovation process
Source: Rothwell (1994, p.12)

The fifth generation of the innovation process (Rothwell, 1994) is a ‘process of system integration and networking’ which is developed based on the fourth generation but emphasises continuous change and improvement. The model addresses strategic elements, including time and cost management, corporate flexibility and responsibility, customer focus, electronic data processing, quality management policy that reinforce the firm’s technological capability (Galanakis, 2006). Rothwell’s fifth generation of innovation mainly focuses on innovation at firm or organisational level. Basic to the model is that the new innovation is a systemic and dynamic process involving interaction of players at the national level. Interaction between key players is conceived to be one of the most critical driving forces of innovation.

Following Rothwell’s typology, some scholars have tried to conceptualise the sixth generation of innovation model. For example, Chaminade and Roberts (2002) propose a model including intangible factors such as social capital that facilitate tacit knowledge sharing, interactive learning and social network development in an innovation system. Marinova and Phillimore (2003) also sought to extend Rothwell’s typology through their contribution to the sixth generation innovation model, in the form of so-called 'innovative milieux'. Their model focuses on the importance of geographical proximity and environmental conditions that facilitate knowledge generation and diffusion in certain localities. The model thus tries to explain why innovative firms are concentrated in some locations or regions. This concept is similar to the concepts of innovation cluster (Porter, 1990); learning region (Florida, 1995; Morgan, 1997) and regional innovation system (Cooke & Morgan, 1994; Cooke et al., 1997). As the nature of innovation system is evolutionarily complicated and varied across countries, the wider and deeper perspectives of innovation system still pose a challenge for research.

The non-linear approach to innovation provides the basis for the development of the concept of 'National of Innovation System' (NIS) (Freeman, 1987; Lundvall, 1988; Nelson, 1993) and the Triple Helix (TH) system (Leydesdorff & Etzkowitz, 1996; Etzkowitz & Leydesdorff, 2000) as a framework for analysing the role of innovation in economic development at national and regional levels. NIS (see section 2.3.1) and TH (see section 2.3.4) concepts are based on the interaction of actors as part and parcel of the innovation process, which involves, among other things, the generation and diffusion and knowledge. NIS also provides a geographical framework to ensure that the benefits of innovation are not totally externalized and lost through international trade. So NIS is used as a policy basis for promoting innovation and capability development at regional and national levels as well as sectoral level. Triple Helix adds to the systemic view of innovation arising from NIS by focusing on the institutional, economic, political and technological factors, which through their interaction pave the way for the innovation process.

2.3.1 National Innovation System (NIS)

The concept of National Innovation System (NIS) has drawn the attention of policy makers across the world as a mechanism for interactive learning through knowledge exchange and technology transfer at national level. This has become particularly important in view of the globalisation of knowledge and the growing concern for capturing the benefits arising from knowledge at national and regional levels. After all, nations/regions allocate resources to promote R&D and innovative activities with the view to enhance prospects for technological progress and long term economic growth. Thus the NIS concept is a policy framework used to investigate, formulate, plan and position national economic and social development by using technology and innovation as the main driving force.

The term ‘system of innovation’ was firstly used by Lundvall (1985) to explain the systemic pattern of ‘product innovation and user-producer interaction’. This is akin to the Rothwell’s fifth model of innovation process. However, it is Freeman who formally defines ‘national system of innovation’ as “the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technology” (Freeman, 1987, p. 1). NIS is later variously defined by many scholars (Lundvall, 1992; Nelson, 1993; Patel & Pavitt, 1994; Metcalfe, 1995). In general, NIS is about the interactive system of institutions, private and public firms, universities and government agencies, aiming at the production, diffusion and exploitation of knowledge within national borders in order to improve technological capability (OECD, 1997). Interaction can be achieved through both market and also non-market mechanisms such as collaboration and long-term network arrangements. The NIS framework would enable policy to condition the speed and direction of technological advance in a country (Patel & Pavitt, 1994) through the provision technology and innovation policy (Metcalfe, 1995). Actors and the linkages between them in the NIS are shown in Figure 2.6.

The basic components of the national innovation system are public and private organisations, and institutions whose interactions would stimulate knowledge and interactive learning. University research units, research organisations, technology transfer offices, public and private funding organisations, and firms are the principal nodes of the NIS. Linkages and interactions among these nodes are important for shaping the speed and direction of the innovation system (Cooke et al., 1997).

The NIS can be analysed at geographical and sectoral (macro, meso and micro) levels. The geographical dimension of innovation as a system can also apply to wider areas (international, continental levels) and to smaller areas (national and sub-national levels) (Freeman, 2002). The focus on this dimension is on geographical proximity, networking, knowledge sharing within a boundary (Cooke et al., 1997;

Saxenian, 2000; Morgan, 2004; Asheim & Gertler, 2006). To the extent that NIS finds expression in sectoral terms, it is very much akin to the Triple Helix approach to the innovation process.

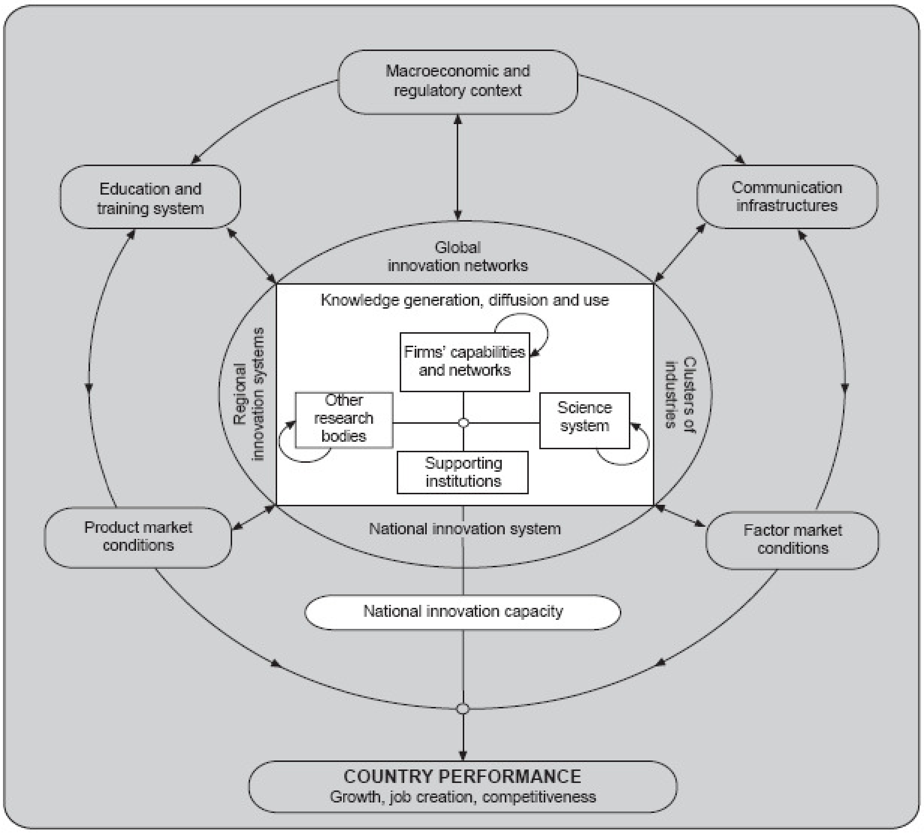


Figure 2.6 Actors and linkages in the innovation system
Source: OECD (1999, p.23)

Also related to the NIS concept is the work of Porter (1990), addressing the concept of industrial cluster and national competitive advantage. The cluster development strategy is now widely applied in industrial policy relating to geographical concentration of interrelated firms. The industrial cluster approach dates back to the work of Alfred Marshall which addressed a localised industry and the advantages deriving from agglomeration of skilled workers and knowledge synergy that strengthen a cluster (Marshall, 1890). Firms in a cluster derive many benefits in terms of economies of scale and externalities arising from economies of agglomeration. These provide the conditions for innovation and productivity growth (Mytelka, 2000). However, there are limitations to the use of the cluster approach, as each region has its own assets and limitations which define the pattern of development process appropriate to it. According to Saxenian (1994, 1999), neither the concept of external economies nor that of an industrial cluster can account for the divergent trajectories of apparently comparable regional economies.

2.3.2 Regional Innovation System (RIS)

Regional innovation system refers to innovation system at local or regional levels without focus on any particular industry. Therefore, rather than emphasis on specific sectors, RIS is about institutional settings, path dependency, technological change and interaction among actors located in a specific region (Cooke et al., 1997).

According to OECD (2008a), the significance of RIS is twofold highlighting the crucial of good governance at all economic levels raging from macro or national level to micro or firm level. Firstly, innovation generated from a dynamic system at regional level is crucial for successful implementation of innovation policy at national level. Good results of innovation production at a regional level could improves overall economic performance and competitiveness of a country. Secondly, innovation performance of an individual region can improve competitiveness of a region by increasing the productivity and innovation capability at firm level.

Issues relating social capital, interaction and networking that account for the coherent of innovation as a systemic phenomenon are more explicit in RIS than in NIS. This has implication for the regional advantages relating to the effectiveness of learning process through the so-called 'proximity matter' (Malmberg & Maskell, 1997), which involves time and geographic, social, and cultural and economic dimensions. Geographic proximity enhances an interactive learning process by shortening the time to travel, reducing cost of communication and providing better transmission. Even though modern technology facilitates long distance communication, some kinds of knowledge, particularly tacit knowledge, are better transferred through direct contact such as face-to-face communication, on-the-job training and other routine activities. Local specificity offers social and culture proximity which helps to develop mutual trust important for knowledge transfer and networking. It also enhances ability to understand not only language but also norms, culture, shared values and other commonalities. These benefits would lead to spatial agglomeration which creates knowledge network among firms and knowledge sources engaging in an interactive learning process.

There are three main types of RIS, namely, territorially embedded regional innovation system; regionally networked innovation system; and regionalised national innovation system (Cooke, 1998; Asheim & Gertler, 2006). Firms in *territorially embedded* RIS have their learning and innovation activities based mainly on localised learning process within their industrial network. This relates to regions without extensive direct interaction with external knowledge sources. This is what Cooke (1998) refers to as *'grassroots RIS'*. *Regionally networked innovation system* or '*network RIS'* is based on an extensive network between firms and external knowledge organisations whether the knowledge sources are from within the region or from elsewhere. This largely results from the provision of a well-planed institutional infrastructure and government policy interventions to support innovative capability and strengthen regions. *Regionalised national innovation system* or *'dirigiste RIS'* is where the knowledge or technology comes from outside the region and the regional institutional infrastructure is integrated into the national innovation system. Here, external actors from different knowledge sources outside the region play crucial role in knowledge and technology supply to firms within the region, and the development of network and collaboration within this system is largely driven by the knowledge proximity of people. Science parks and technolopoles in many countries are the best example of this case.

Radical innovation tend to occur more in *regionalised national innovation system* (Asheim & Coenen, 2005; Asheim & Gertler, 2006). This is because of benefits arising from exogenous knowledge sources, R&D collaboration and cooperation in terms of new knowledge, technology and information. In contrast, tacit knowledge and know-how dominating *'grassroots RIS'* would limit regions from acquiring best practice technologies and new knowledge from external sources. Therefore, innovation deriving from *'grassroots RIS'* are mainly of the incremental innovation type.

2.3.3 Sectoral Innovation System (SIS)

The Sectoral Innovation System (SIS) involves a network of institutional actors through which knowledge articulates and innovation occurs in a specific industry (Malerba, 2006). Unlike in NIS and RIS, the geographical constraint does not operate in the SIS, so SIS can be considered at local, regional, national or even global levels. While, firms in NIS and RIS are from various sectors, firms in SIS are more specific to one sector. Firms in SIS share basic commonalities, particularly for knowledge and product groups.

According to Breschi and Malerba (1997), SIS can be defined as “a system or group of firms active in developing and making a sector’s products and in generating and utilising a sector’s technologies”. Firms in such a system are related in two different aspects: cooperation and competition. Cooperation occurs in the development of technology and innovation. Competition occurs as a selection process of innovative and market activities involving firms’ capabilities and innovative performance. Even though SIS focuses on a specific industry, the interacting agents in the system are heterogeneous including users, producers, government agencies, universities, financial institutes, and non-governmental organisations (NGOs) like industrial association. The effectiveness of SIS depends on the performance of supporting infrastructure and knowledge network in the system.

SIS focuses on the specific knowledge base in the system and how it performs and evolves in terms of generation, diffusion and combination (Bergeki et al., 2005). Conceptualised from an evolutionary perspective, the dynamic process and evolution of SIS is different and varies greatly among industrial sectors ranging from traditional to hi-tech, and IT industrial sectors (Malerba, 2004).

An individual sector having the same product ranges uses various technologies in production processes. These technologies are however interdependent and complementary, and as such provide the basis for interactive learning and the accumulation of knowledge. Technological proximity, commonality of knowledge base and of basic attributes characterises explains the differences between sectors.

Sectoral innovation system relates to national and regional innovation systems in terms of institutions (e.g. patent and intellectual property system, regulation, technology policy and knowledge infrastructure) which affect innovation activities and the performance of a sector. The study of innovation system at sector level provides understanding of the peculiarities of the innovation process corresponding to the various sectors. With this information, sectoral technology policy can be appropriately constructed drawing balance between the horizontal sectoral framework and customisation to a specific industry (OECD, 2006).

2.3.4 Triple Helix System of innovation

The concepts of national and regional innovation system use the geographical dimension as a point of departure to explain technological development and innovation, arising from the interactions of institutions and organisations as key players. The Triple Helix System does not defy the principles underlying the NIS or RIS. Rather, at seeks to explain the evolutionary nature of the mechanism that defines the dynamics of change in the relationship between the actors in the system. Knowledge generation through the process of learning, and knowledge use are issues central to the system. Leydesdorff and Etzkowitz (1996) proposed an evolving 'Triple Helix' (TH) model of innovation explaining the relation, interaction, and linkages between government, university and industry (GUI). These actors reflect the underlying dynamics of change in the system in the way they interact.

As an innovation network, the 'Triple Helix' is a dynamic system, akin to the double helix in the DNA network as shown in figure 2.7(d). Whereas the national innovation system has the firm at the centre of innovation, the TH network focuses on the role of the university plays in boosting and driving innovation (Etzkowitz & Leydesdorff, 2000). The TH model views the university as the institutional sphere responsible for knowledge production; industry concentrates on production; and the role of the state is to maintain and improve condition favouring linkage development. The model also shows how interaction between the three institutional spheres evolves into a hybrid of institutional culture in which institutional boundaries are blurred and each actor can 'takes the role of the other' in some circumstances (Etzkowitz, 2008).

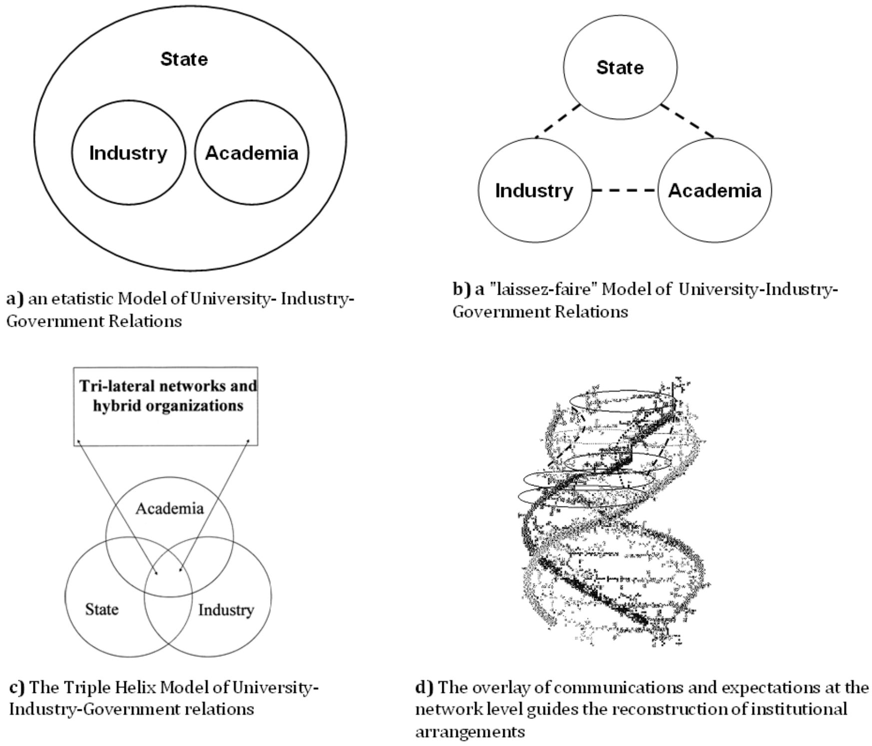


Figure 2.7 The configuration of the Triple Helix system of innovation
Source: Etzkowitz and Leydesdorff (2000, pp. 111-112)

In developing countries, the TH approach has been widely adopted as a tool to analyse policy for industrial clusters at regional level. For example, the study of Irawati (2007) indicates the role of university in the provision of knowledge transfer and skill development for small and medium-sized enterprises and industrial cluster development in Indonesia. Regional universities conduct various types of capability development programmes for industrial cluster development such as training, consulting, and business incubation. However, the government still needs to be involved at all stages of industrial cluster development to improve linkages and networking between and within industrial clusters and supporting organisations.

Also in developing countries, intermediary or bridging institutes are increasingly required to interface universities and firms to expand GUI network (Yokakul & Zawdie, 2009). This is because the university in developing countries are at the early stage of transition from traditional university to entrepreneurial university and they are not as yet keen to transfer, distribute and commercialise their knowledge (Saad et al., 2008). Intermediary agencies also play a crucial role in regulating the speed and direction of technological learning in the industrial sector throughout their project-monitoring scheme to ensure the accomplishment of collaborative projects.

The TH model is a network-based approach relating social relations and collaboration that facilitates knowledge exchange and dynamic system of interactive learning. The development of trust is important for establishing effective links among actors in the TH system. Such links are particularly important for the circulation of tacit knowledge which are often transferred through informal relationships. Informal activities, informal meetings and individual relationships between knowledge organisations, universities and firms including personnel movement also increase the extent of trust and encourage collaborative projects as well as creating the norm of reciprocity throughout a network (Casas, 2003). This would strengthen GUI links and maintain long-term relationships resulting in the improvement of regional and community development.

2.4 Basic features of innovation system

Innovation system may differ across countries and regions due to differences in, for example, traditions, cultures, institutional settings, and path dependency. The basic elements that constitute the innovation system also reflect the salient features of the system, its evolution and transformation.

2.4.1 Institutions, organisations and the innovation system

Organisations and institutions are the main components of an innovation system. Organisations are administrative bodies through which institutions find expression. As such, organisations could be a constraint on or else a facility for the development of institutions. Thus it is common to have economic, business, social, scientific and technological and political organisations. What is of essence is the social, scientific, business, economic and political culture and the associated dynamics underlying these organizations (Edquist & Johnson, 1997; Nelson, 2002).

Institutions can be defined as "sets of common habits, norms, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups, and organisations" (Edquist, 1997; Edquist, 2006, p. 182)

Institutions shape the way of doing things and behaviour that are vital for individuals to perform activities relating to innovation, and to establish relationships with other actors in an innovation system. Institutional environments differ across countries and regions according to political and socio-economic structures which comprise formal regulations (e.g. laws and government policies) and informal constrains (e.g. norms, traditions, behaviour) (North, 1990). Institutional changes involve implementation of new knowledge in society and social interactions that result in improved economic performance.

Government regulations represent institutional interventions to promote technology and innovation through various support systems, such as R&D funding, subsidy, incentives, intellectual property protection and regulations etc (King et al., 1994). Intellectual property laws, norms and support regulations are institutional components that affect R&D collaboration between firms and universities or research organisations. Governments also play a crucial role in establishing policy framework for intermediaries that act as a bridge between firms and knowledge organisations in the public sector, especially in developing countries where the link between universities and industry is characteristically weak. A recent study by Mueller (2006) indicates that institutional environment that warrants provision of high social capital is favourable for innovation. This is because social capital facilitates trust and reduces risk. The significance of social capital for knowledge exchange and innovation is a crucial factor for technological learning and innovation (see Chapter 3, Section 3.3).

Differences in institutional arrangements determine differentials in the rate of technological progress between countries, regions or industrial sectors. Proper institutional settings would facilitate tacit knowledge flows that occur in non-market or near-market states, such as R&D collaboration and consultation (OECD, 1999b).

2.4.2 Knowledge and learning in innovation system

The study of National Innovation System concentrates mainly on knowledge flow in the system. Knowledge generation, diffusion and application occur through interactive learning and linkages between actors in an innovation system. Unlike the

Neoclassical model, the Evolutionary and New Growth perspectives view knowledge to be endogenous to the economic system, generated by firms, public research institutes, universities. In the NIS, firms are the main sources of innovation. They acquire and use knowledge. According to OECD (1997), there are four basic types of knowledge flow in the NIS: interactions among firms; interactions between firms, academia and public research institutes; knowledge and technology transfer to firms; and workforce transition or labour turnover across industry. Muller and Zenker (2001) argue that knowledge-intensive business services also play are important role in the transfer and implementation of new technologies that are suitable for clients and through this in the technological capability development of firms.

Knowledge is embedded in human capital and in technology. In general, there are two types of knowledge: codified and tacit knowledge. Codified knowledge is readily available for transfer since it is in written or recorded forms such as manuals, patents, procedures and electronic resources etc. Tacit knowledge is much more complicated and is usually embodied in individuals. Unlike codified knowledge, it is difficult to de-contexualise and transfer. This kind of knowledge is probably transmitted by the movement of workforce; collaborative projects; informal network; and personal relationships. Collective tacit knowledge, embedded in organisations, is the main source of competitiveness because it is difficult to be imitated (Leonard & Sensiper, 2000).

The study of Chang and Chen (2004) indicates differences in knowledge links and factors facilitating knowledge diffusion between national, regional and sectoral innovation systems. At national level, knowledge links concentrate on knowledge transfer between the main actors in an innovation system with the firms at the centre of the system. In sectoral innovation system or the industrial cluster approach, unwillingness to share core knowledge is a common barrier if knowledge sharing results in loss of core competency. However, inter-firm links of knowledge in sectoral or technological innovation system arises mostly from technological interdependence. In regional innovation system, knowledge sharing occurs through informal relationships, networking, personnel movement and skill development training. Geographical proximity is also important for knowledge sharing in a regional innovation system. Importantly, cultural proximity, expressed in the form of trust, norms and networks, facilitates knowledge sharing and interactive learning in innovation systems at all levels (UNIDO, 2006).

2.4.3 Linkage and networking in innovation system

It is now widely recognised that networking is important for innovation at firm level. Public-private partnerships and links are significant channels for knowledge and technology diffusion in an innovation system. This is addressed in social network theory, one of the newcomers to the study of innovation management. Cooke and Morgan (1991) introduced 'the network paradigm' as a development system of learning ability in firms, which can be improved by inter-firm interaction. Network also refers to links between firms and other organizations such as customers, suppliers, government and technology institutions, which facilitate technology and knowledge transfer.

The OECD (1997) conducted a comparative study on firms in many countries that have and do not have collaboration with external sources. The result shows that firms having joint R&D with external sources have more product development than firms that do not have joint projects. Ruuskanen (2004) also indicates that small firms having corporative networks with other firms, knowledge institutes and public sector agencies tend to have higher innovative opportunities than firms without networks. Factors affecting the extent of networking between them have been studied. The study on networking by Cooke (1996) indicates the key elements contributing to networking to be: trust, reciprocity, learning, partnership, and decentralism. The evolution of perspectives from technology to social network partly resulted from the advance of information technology that can communicate and translate knowledge into product development and process improvement.

The persistence of weak innovation in small firms in many developing countries, including Thailand, is largely attributable to the weak links between actors in national innovation systems resulting from low social capital base in these firms. The OECD (2001) notes the importance of informal network for building social capital, involving trust, sharing of personal experiences, and loyalty. Many small firms in developing countries, however, appear to have the perceived fear that networking would deprive them of their know-how. They feel that they would gain less knowledge and would have little or no chance to innovate as a result of such relationships. Consequently, they have no desire to build a network of relationship with others. There is however a growing body of knowledge, which suggests social capital and networking to be a major influence on successful innovation system (see, for examples, Fountain, 1997; Grootaert, 1998; Carayannis et al., 2000; Cooke et al., 2005; Tura & Harmaakorpi, 2005). At issues here is therefore the absence or presence of social capital in adequate amount to explain the scope for knowledge exchange, creativity and innovation.

2.4.4 Government Policy and innovation system

The significance of the role governments play in national innovation system and economic development is widely recognised. Governments are accountable for constructing and reforming institutional frameworks that facilitate knowledge diffusion among actors - both public and private organisations - in national , regional and sectoral innovation systems (OECD, 1999b). Governments, respond to the globalisation pressure through the adoption of policies and strategies for the development of industrial clustering, networking, and linkages between the government, academic and industrial sectors. Policies promoting technology and innovation include provision of public goods, intellectual property protection law, R&D funding, human resource development, R&D incentives, and infrastructures. Public policy is very important in the way it influences firms' decision making on adoption of new technology and improvement of technological capability and innovation prospects. Proper policy interventions could speed up technology diffusion and adoption by firms (Stoneman & Diederen, 1994).

There is growing interest in the two dimensions of policy supporting innovation at national and sub-national/regional levels. The challenge is how to set and manage regional policies consistent with overall national policy given that there are a number of non-government organisations, local authorities and agencies involved in regional development (OECD, 2008a). In developing countries, because of financial constraints, the provision of financial support from the government is crucial to stimulate innovation at firm level. For example, in Thailand, the government heavily subsidises R&D projects through collaboration with firms and public research institutes or universities. This is to promote research projects that can be commercialised to meet industrial needs and also strengthen public-private links.

Innovation involves path-dependence and is developed in the context of each country. Innovation policy should therefore be constructed and developed for a particular framework and context (Lundvall & Borras, 2006). While setting up policy framework, key factors that need to be taken into account are scope of needs, basic capability, attitude and behaviour of companies towards innovation; and shortfalls of the university sector (Promwong & Yokakul, 2006). This also includes advantages that the government may have in terms of its organisational or institutional setting, which can effectively be used to support linkages among key actors in the national innovation system.

In developed countries, the diffusion of technology is often effective. Developed countries have advantages over developing ones in the provision of high-skilled workforce, favourable market conditions and technology infrastructures. Government policies in many developed countries have focused on regional innovation system as in the case of the UK, where regional actors are active and efficient (OECD, 2008a). Regional universities in such countries are said to be forward-looking and act as major sources of knowledge for industry. On the other hand, regional universities in developing countries like Thailand are not keen to develop networks and they are inexperienced with respect to industrial liaison. Consequently, regional policies are not as effective in developing countries as they are in the developed ones.

Government policy and institutional settings are big issues in National Innovation System. As they are context-specific, they are not capable of being directly transferred from one country to another. Countries have their own unique circumstances, which occur in terms of socio-economic environment, institutional complexity and innovation infrastructures. These peculiarities define the path dependence characteristics of innovation.

2.5 Towards a general framework linking innovation, technological progress and economic growth

This section now brings together the various trends of idea discussed in this chapter to construct a framework linking innovation, technological progress and economic growth. As shown in Figure 2.8, innovation translates into economic growth through the interaction between the demand for and supply of technologies. The demand for technologies arising in firms (small and large) derives from changes in demand structure which result from economic growth. The impact of growth on market structure would give rise to technology gaps if the quantity and quality of existing production cannot meet the prevailing demand. Thus to take advantage of the new category of demand that has emerged consequent upon economic growth, firms would seek to adjust their production functions through engagement in in-house R&D or through private consultancy firms, university, Research and Technology Development (RTD) centres. If local sources of technology supply fail to bridge the gap in the system, international sources of technology supply would be accessed either by the firms (large scale firms) or by universities and RTD centres. SMEs in particular would depend on support from government agencies (like the Industrial Technology Assistance Program (ITAP)) as in Thailand, or non-governmental organisations (NGOs) to promote the development of their technological capability through networking with universities, RTD, and relevant government agencies.

Technological capability development in the production sector arises in the context of the development of a network between sources of demand for technology and sources of supply. This would take time to evolve. As the network evolves, however, social capital accumulates and this would be expected to promote the creativity and innovation process in the system. Hence new ideas generated in universities and RTD centres translate into innovation in the form of adaptation and new developments bridging prevailing technology gaps. The subsequent transformation of production function at micro level gives rise to economic growth.

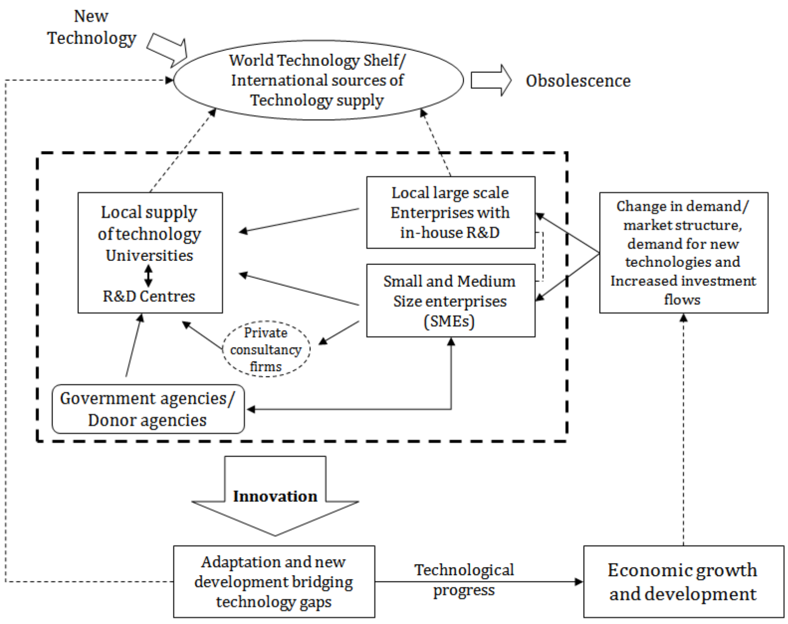


Figure 2.8 Conceptual framework relating innovation, technological progress to economic growth

Source: adapted from Zawdie (1996, p. 98)

As one technology gap closes through innovation, the process of economic growth precipitates new technology gaps, which in turn reinstate further research and development and hence further innovation. But every time the demand-driven R&D cycle is repeated, it broadens and deepens the network between sources of technology demand and technology supply, thus consolidating the social capital base of innovation and hence the scope for sustainable economic growth.

However, effectiveness of the national innovation system in terms of its impact on technological capability development leaves much to be desired in many developing countries. This derives from the ineffective matching between supply of and demand for technology and the limited scope that is available for networking to allow knowledge sharing and transfer. This thesis seeks to explain why the concept of NIS is far from successfully implemented in Thailand and the factors affecting technological and innovation development in Thai SMEs.

2.6 Conclusion

This chapter has discussed the importance of innovation for technological progress and economic growth. It examined various conceptual schemes relating to growth and innovation including the evolution of the study of innovation systems starting from the traditional Schumpeterian view based or simple linear models, which do not, however, explain how the process of 'creative destruction' occurs. Consequently, the innovation study has evolved over the years from the basic linear model based on technology push and demand pull to a coupling, network system involving of feedback loops and interactions among various actors in the system as seen in the fifth generations of innovation model by Rothwell.

The concept of innovation system has been widely adopted at national, regional and sub-regional levels. It has also been applied to specific industrial sectors. The main actors in the innovation system, namely government, university and industry, play important roles in knowledge generation, and knowledge exchange. The accumulation of knowledge in knowledge-based economies is crucial for nurturing the full potential of innovativeness and competitiveness. Government has responsibility to formulate policy to promote technology and innovation and provide supporting infrastructures. The coherence and consistence of innovation policy would reflect the overall effectiveness of the national, regional or sectoral innovation system. This will depend on the extent to which the policy itself is contexualised within a framework that address the interaction of actors or the supply and demand sides of knowledge and technology.

CHAPTER 3

SMEs, Social Capital and Innovation in Developing Countries

In the long run, Schumpeter would argue, achievement of economic growth and competitiveness would be expected to turn on advances in science and technology. This is more so especially in the case of the industrial sector which offers a wider scope for the application of new ideas. Although small and medium size enterprises (SMEs) are considered to be significant as a source of innovation (OECD, 2002), their innovation performance has remained somewhat patchy at best, particularly in the context of developing countries. Much of the innovation deficiency in SMEs is said to be due to the prevalence of social capital deficit and the lack of appropriate policy provisions to remove the constraints on social capital formation and hence on the development of the culture of innovation in SME communities (Morgan, 1997; OECD, 2005c).

However, there has, of late, been growing interest in SMEs as major drivers of industrialisation in developing countries, where, generally speaking, SMEs account for a high proportion of the total number of industrial firms. Consequently, industrial policy in these countries has largely focused on the technological capability building with the view to improving the innovation performance of the SME sector as a strategy for strengthening the performance of the wider economy.

This chapter discusses the role of SMEs in economic growth and in the wider innovation system within the context of developing countries by exploring the significance of social capital for SME innovation, and the role of policy intervention in promoting the development of social capital and expediting the innovation process. The aim is to set in place the conceptual framework for the empirical investigation of factors affecting the innovation and competitive performance of SMEs in Thailand in subsequent chapters. To this end, the remainder of this chapter is organised in five parts. The first part of the chapter sets the context through a discussion of the role of SMEs in economic growth. Based on this the second part addresses issues relating to the scope for creativity and innovation in the SME sector. In this part, SMEs are presented as carriers of indigenous knowledge, and the role of indigenous knowledge in SME innovation is discussed in relation to SME efforts to cultivate indigenous knowledge to cumulatively yield what is generically known as disruptive technological innovation on the back of their experiences in incremental innovations, thereby enhancing the competitive advantage of SMEs. The third part looks into the role of social capital in promoting SME innovation and competitiveness. In the fourth part, the role of government intervention in mitigating the constraints on SME innovation through social capital formation is discussed. The fifth part draws conclusions to the discussions in the chapter.

3.1 SMEs and Economic Growth

As noted above, there has been growing interest in SMEs as major drivers of industrialisation and economic development, and policy focus has consequently shifted from large to small firms, particularly since 1980s (Carree & Thurik, 1998). There have since then been many studies on the importance of the role SMEs play in the course of socio-economic development (see Keeble et al., 1999; Kaplinsky & Readman, 2001; Klerk & Havenga, 2004). But what are SMEs?

The definition of SME varies across countries and regions according to size of employment, business turnover, invested capital and capitalised value of the firm, as shown in Table 3.1.

Table 3.1 Definition of SME

Country/ Regions	**Source**	**Number of employee** (up to)	**Turnover (£) / year** (up to)	**Balance sheet valuation (£)** (up to)	**Registered/ Invested capital (£)** (up to)
Thailand	(OSMEP, 2006)	200	-	-	3.64 million
UK	(Companies Act 2006)	250	22.8 million	11.4 million	-
European Commission	(European Commission, 2009)	250	45 million	38.7 million	-
OECD	(OECD, 2002)	250	36 million	24.3 million	-
US	(U. S. Small Business Administration, 2008)	500	20.2 million	0.45 million	-
Japan	(Tsukahara, 2005)	300	-	-	1.63 million
South Africa	(International Institute for Sustainable Development, 2004)	200	5.42 million	1.99 million	-

In probing why SMEs have become the focus of industrial policy, many would point at the employment and output/income effect of SMEs. The employment opportunities SMEs offer are significant, as SMEs are generally labour-intensive and also constitute a large proportion of the total number of firms in each industry[1](OECD, 2002). Also significant is the contribution of SMEs to Gross Domestic Product (GDP), which is approximately around 30% – 60% of total GDP for Asian countries (Hall, 1996). For instance, the SME sector in Thailand contributed 37.9% to total GDP in 2008 (OSMEP, 2009b).

SMEs have particular appeal in developing countries because they are technologically accessible insofar as their skill requirement is not exacting, and also because they are invariably well geared to local resource and market circumstances. Some would also invoke the usefulness of SMEs as counter-cyclical policy measure because of their small size and flexibility to adapt themselves to changing market and production conditions. The SME sector also plays a dynamic innovative role, contributing to the competitiveness of industry by introducing new products to the market at minimum risk (Coskun, 2004). According to Storey (1994), SMEs provide scope for creativity and innovation. This, however, begs the question about the extent and relative significance of innovation in SMEs and more significantly, the factors that constrain the occurrence of innovation in the SME sector.

While the role of SMEs as a vehicle for economic growth is widely acknowledged, given their employment and output effects, their role as a vehicle of innovation, however significant, is less understood. This is particularly the case with SMEs in developing countries (Mytelka, 2000). Nor has much work been done in this respect. This is not surprising considering that the factors which underpin SME innovation in developing countries – particularly indigenous knowledge and social capital - are not clearly established. Lessons can, however, be drawn from the experience of SMEs in the innovation process in developed countries. For instance, a study by Keeble et al. (1999), which focuses on the role SMEs play in national innovation system, establishes SMEs as a key driver of effective regional innovation in the Cambridge

[1] The percentage of SME in OECD countries take up to 96-99% of total number of firms (OECD, 2002) while 99.7% in Thailand (OSMEP, 2006)

region. In industrialised countries, SMEs have supported a collective learning process with a large network involving government, academia and industry, which are considered to be main actors of the National Innovation System (NIS). In developing countries, on the other hand, this network is generally weak (Chairatana, 2006), resulting in a rather slow technological capability development. Policy makers in developing countries are nonetheless highly interested in promoting technology and innovation in the industrial sector, particularly the SME sector, through the networking of the principal NIS actors that would stimulate knowledge production as well as it transfer and sharing (Cooke, 1996). As noted above, this begs the question about the scope for creativity and innovation in SMEs, and it is to this question that we will turn in the following section.

3.2 Scope for creativity and innovation in SMEs

The survival and growth of firms in an increasingly globalising word depends on their ability to innovate and achieve competitiveness. Successful innovation at the firm level requires internal and external resources of both tangible and intangible categories (Lundvall et al., 2002). Schumpeter (1942) hypothesised that large firms have the resources and capabilities (i.e. tangible resources) to produce more innovation than small firms. This hypothesis has, however, been dealt a heavy blow by empirical findings which show that small firms, despite their size and the resource constraints they envisage, create more innovations than large firms (Pavitt et al., 1987; Acs & Audretsch, 1988; Cohen & Klepper, 1996; Synreonidis, 1996). Researchers attribute this apparent paradox to the flexibility of small firms to develop and enhance their technological capability through co-operation, collaboration and networking with other actors in the National Innovation System (NIS). Because of the limitation of knowledge resources in small firms, it is very important for small firms to engage in knowledge networks that foster interaction and learning, and so create the conditions for innovation.

Because of the less bureaucratic nature of SME management, small firms are usually flexible and quick to respond to changing in market needs and conditions (Nooteboom, 1994). Their organisational structure also supports quick decision-making processes with short communication lines. These provide a conducive environment for creativity and innovation to thrive. Moreover, flexibility of the cost structure in small firms allows them to readily adapt themselves to fluctuating market conditions (Fiegenbaum & Karnani, 1991) through, for example, restructuring, marketing innovation, and applying the supply chain strategy or using subcontractors. Having close relationship with customers helps small firms to receive useful feedback for product and process improvement. Small firms also have an edge over their larger counterparts in the way that they can respond to the specific needs of customers by suitably deploying technologies for customisation (Pavitt, 1991). This helps small firms to preserve their niche markets.

Small firms are generally better suited for incremental innovation, which involves improving processes and existing products responding to customer needs, than for radical innovation, which involves developing new products (Oke et al., 2007). Nevertheless, Stam and Wennberg (2009) argue that the occurrence of radical technological innovations tends to concentrate in new start-up firms, which are usually small scale enterprises. This is especially the case for firms hi-tech industry, as is shown in the study of Bobulescu and Soulas (2006), which observes that small start-up firms in the pharmaceutical industry are keen to access up-to-date technologies and information and extensively utilise these by venturing into innovative activities.

The situation with firms in the low-tech industry[2], especially traditional industries like the Thai dessert industry, is, however, different. While innovation in most hi-tech industry firms extensively need new technologies as a source of product development and innovation, traditional industries such as the Thai dessert industry, would need new aesthetic designs, new ideas, and non-technological innovation that would enhance the consumer appeal of products (Breschi & Malerba, 1997). They would also need process innovation that would improve the competitiveness of production. Kirner et. al. (2009) provide an empirical study based on cases from Germany which shows that although hi-tech industries generally perform better on product innovation than low-tech industries, their performance in process innovation

[2] According to OECD (2005b) classification of manufacturing industries based on technological intensity, food and beverage industry is categorised as a low-tech industry.

is comparable to that of the low-tech industries. This confirms that there is scope for innovation and creativity in low and medium-tech SMEs. SME innovation, which is largely 'non-technological', mainly derives not from inventions but rather from the capabilities of SMEs to adjust to and effectively implement new ideas (Nooteboom, 1994).

Much of the knowledge base of SMEs is tacit in nature (Koskinen & Vanharanta, 2002). The prevalence in small firms of such factors like the absence of bureaucratic red tape and the informality about social interactions and relations facilitates successful sharing of tacit knowledge among SMEs. Unlike explicit knowledge, tacit knowledge is not formally documented. It is embedded in individuals and is often difficult to transfer (Nonaka, 1994). Close ties and intra-firm relationships in small firms would facilitate the transfer of tacit knowledge from person to person and thus stimulate intra-firm knowledge diffusion by learning through informal activities and socialisation (Nonaka & Takeuchi, 1995). However, in their study of firm level innovation in the US, Cavusgil et. al. (2003) argue that firm size has no effect on transfer of tacit knowledge. Their study points out that large or small firms have the same capability to transfer tacit knowledge, even though they could be using different approaches - formal and informal ways, respectively.

Considering the differences between large and small firms in terms of resource availability, among other things, there is no doubt that the process of innovation in SMEs would be different from the way large firms innovate. The impact of firm size on innovation - particularly the view that innovation is size-neutral - however remains an open question. What is not in question is that innovation at the level of firms is conditional on the nature and context of each industry as these vary with respect to the socio-economic and behavioural profiles of firms (Malerba, 2006). This does not, however, diminish the significance of the evidence suggesting that small firms can be good innovators, although it must be noted that SME innovation is seldom in evidence in developing countries, where the innovation system is generally acknowledged to be weak. Nor, as will be discussed in the following section, can it be maintained that the tacit nature of indigenous knowledge, which drives most SMEs, as in the case of the Thai dessert industry, inherently incapable of innovation.

3.2.1 Indigenous knowledge and innovation

In recent years, the issue of indigenous knowledge has been recognised as a key element of social and economic development, especially at rural and community levels. The significance of indigenous knowledge is well taken on board by international development organisations, such as the World Bank, the United Nations Educational Scientific and Cultural organization (UNESCO), the United Nations Development Programme (UNDP) and the United Nations Industrial Development Organisation (UNIDO), among others. The concern now is how to promote indigenous knowledge by infusing scientific knowledge and modern technology/knowledge into it without, however, undermining the basic characteristics that define the essence of indigenous knowledge. Modern knowledge is based on scientific and technological foundation aiming to manipulate the surrounding system (Gadgil et al., 1993). When it confronts with complex ecological system, neither indigenous nor modern knowledge may not very successful.

There is substantial evidence supporting the view that far from being sterile and retrograde, as it is often perceived to be, indigenous knowledge has in it the seeds, which, if properly nurtured, would be capable of generating innovation and growth (Mauro & Hardison, 1999; World Bank, 2004). This would be the result of effective acquisition, assimilation and exploitation of extra-traditional knowledge.

According to Grenier of the International Development Centre (IDRC) (1998), 'indigenous knowledge' refers to *"local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area"* (p.1). Indigenous knowledge is alternatively referred to as 'traditional' or 'local' knowledge which are frequently used interchangeably (Ellen & Harris, 2000).

Unlike modern technology or scientific knowledge that derives from the activities of academic and research institutes, indigenous knowledge is a product of cultures, traditions, values and beliefs, generations of experiences, practices, and trial-and-error experiments that are unique to specific societies. Therefore, indigenous knowledge characteristically occurs in the form of tacit knowledge which is not documented and, hence, is difficult to transfer. Basically, tacit knowledge is orally transferred from generation to generation and from person to person through social relationships and network systems where social capital is developed through those social activities (Agrawal, 1995; World Bank, 2004).

Nonaka et al. (2001) explain the creation and conversion process of tacit and explicit (codified) knowledge in four step as shown in Figure 3.1. The figure helps to explain how indigenous knowledge, which is tacit in nature, can be developed and evolved through these social activities.

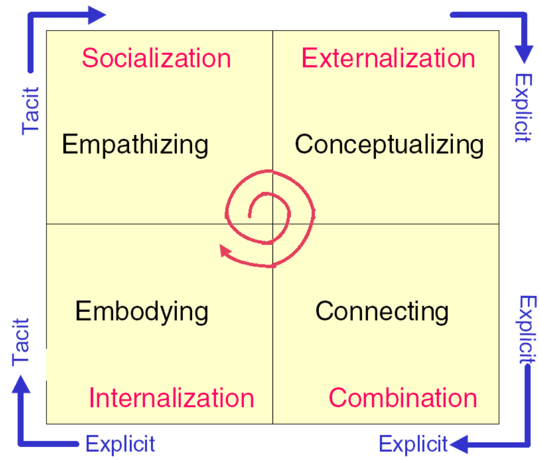


Figure 3.1 The continuous self-transcending process of knowledge creation
Source: Nonaka et al. (2001, p.18)

Indigenous knowledge is dynamic in the sense that it has continually evolved through the creativity of indigenous people in the course of their interactions with the external environment (Flavier et al., 1995). It enables local people in resolving problems arising from the social and ecological complex encountered in a wide range of economic activities such as farming, food preparation and preservation, traditional medicine and medication, human and animal health, environmental management etc. (World Bank, 1998; UNESCO, 1999). There is now growing awareness that indigenous knowledge provides the basis for sustainable development as it relates directly to the complexities of local socio-economic cultures and behavioural patterns; local resources and biological and ecological conditions. As such, indigenous knowledge would serve as an important information support for expediting communication and decision-making while designing, developing and implementing projects targeted at promoting rural development. But how does indigenous knowledge translate into innovation? The following part of this section will look into the concept of 'disruptive technologies', which in contrast to 'established' or 'incumbent' technologies, is based on indigenous knowledge and draws from indigenous knowledge and existing practice the ingredients that would make it uniquely innovative and competitive.

3.2.2 From indigenous knowledge to 'disruptive' technologies

The belief that indigenous knowledge is inferior to modern knowledge or existing best practice and that it should give way for the latter to thrive, however erroneous, has for long been used to establish the significance of technology transfer from 'North' to the 'South' as a strategy for development. The belief essentially draws support from the two-sector Arthur Lewis model (Lewis, 1954) in which sustainable economic growth is postulated to derive from the expansion of the modern (capitalist) sector, which is considered to be dynamic and productive, displacing the preponderant traditional sector, where the bulk of the labour force in the economy is disguisedly unemployed. The Lewis model assumes, if implicitly, that the indigenous knowledge in the traditional sector does not have the transformative potential, and that economic growth could only be achieved by growing the modern sector through the transfer of modern technology from developed countries. The adoption of this model has led to the development of economic and social dualism, with the rural-urban gap ever widening and the conflict between the traditional and the modern ever deepening, thus resulting in the perpetuation of poverty rather than its reduction. The problem with the Lewis model is not in its support for technology transfer but in its failure to give due recognition to the significance of indigenous knowledge as a dynamic factor that could evolve by learning from modern knowledge.

For instance, in a study based on rural Tanzania, Mwantimwa (2008) found that integration of indigenous knowledge and modern technology can create local innovation and generate income and job opportunities for local people. With interventions from various supporting agencies, integration of tacit indigenous knowledge and knowledge embodied in modern technology could lead to indigenous innovation in a wide range of rural activities, such as crop breeding, food production, pre- and post-harvest activities. When indigenous knowledge is incorporated with modern knowledge, it can generate innovation at grassroots level and the technology thus produced could have a wide market base (World Bank, 1998).

When adapted to existing ‘best practice’, indigenous knowledge offers the basis for the development of what is known as ‘disruptive technology’. Disruptive technology is essentially indigenous knowledge with value added to it through integration with modern knowledge or ‘best practice’ associated with the ‘established’ or ‘incumbent technology’. Disruptive technology is systematically developed on the back of indigenous knowledge but within a strategic framework that would enable it to evolve on a competitive basis in relation to globally established technology. It is the cumulative synthesis of incremental innovations arising from the integration process. Indigenous knowledge is in this context considered to be the essence of core competency of a specific location, which when strategically and innovatively developed, could give rise to disruptive technologies that are capable of effectively outperforming established technologies. This is graphically demonstrated in Figures 3.2 and 3.3. Figure 3.2, where it is shown that indigenous knowledge-based technologies could in the event of consecutive disruptive innovations outperform established or mature technologies by taking away from them the size, capacity, reliability and price advantages that once gave established technologies a competitive edge in the global market (Christensen, 1997).

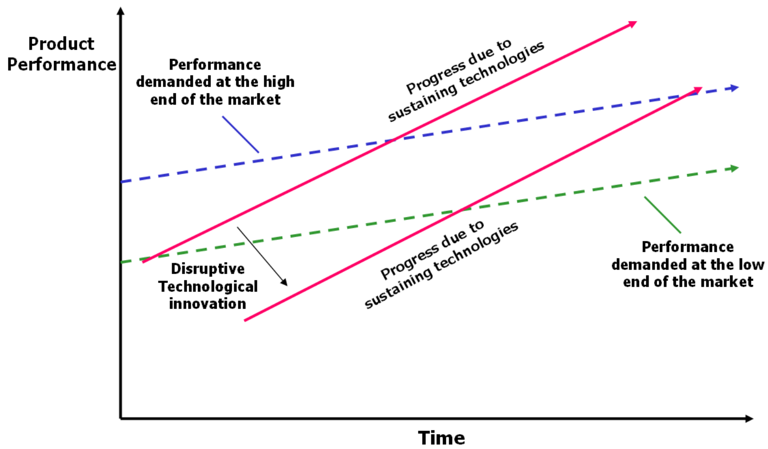


Figure 3.2 The impact of disruptive technological change on product performance
Source: Christensen (1997, p.12)

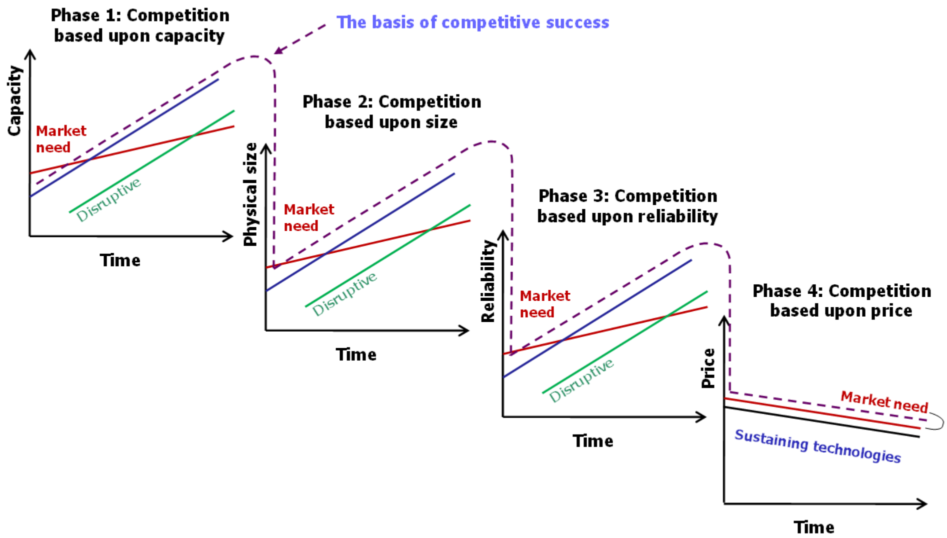


Figure 3.3 The basis of competitive success for Disruptive technologies
Source: Christensen (1997, p.148)

Thus, whereas indigenous knowledge is limited to specific locations or communities (Nwokeabia, 2003), disruptive technology has a much wider, even global appeal. An important advantage of 'disruptive technology' is that by integrating new ideas with indigenous knowledge, it offers a low cost approach of delivering goods and services that would otherwise be delivered by relatively high cost established technologies (Bower & Christensen, 1995; Christensen, 1997). Moreover, disruptive technologies involve knowledge that are readily accessible and are therefore appropriate to the conditions of rural communities. They are effective approaches to generating income and employment.

Moreover, when disruptive technologies evolve, they would achieve competitiveness on a global scale, thus challenging the dominance of established technologies, and also transcending the limitations of indigenous knowledge without however ignoring the significance of its basic attributes – namely, its authenticity, uniqueness and tacitness that make industries based on it to be unique global players.

As export markets grow offering market opportunities for indigenous products, indigenous knowledge-based producers would, short of learning and adapting to changing production and market circumstances, find it difficult to take advantage of these opportunities as they can't compete along key profiles like technological capability, economies of scale, reliability and price. Consequently, indigenous knowledge-based producers would either wither or be relegated to a position too remote to be of commercial significance. To promote indigenous producers in a global market, technological assistance and management skills are needed to blend indigenous knowledge with ideas extracted from established technologies so as to achieve innovation at both the process and product levels of the activities of local SMEs. Littrell and Dickson (1999) provide the case of artisan groups that have evolved from being indigenous producers limited to remote rural locations to competitive entrepreneurs operating in a wider market framework. The transformation happened as a result of improvements that involved creativity and innovation in product development and marketing - in short, by growing indigenous knowledge-based SMEs from being limited local players to becoming global players based on the application of 'disruptive technology'.

3.3 Social capital and SME innovation

Competitiveness of firms largely turns on their innovation performance, which is conditioned by the level of their technological capability. However, technological capability building and innovation performance of small firms, especially in developing countries, have been characteristically weak, particularly with respect to the ability to adjust to advances in knowledge and technology systems (Arnold et al., 2000). The persistence of this problem can in large part be attributed to the fact that SMEs are poorly networked between themselves and with other agents like universities, government institutions and other industries, which means that their ability to share and gain knowledge is limited (Intarakumnerd et al., 2002).

As noted in the preceding section, SMEs provide ideal vehicles for the emergence and development of 'disruptive' technologies. These are technologies that would make SMEs innovative and competitive not only in local markets but also globally. However, the state of SMEs in developing countries would not warrant the occurrence of innovation as a systemic phenomenon short of policy interventions to make up for shortfalls in resource and networking provision. The key problem militating against the innovation prospects of SMEs in developing countries is the preponderance of the weak social capital base of the sector resulting from the fragmented and least networked nature of the sector. The weak social capital base has the effect of mitigating the innovative capability of SMEs by increasing the risk and transactions cost of innovation (Cooke & Wills, 1999). Moreover, fragmentation of the sector for lack of networking reduces the degree of competition in the sector, and the lack of competitive pressure would make SMEs reluctant to take the risk to innovate (Porter, 1990). Thus, although it may well be that SMEs provide a fertile ground for budding enterprises with the potential to innovate, it is important to note that these enterprises would be ineffective agents of innovation unless they are supported and equipped through structured policy interventions (OECD, 2005c).

The remainder of this chapter will discuss the role of social capital and government intervention in SME innovation in developing countries. In particular, the discussion will explore the argument that weak social capital arising from the existing state of the SME sector in developing countries has consequences that are reflected in the risk perception of firms; the transactions cost of engaging in innovative ventures; the flexibility of access to resources; and the degree of competition within the sector.

3.3.1 Aspects of Social capital

Innovation is presumed to derive from a network of collaboration between actors in the innovation system. The stronger the linkage or social relations between actors in the system, the higher the probability for innovation to occur. The extent of social relations that SMEs forge with other firms and agencies and the extent to which these relations are underpinned by trust together account for what is generically referred to as the social capital of SMEs. This is important because the extent to which SMEs would grow and flourish is presumed to be contingent upon the size of social capital they have developed over time.

For Porter (1990), industrial clusters provided the basis for the development of networks between firms, and between firms and external agencies. As such, industrial clusters would have the effect of raising the level of social capital and competitiveness. Tangible factors or the conventional production factors such as financial investment, labour and other infrastructures appear to be not enough for firms to improve their technological capability and innovation (Westlund, 2005). It is argued that 'social capital' plays a key role in expediting the innovative process and technological capability development at the level of firm (Maskell, 2001).

Pierre Bourdieu (1986) is the pioneer who tried to analytically conceptualise the concept of social capital. He defined 'social capital' as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintances or recognition" (Bourdieu, 1986, p. 248). His seminal work focused on the advantages and benefits of power functions deriving from being included in the network, and the social obligations resulting from social capital. However, he did not explicitly mention the role of trust in connection with social capital formation and development (Siisiäinen, 2000), while the broad definition of social capital in contemporary development studies considers trust to be one of the important elements contributing to the social capital complex (Coleman, 1988; Putnam, 1993; Woolcock, 1998).

Putnam (1993) explains social capital in terms of trust, norm and network – attributes that enable collaboration resulting in mutual benefits. A country with high social capital index would be expected to perform better in terms of economic growth and social well-being than one with low social capital index. Ever since Putnam popularised this concept in collective terms as "stock of social trust", many have sought to explain as to how social capital influences innovation and economic growth. It is nonetheless generally recognised that the absence or else weakness of the 'social capital' base of an economy would result in the failure of the major social and economic actors to interact and generate innovative ideas and economic growth (Grootaert, 1998).

Although the concept of social capital was first developed in the context of community development, it has subsequently been applied to technology and innovation (Dietz, 2000). Fountain (1997) notes the importance of social capital as an intangible factor that accelerates innovation in science and technology by stimulating interactive learning, knowledge sharing and transfer in industrial clusters and innovation network (see also Chaminade & Vang, 2006).

In relation to National Innovation System (NIS), Arnold (2000) demonstrates the complex relationship and interaction between the NIS actors corresponding to the institutional context, financial capital, human capital and infrastructure, which are tangible factors. However, he argues that there is more to the NIS than such tangible factors. Arnold's framework thus invokes the concept of intangible factors or social capital *a la* Putnam (1993), Cooke (1996; 1999; 2005) and Fountain (1997), as being critical for the success of NIS and regional innovation systems. Maskell (2001) identifies social capital as a key factor for the occurrence of innovation in low-technology industries, such as the furniture industry, in the form of production improvement, enhancement of delivery and product quality, skill training and diffusion through interaction with partners on the supply chain.

Unlike large firms, SMEs have limited resources at their disposal, particularly financial capital, which constrains their scope for becoming creative, innovative and competitive. On the other hand, it is argued that they could make up for this shortfall, at least in part, through the provision of social capital. This would enhance SMEs' ability to innovate through networking, thus facilitating their interactions with other firms and knowledge agencies. Social network activities increase the advantages small firms can have in terms of access to resources and knowledge from various sources including support from public agencies, and access to markets.

3.3.2 Measurement of social capital and issues arising

Social capital is a concept admittedly too difficult to measure in precise and objective terms. Not surprisingly, there is to date no single direct measurement of social capital. To measure social capital, Hudson and Chapman (Hudson & Chapman, 2002) reduced the key dimensions of the concept into 5 categories: trust, informal networks, formal networks, political involvement, and equality of member engaging in community. Hjerppe (2003) proposed a three-dimensional approach to measure social capital at macro, meso and micro levels. Measurement of social capital at the macro level focuses on the adequacy of the existing policy framework and institutional basis for promoting knowledge flows. The meso level addresses issues at regional or community levels. The micro level relates to individuals and organisations.

Ruuskanen (2004) proposed measurement of social capital and innovation at firm level in Finland by identifying the sources of social capital and the mechanisms that relate social capital to innovation activities. The key indicators he used for trust are the extent of network relations and the quality of cooperation along the network. UNIDO (2006) provided a more complex approach to measure social capital for industrial development in Ethiopia and Vietnam in terms of trust level, network participation and association membership.

The quest for indicators has been prompted by the growing research interest to explain social capital as a missing link in the innovation system (Grootaert, 1998). Fukuyama (2000) studied generalized trust - the trust of strangers - to show that where there is high trust, as in the United States, Germany and Japan, for example, there has generally been marked progress in technology, innovation and competitiveness.

3.3.3 Social capital and the sociology of SMEs

SMEs are important vehicles for local community development in both social and economic terms. Agglomeration of small household firms to form a community-based businesses can help increase income of the community and underpin development of social network among community members. Raco (1999) argues that the geographical concentration of small firms can be growth-effective, particularly if supported by appropriate policy incentives. Such agglomeration of firms brings about a powerful 'institutional thickness' of a community or industrial cluster, which enhances the learning capability, and competitiveness of the community of firms. Small firms in a community can become creative and innovative by learning from their neighbours' success stories. The emergence of entrepreneurial communities within the SME sector can help promote the innovation culture among SMEs and can also create spillover effects that are beneficial to the economy at large (Nijhawan & Dubas, 2007).

The sociology of SMEs in developing countries is generally conditioned by the geographical distribution of social capital and market base for the products of SMEs. To the extent that the market for SMEs is limited to specific geographically and even ethnically and culturally bounded localities, the social capital base of SME activities can for the most part be attributed to the organisational relations within the SMEs, and also to a limited extent to the SMEs' market relations. The trust level within the SMEs, particularly in the case of family businesses, would generally be expected to be high, but such trust and the social capital borne by it is likely to be knowledge-constrained in view of the limited extent of market relations. Consequently, there would be little or no scope for creativity innovation. This situation is reinforced when ethnic or family loyalty and geographic remoteness pre-empt the scope for competition. Indigenous knowledge would in such circumstances be sterile and incapable of creativity and innovation for lack of interaction with new ideas and knowledge from outside the geographic and ethnic/family boundaries. What we have in this scenario is regionally distributed independent SMEs with no cross-boundary transactions. The absence of cross-boundary transactions means there is no scope for knowledge exchange, cooperation and hence innovation. Indigenous knowledge would be advanced through external transactions and use of technological infrastructures from university R&D, clustering of firms in related industries and business-service firm network (Feldman, 1994).

SMEs, and particularly those in the household-based category, have good reason to mistrust their counterparts outside their boundaries in the event of imperfect market conditions and the absence of institutional or organisational safeguards against possibilities of being exposed to 'hold-up' threats by competitors from outside their boundaries. Thus, where knowledge and market power are not evenly distributed across SMEs, submitting to transparency rules would play to the disadvantage of weaker firms. Not surprisingly, therefore, firms under such circumstances would feel comfortable to live in mistrust of one another, deeply averse to the idea of sharing their culturally unique knowledge and experiences. And this culture of 'mistrust' generally exists among SMEs in developing countries (Nguyen et al., 2009).

SMEs in such a scenario bear the characteristic of having strong 'internal social capital', but little or no 'external social capital' as they hardly have any communication network with other firms and agencies. Since it is the social capital of the latter type that is crucial for innovation through knowledge sharing and exchange (Zhang & Chen, 2003), there is a need for policy intervention to enable SMEs to interact through the establishment of intermediary or bridging institutions (Yokakul & Zawdie, 2010; Yuwawutto et al., 2010). This arrangement will reduce the transactions cost of knowledge exchange and so enable SMEs to exploit indigenous knowledge to the full by incorporating into it new ideas and knowledge. This way, SMEs can play a major role in the development of disruptive technologies, while at the same time transforming the salient features of their sociology.

3.3.4 How does social capital influence innovation?

Theoretically, innovation would be expected to occur in SMEs when external social capital arising from external links is greater than internal social capital deriving from the organisational strength of the firm. Both internal and external social capital constitute important bases for innovation, although it can be argued that external social capital is more crucial, as this is the factor that reduces the transactions cost constraint on knowledge exchange (Lee et al., 2001).

When relationships are forged between firms and then underpinned by a culture of transparency and trust, the stage is set for knowledge and information to flow freely between firms thereby relaxing the transactions cost constraint on innovation. Trust, which is built up by norms and social networks, removes barriers to communication and the flow of information, and thus provides the necessary condition for creativity and innovation to thrive (Landry et al., 2002). Where there is free flow of information among network members, it is possible to identify specific needs that are not yet met in the wider network. It is also possible for individual members in the network to evaluate themselves in the light of the position and experiences of others in terms of strengths and weaknesses and threats and opportunities, so that they can creatively work out as to how they could turn weaknesses into strengths and threats into opportunities with respect to production and marketing activities. Therefore, firms in the network would benefit from network complementarity of resources, and knowledge among network members that would necessary to strengthen their weaknesses (Adler & Kwon, 2002).

SMEs in strongly developed networks would be more innovative and competitive than those who are not as they would have more opportunities for knowledge sharing. Carayannis et. al (2000) identifies three categories of trust, according to the extent of trust: weak, semi-strong and strong. Strong trust contributes towards effective networking. The work of Carayannis also clearly illustrates the link between of social capital, the learning process, and knowledge sharing, as shown in Figure 3.4 below. Weak and semi-strong trust attributes can, on the basis of this model, be invoked to explain the 'patchy' character of networks that are in evidence in many developing countries where the incidence of innovation is observed to be few and far between.

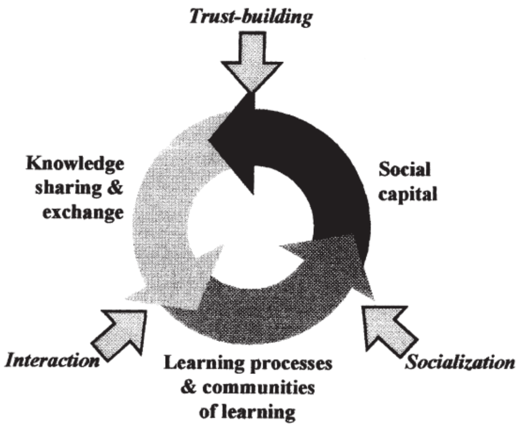


Figure 3.4 Process linking knowledge sharing, learning and social capital
Source: Carayannis et. al (2000, p.481)

As noted above, the weakness of innovation network in the SME sector is attributable to the lack of trust to underpin social relations. Lack of trust among firms is engendered, among other factors, by lack of knowledge about the benefits accruing from knowledge sharing, and by the perceived risk associated with active engagement in social networks in the absence of transparency[3]. Where there is lack of trust, there is lack of commitment of individuals/firms in the network to exchange knowledge and share experiences with each other. When trust is multiplied and takes root across the network of firms, it translates into collaboration between partners

[3] External links provide firm gaining access to knowledge resources, reduce transaction cost, and increase repeat transactions with business partners. According to Dahlman (1979), transaction cost is a cost associated with "search and information costs, bargaining and decision costs, policing and enforcement costs". Firm's perception of transaction cost may vary depending on individuals and industries. However, most firms want to minimise their total cost.

based on equality of opportunity and equity in the distribution of the gains from collaboration. Thus, trust, in supplement with the good learning ability of members in a network, would enhance the innovativeness and competitiveness of firms in the network (Meerod, 2006). Firms that have high degree of network embeddedness based on trust would therefore have much to gain from participating in the network.

Lack of effective network among firms results from weak social relations and the absence of trust. Gray (2002) argues that very small firms, especially owner-managers, are generally risk-averse because of the fear of losing control over their firms in the event of opening themselves up for interaction with other firms. They would be satisfied remaining closed and limited to low but stable business turnover rather than engage in what they perceive to be a high-risk venture of sharing knowledge with potential competitors, notwithstanding the prospect of growth that could arise from such engagements.

On the other hand, as noted above, social network increases opportunities for SMEs to receive more information embedded in social relations. Firms consider to collaborate with external knowledge bodies because they need to reduce the risk associated with R&D and innovation as well as the transactions cost of search for appropriate technology and information (Tether, 2002).

Networking thus helps firms to gain access not only to knowledge that would inform best practice in production and marketing activities, but also to financial support from government and non-government agencies and private sector credit organisations. This is particularly important for SMEs in developing countries for most of which social capital would reduce to that of the internal type and the sources of knowledge and finance are often limited to family circles, and there are no institutional mechanisms to make up for the deficiencies in social capital precipitated by the lack of trust-based social relations.

It may be asked why, despite the evidence of policy intervention, the linkage between NIS actors is more effective in some countries (i.e. developed countries) than in others (i.e. developing countries) in terms of its impact on innovation. For the most part, this can be accounted by the extent of the social capital stock that can be readily accessed. This would require governments to consider their role in supporting and promoting innovation and technological progress through 'social capital' formation. It is to this point that we will turn in the following section.

3.4 Government interventions to promote social capital and innovation

Government intervention is crucial where the SME sector is weak and the degree of networking and social capital is low. SMEs in developing countries have limited ability to access knowledge, information, and finance; and are characteristically risk averse and seldom proactive to be considered creative and innovative. The challenge of policy in such cases is to design appropriate support schemes to help SMEs overcome such obstacles. This can be done not only by enhancing the availability of accessible technologies, but also by providing support to social capital development through the creation of networks that would effectively integrate SMEs into the national system of innovation (Lundvall et al., 2002).

Storey (2008) compares traditional SME policy with newer entrepreneurship-related SME policy. The former aims to provide services to SMEs while the latter explicitly focuses on facilitating network development for SME to gain access to public services. Policy of the latter type is enabling and so is capable of bringing out the entrepreneurial and innovative drive of SMEs. If policy interventions are designed along this line, they will help expedite the process of innovation and growth (Oldsman & Hallberg, 2002).

Policy intervention embedding creativity and innovation in industrial culture would be expected to stimulate initiatives at micro (firm) level by providing support systems and promoting the culture of transparency, trust and networking, so that the top-down approach to investment initiatives and decision-making is reversed, with grassroots initiatives taking the lead (Yokakul & Zawdie, 2009).

In Thailand, the government policy framework has recently shifted its focus towards the development of industrial cluster, public-private links and industrial networking with the aim to improve social capital formation in the SME sector for long-term development. By contrast, in advanced economies like the U.K., the focus of policy with respect to SME development has for long been on the development of institutions and support structures such as knowledge network for SME innovation and growth (Gibb, 2000). A well-known project under this scheme is the UK ‘Business Links’ scheme which provides SME services through a network of local support agents. The BL programme has been found to be very successful particularly for the transfer of tacit knowledge through the advisory role of local experts from various disciplines (Mole, 2002).

The regional clustering of SMEs has prompted policy in many countries to put increasing emphasis on regional innovation system and networking (Cooke et al., 2005; Tura & Harmaakorpi, 2005). Decentralisation has the effect of fast delivering technical, financial or administrative support services to SMEs in their respective regions. Support programmes offered at regional level include the development of learning and knowledge regions based on intensive networking to promote knowledge transfer and diffusion to industry by various subsidiary schemes such as consultancy services, and business network with academic institutions, banks and SME networks elsewhere (Storey, 1994). Such programmes aim at strengthening relationships among various actors in the regional and national system by providing institutional mechanisms that would bridge the communication gap between SMEs and players in the knowledge sector of the economy. This would enhance understanding between SMEs, and also between SMEs, government, non-government and knowledge providing agencies. It would also increase the social interaction of SMEs thus reflecting progress with respect to social capital formation in the SME sector.

Thus, government intervention is crucial to close learning and communication gaps in the SME sector resulting from cultural and institutional barriers that obstruct the flow and exchange of knowledge and information in the system (Yuwawutto et al., 2010). Government intervention in the SME sector nurtures social capital development by providing the necessary interfaces and linkage mechanisms that would facilitate interactions between the supply of and demand for technologies in the SME sector (Oughton et al., 2002). The provision of a strong social capital base in the system would, by enhancing the effectiveness of innovation systems at national, regional and sectoral levels, make SMEs active players in the process of socio-economic development.

3.5 Conclusion

This chapter has addressed the significance of SMEs for economic growth felt chiefly through SMEs contribution to GDP and aggregate industrial employment, and through the role they play in the national/regional innovation system as carriers of indigenous knowledge, which is capable of creativity and innovation when integrated with new ideas. However, the record of SMEs in many developing countries shows that their contribution to innovation is far from significant. This is because they are constrained by a whole range of factors like shortfalls in the supply of investment funds, managerial, organisational and operative skills, and lack of access to new ideas. All these shortfalls can be explained by the fact that the SME sector in developing countries is characterised by the preponderance of social capital deficit as a result of which SMEs are least networked and seldom communicate and interact with each other and with other players in the innovation system. Social capital deficit has persisted in the SME sector because of the prevalence of a culture of mistrust. This has limited SMEs to small local markets and deprived them of the possibility of developing 'external social capital' by forging links with external knowledge bodies. The indigenous knowledge on which their activities are based has consequently remained sterile.

The chapter has pointed out two major challenges that would need to be confronted if SMEs in developing countries are to be active players in the national/regional innovation system. First, the innovative potential of indigenous knowledge, which forms the basis of a good part of SME activities, has to be exploited, so that SMEs can be competitive not only in local markets but also in regional, national and even global markets. This could happen if a learning mechanism is set in place for indigenous knowledge to be readily adapted to the ever changing frontiers of knowledge. Technological learning in the SME sector would result in the occurrence of "disruptive technological innovations", which by combining the tacit aspect of indigenous knowledge with the explicit or codified aspect of knowledge based on science and technology would make SMEs innovative and competitive, and significant participants in the national/regional innovation system.

Secondly, policy intervention in the SME sector is absolutely important to address the challenges posed by the limitation of indigenous knowledge on which SME activities are based, and by the prevalence of social capital deficit. This is best done through the creation of ‘bridging’ or ‘intermediary’ institutions that act as promoters by networking SMEs, so that they can communicate and share experiences not only with one another but also with other actors in the innovation system, notably universities and research organisations, and government and non-government and private sector agencies.

It is within this analytical framework that the following chapters of this thesis will explore the state of SMEs in Thailand - particularly the Thai dessert industry – with respect to the issue of innovation and competitiveness and the role of indigenous knowledge in this.

CHAPTER 4

Thailand's Economic Development and National Innovation System

This chapter provides an overview of Thai economy as a basis for understanding the National Innovation System (NIS) in Thailand. The chapter is divided into two main parts. The first part focuses on changes in the economic structure that have resulted from the application of strategies for industrialisation and transition to a knowledge-based economy. The second part discusses the experience of NIS implementation in Thailand with particular emphasis on the main NIS actors; the successes and failures of the system; and the role of science and technology policy framework that was adopted by the government to promote technology development through innovation.

4.1 An overview of the economy of Thailand

This section discusses Thailand's economic structure from historical background and its transition to a recent development, including government policies and strategies relating to science, technology and innovation. Thailand competitiveness from the past and present are also discussed as a reflection of policy implementation.

4.1.1 Economic structure: history and transition

The Thai economy was for long dominated by agricultural activities. Over the last five decades or so, however, it has evolved significantly with a shift towards industry-based and knowledge-based activities. Figures 4.1 and 4.2 show the growth of Thailand's Gross Domestic Product (GDP) during the period between 1960 and 2009. GDP grew steadily until 1997 when it fell down by 11% as a result of the Asian economic crisis that also engulfed Thailand. The crisis was short-lived and economy is observed to have quickly recovered from the shock to be able to grow, as it did, at the average annual rate of 4.7% from 1998 to 2007. In 2008, growth fell by 2.3% partly as a result of the occasion of political unrest and the onset of global economic recession.

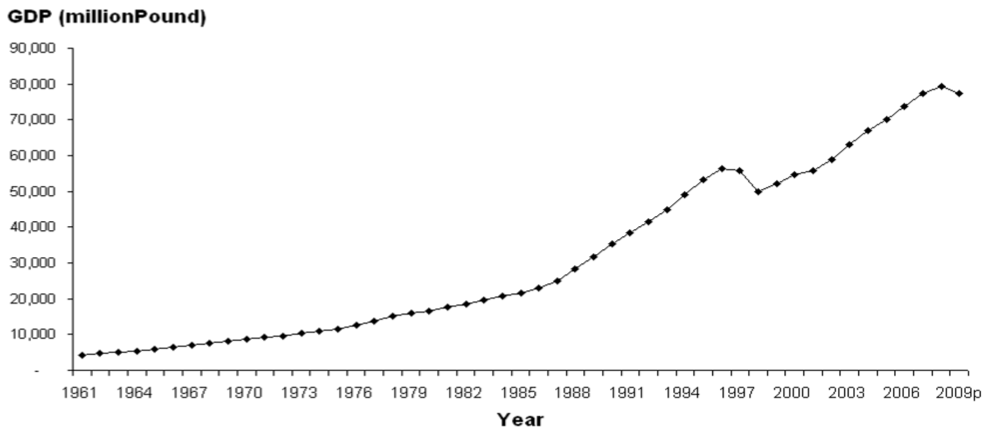


Figure 4.1 Thailand Gross Domestic Product (GDP) (1961-2009)
Source: The National Economic and Social Development Board (NESDB) (2010)

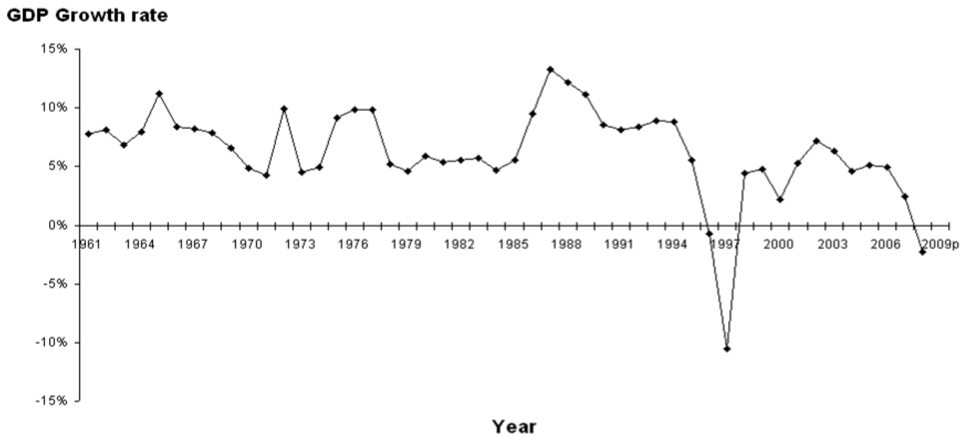


Figure 4.2 Thailand GDP growth rate (1961-2009)
Source: The National Economic and Social Development Board (NESDB) (2010)

As can be seen from Figure 4.3 and the data in Table 4.1, industrialisation has now taken a firm root in Thailand. This is the result of a cumulative growth process very much in line with the pattern of modern economic growth. According to Simon Kuznets (1955) modern economic growth involves a generally consistent decline in the share of agriculture in total GDP, while the share of industry rises as the economy grows. With respect to employment, Kuznets observes a general decline in the proportion of labour force in agriculture and a rise in industry's share of labour forces as national income increases. Kuznets' observation (1955) was corroborated by Chenery (1960) who showed empirically that as income grows, the industrial sector, led by the manufacturing sub-sector would grow more rapidly than the rest of the economy, thus absorbing more and more of the growing labour force. Chenery attributes the 'non-proportional' growth of the industrial sector in relation to the growth of the economy as a whole to the terms of trade in favour of industry and against agriculture.

The experience of economic growth in Thailand is basically consistent with the Kuznets pattern. In 1960, industry accounted for 14.5% of total GDP; industry's share in total GDP had grown to 39% in 2009. During the same period, the share of agriculture had declined from 31.5% to 8.9%.

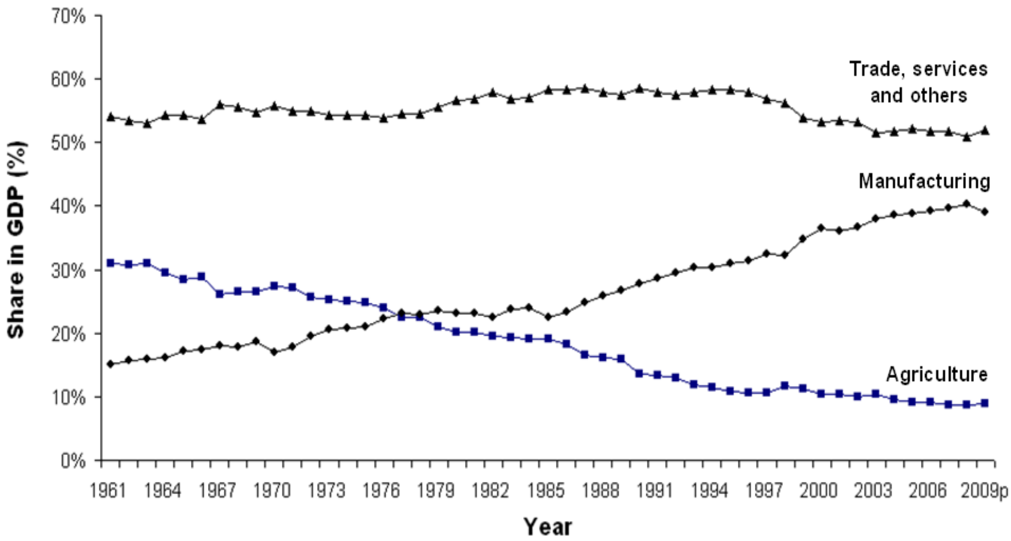


Figure 4.3 Contribution to GDP by economic sectors
Source: The National Economic and Social Development Board (NESDB) (2010)

Table 4.1 Contribution to GDP by economic sectors (1960-2009)

Economic sectors	1960	1970	1980	1990	1995	2000	2005	2006	2007	2008	2009
	Contribution to GDP (in %)										
Agriculture	31.5%	27.3%	20.2%	13.6%	10.8%	10.3%	9.0%	9.0%	8.7%	8.8%	8.9%
Manufacturing	14.5%	16.9%	23.1%	27.8%	31.0%	36.4%	38.9%	39.1%	39.6%	40.2%	39.0%
Trades, services and others	54.0%	55.7%	56.7%	58.6%	58.2%	53.3%	52.1%	51.8%	51.7%	51.0%	52.0%
GDP[4] (million Pound)	**4,103**	**8,691**	**16,613**	**35,370**	**53,330**	**54,698**	**70,146**	**73,755**	**77,392**	**79,298**	**77,492**
GDP Growth	**5.2%**	**4.8%**	**5.9%**	**8.6%**	**5.5%**	**2.2%**	**5.1%**	**4.9%**	**2.5%**	**-2.3%**	**-**

Source: The National Economic and Social Development Board (NESDB) (2010)

[4] GDP at constant prices in 1988

In terms of employment, Figure 4.4 shows that employment in agriculture had declined from approximately 70% in 1977 to 40% in 2009. On the other hand, the employment in the service and other sectors had significantly increased from 23% in 1977 to 47% in 2009. The share of the manufacturing sector in total employment had slightly increased from 9% in 1977 to 14% in 2009. Industry's share of total employment is not proportionate to its contribution to total GDP, indicating that activities in industry are less labour-intensive that those in agriculture and that productivity is higher in industry than in agriculture. Within industry, SMEs contribute 99.45 % of total number of firms and 33.65 % of manufacturing GDP (OSMEP, 2009b).

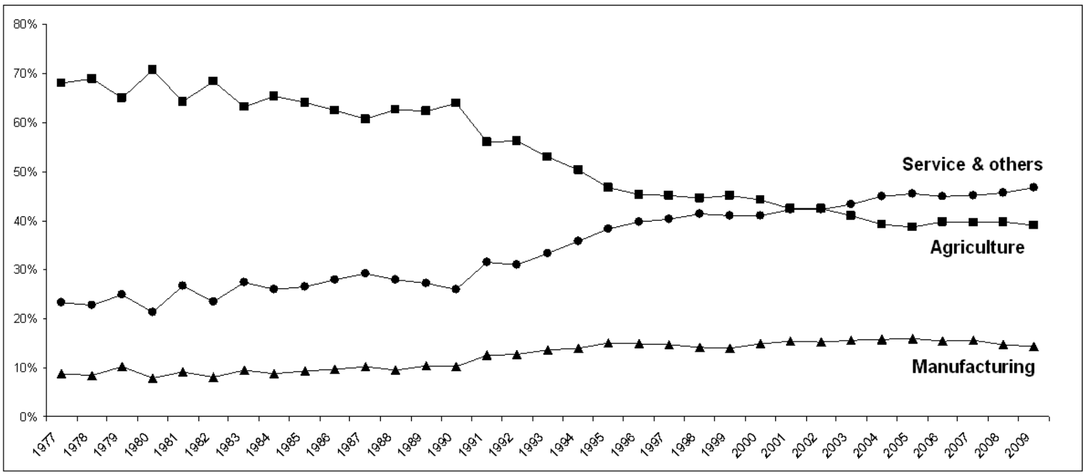


Figure 4.4 Contribution total employment by economic sectors (1977 – 2009)
Source: The National Statistic Office (NSO) (2010)

Table 4.2 Contribution to employment by economic sectors (1960-2009)

Economic sectors	1977	1980	1990	1995	2000	2005	2006	2007	2008	2009
	Contribution to employment (in %)									
Agriculture	67.9%	70.8%	64.0%	46.7%	44.2%	38.6%	39.7%	39.5%	39.7%	39.0%
Manufacturing	8.8%	7.9%	10.2%	15.0%	14.9%	15.8%	15.4%	15.5%	14.7%	14.3%
Trades, services and others	23.2%	21.3%	25.9%	38.4%	40.9%	45.5%	44.9%	45.0%	45.6%	46.8%
Total employment (thousand persons)	**18,138**	**22,524**	**30,844**	**30,815**	**31,239**	**35,257**	**35,686**	**36,249**	**37,017**	**37,706**

Source: The National Statistic Office (NSO) (2010)

Industrialisation in Thailand is largely based on exported-oriented strategy. As can be seen from Table 4.3, the share of total export of goods and services increased from 21% in 1980 to 65% in 2009. A large proportion of this increase in exports is due to the export of goods, which increased from 17% in 1980 to 52% in 2009. Overall, the Thai economy is shown to have grown to be increasingly export-dependent, with 65% of goods and services produced in the economy being destined for exports.

Table 4.3 Contribution to GDP by the export of goods and services (1980-2009)

Year	Total export of goods and services	Export of goods	Export of services	Year	Total export of goods and services	Export of goods	Export of services
1980	21.4%	16.5%	4.8%	1995	47.1%	37.9%	9.2%
1981	22.0%	17.3%	4.7%	1996	42.0%	32.2%	9.8%
1982	23.3%	18.5%	4.8%	1997	45.7%	35.1%	10.6%
1983	20.8%	16.1%	4.7%	1998	55.3%	42.5%	12.7%
1984	23.0%	18.3%	4.7%	1999	57.7%	45.3%	12.4%
1985	24.2%	19.0%	5.2%	2000	64.8%	52.9%	11.9%
1986	26.4%	21.2%	5.2%	2001	60.7%	48.8%	11.9%
1987	29.4%	23.4%	6.0%	2002	64.5%	51.9%	12.7%
1988	33.0%	25.5%	7.5%	2003	64.5%	53.0%	11.5%
1989	35.6%	28.3%	7.4%	2004	66.5%	54.0%	12.5%
1990	36.5%	28.5%	8.0%	2005	66.2%	54.0%	12.2%
1991	38.7%	31.3%	7.4%	2006	68.7%	55.8%	12.9%
1992	40.7%	32.5%	8.3%	2007	70.6%	57.2%	13.5%
1993	42.5%	33.6%	8.9%	2008	72.4%	59.1%	13.3%
1994	44.6%	36.3%	8.3%	2009	64.7%	52.0%	12.7%

Source: the National Economic and Social Development Board (NESDB) (2010)

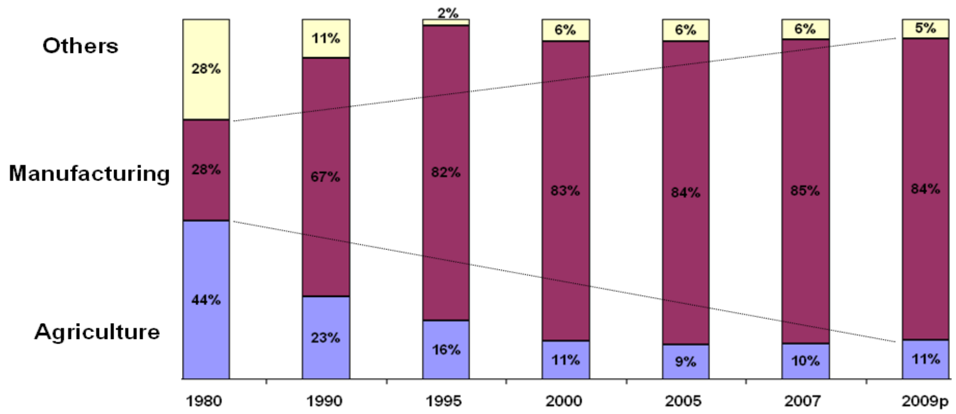


Figure 4.5 Contribution to export by economic sectors

Source: The Ministry of Commerce (2010)

In relation to export by economic sectors, Figure 4.5 shows the share of manufacturing in total exports to have increased from 28% in 1980 to 84% in 2009, while the share of agriculture in total export is shown to have declined from 44% in 1980 to 11% in 2009. Important products exported are computers; electronic and electrical appliances; automotive parts; plastics; rubbers; and machinery parts etc. Thailand's largest export market is the United States (The Customs Department, 2005).

As an export-oriented economy, Thailand depends on its competitive prowess for sustainable growth. Hitherto, much of its competitiveness has derived from the supply of cheap labour. But cheap labour cannot be considered as the basis for long-term competitiveness. Already, Thailand is trapped between the rapidly growing high-wage Newly Industrialising Countries (NICs) like South Korea and Singapore and the rapidly growing low-wage countries like China and India. This situation has the so-called "nutcracker effect", which is causing Thailand to lose competitiveness due to the increase in technology gap which separates it from the NICs and other developed countries, and also price competitiveness due to the increasing role of the low-wage countries in the export markets (Phasukvanich, 2003). There is now increasing realisation that what Thailand needs for the long-term competitiveness of its economy is embedding more knowledge and skills in all activities across the economic spectrum.

4.1.2 Government policies and strategies

Government attempts at social and economic development in Thailand were launched in earnest in the early 1950s when the National Economic Council (NEC) was established with the mission to advise the government on the state of the economy. National Economic Council later became to be the National Economic and Social Development Board (NESDB), charged with the responsibility of producing the National Economic and Social Development Plan (NESDP). NESDP is a five-year plan. The first five year plan was launched in 1961. There have so far been 10 five year plans or NESDPs.

The first three NESDPs (1961-1976) did little to focus on science and technology. Instead, the focus was on the social and economic development based on the provision of agricultural and public infrastructures. The government's recognition of the importance of Science and Technology (S&T) in the 4^{th} NESDP (1977-1981) led to the establishment of the Ministry of Science and Technology in 1979. During the 4^{th} Plan, policy aims were focused on technological development as a basis for import substitution of industrial products. The 5^{th}, 6^{th}, and 7^{th} NESDPs (1982-1996) were explicit in their emphasis on the development of S&T infrastructure as a basis for industrialisation. This resulted in the expansion of the share of the industrial sector in total GDP from approximately 15% in 1961 to 35% in 1997 (see Figure 4.3) with the economy growing at the average rate of 7.7% per year (Promwong & Rajadanuraks, 2005). The 7^{th} NESDP, in particular, addressed the issue of technology development to improve efficiency and productivity in the manufacturing sector in order to respond to the competitive pressure felt by the rapidly expanding export sector of the Thai economy. However, while prioritising S&T needs, concerns relating to the social and economic conditions were relegated to secondary position in the 7^{th} Plan.

Even so, the framework of S&T policy produced by the 7^{th} Plan was limited in that it focused on the public and academic sectors rather than on private and industrial sectors. Moreover, the term "innovation" had never been mentioned as in previous national policy plans (NSTDA, 2005a). The industrial policy adopted during the 7^{th} Plan did not provide adequate room for indigenous technological capability development either. This is in contrast with the experience of Japan and the Newly Industrialising Economies where the actively positive role of state organisations played important roles in promoting industrial S&T.

Little wonder, therefore, that in Thailand, the industrial policy interventions exercised during the 7^{th} Plan did little to transform the general infrastructure; the educational system; export structure; and growth, etc. (NSTDA, 2005a). The mechanism linking government subsidy and industry to promote long-term technology development through innovation was not clearly determined either. The main objective of human resource and skill development in Thailand was to increase employment rate, whereas in Taiwan and Singapore, high-skill training was pursued to support technology development (Arnold et al., 2000). Such weaknesses in the policy framework resulted in a slow development of S&T, in Thailand in relation to the experience in the Newly Industrialising Countries, like South Korea, Taiwan and Singapore. This was not, of course, without consequences for the industrial growth performance of Thailand.

The weak industrial growth performance due to the failure of policy to promote strong S&T base was further aggravated by the onset of the 'Asian economic crisis' in 1997. The crisis, which started Thailand following credit boom, that precipitated economic bubble, liquidity/currency mismatches, current account deficit; and financial disturbance was externalised to other Asian countries, particularly Malaysia, Indonesia and South Korea (Goldstein, 1998). The crisis dealt a major blow to investment confidence and the stability of the currency. Intervention by the International Momentary Fund (IMF) helped to mitigate the adverse effects of the crisis. The crisis had nonetheless left Thailand with structural and institutional weaknesses of the Thai economy (Lauridsen, 2009). But the crisis, however, damaging was not without a 'silver-living' insofar as policy intervention in Thailand proved more proactive after the crisis than before it.

After the economic crisis in 1997, the Thai government focused more on industrial development and came up with proactive policies for economic recovery and also for strengthening the competitiveness of the economy. This featured as a major objective in the 8th NESDP (1997-2001). The plan to promote technology development in the 8th Plan was based on what was stated in the 7th NESDP; but the 8th Plan put more emphasis on human resource, and S&T infrastructure development than the 7th Plan did.

The NESDPs before the 8th Plan, addressed the issue of S&T and industrial policy in broad terms without providing operational contents and guidelines for Ministries and implementing agencies. The strategies adopted under the various Plans, especially the first six Plans, were found wanting because they gave rise to growth disparities across sectors and regions (Chairatana, 2006). The economic crisis which occurred during the 8th Plan indirectly helped to concentrate the policy making process by focusing attention not only on a short term recovery programmes but more importantly on long term prospects for sustainable development. This was central to the task which the 9th NESDP took on board during the period 2001- 2006. The 9th Plan saw the economy thrive under the so called 'Thaksinomics'[5] regime. It was under this Plan that S&T and industrial policy was given a new direction.

The 9th NESDP (2002-2006) introduced a major shift in economic, S&T and innovation policy in a way that would prepare Thailand for the development of a knowledge-based economy. This shift in policy together with the political commitment to the development of a 'sufficient economy'[6], helped the economy to thrive by counteracting the consequences of globalisation in a sustainable way through innovation and competitiveness (UNEP, 2006).

The 9th and 10th NESDPs were developed based on Thailand's S&T vision to become a fully fledged knowledge-based economy by 2020. The 10th NESDP (2007-2011) focused on three main aspects of development: economic capital, natural resource and environmental capital, and social capital. Under this Plan, policy provision sought to foster industrial cluster development, and the development of S&T and tangible infrastructure support mechanisms, to enhance national competitiveness. Innovation policy focused on strengthening the educational system to provide qualified workforce particularly in S&T skills; building new knowledge through R&D for technology transfer; developing links between knowledge sources and users; providing adequate support mechanisms for industrial innovation; and establishing S&T infrastructure such as science pars and IT infrastructure. There is an explicit recognition in the 10th NESDP that S&T issues should be integrated into macro economic policy and planning as a critical component for the economy to be

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[5] 'Thaksinomics' is derived from 'Thaksin' and 'economics'. Thaksin Shinawatra is the 23rd Prime Minister of Thailand during 2001-2006 whose background is a businessman. The term refers to two aspects. The first aspect refers to 'political brand name' of the party led by Thaksin and another aspect generally refers to the set of economic policies during his duty (Thanapornpan, 2003).

[6] Sufficient economy is a development philosophy created by His Majesty King Bhumibol Adulyadej guiding Thai people to behave in a balanced approach. The theory is based upon "a Middle Path between society at the local level and the market in the global context. By highlighting a balanced approach, the philosophy allows the nation to modernize without resisting globalization, but provides a means to counteract negative outcomes from rapid economic and cultural transitions" (UNEP, 2006, p. 1). 'Sufficient economy' is believed to enable the community to sustain their strength and survival by adequate production and consumption; proper technology usage; natural resource preservation.

able to evolve as a major global player. The 10th Plan recognises the importance of S&T as a key driver for long-term economic growth. Whereas earlier plans sought to promote growth through increased use of resources including cheap labour, the 10th Plan has sought to increase the knowledge content of resource input in the growth process with the aim to enhance the competitiveness of the economy in the global market. Improved competitive performance is of particular importance for Thailand since it is an export-oriented economy.

The occasion of economic crisis in 1997 might have frustrated the achievement of the objectives set out in the 8th NESDP; but it also laid bare the weaknesses at the heart of economic and industrial policy which relegated S&T-based development as a matter of marginal concern. Thailand has had to learn through the crisis the attractions of a knowledge-based economy - namely, that a knowledge-based ecoomy is better positioned to adapt to changing circumstances including absorbing external shocks.

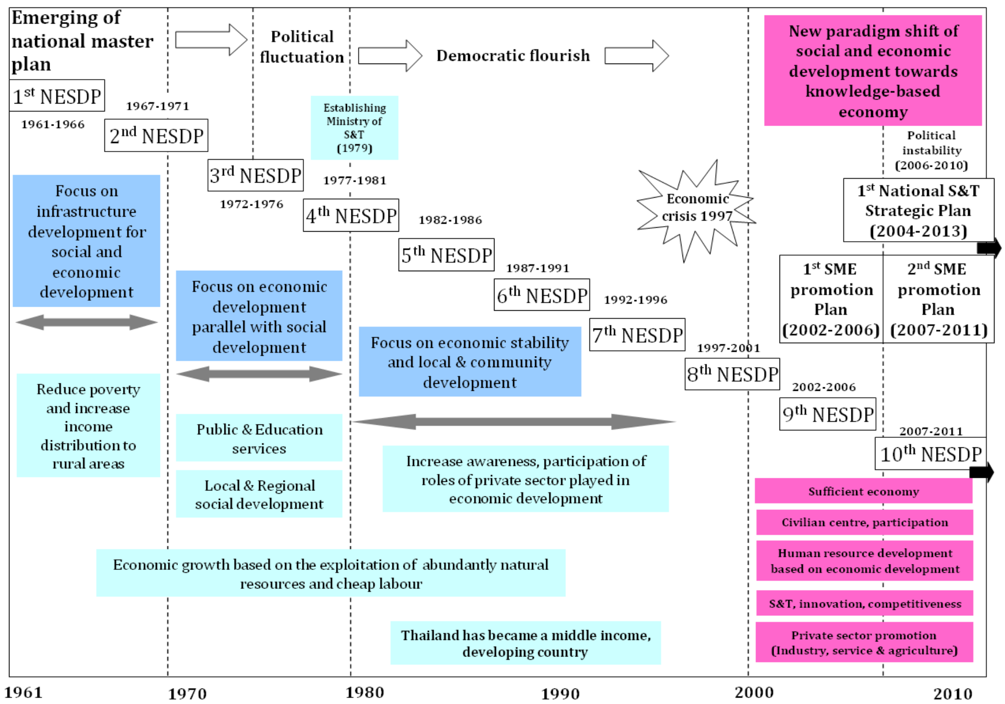

Figure 4.6 The development of Thailand's master plan of social and economic development and transition to knowledge-based economy
Source: adapted from Termpittayaphaisit & Pa-aim (2009)

4.1.3 Thailand competitiveness

It is apparent from the experience of planning and development over the years that Thailand has been evolving as a competitive economy. The well-known international competitiveness ranking conducted by the International Institute for Management Development (IMD) in 57 countries shows that Thailand's position in the league has indeed improved over the years, as shown in Figure 4.7. In 1997, it ranked 31st on the competitive league table. By 2009, its ranking had moved up to the 26th position, showing that Thailand had performed better than Indonesia, but that it has yet to catch up with countries like Singapore, Malaysia and China.

Competitiveness is assessed on the basis of the ability of a country to create supportive infrastructure and business environment that would promote sustainable economic development. As shown in Table 4.4, four main criteria are applied to assess the competitiveness - namely economic performance, government efficiency, business efficiency and scientific and technological infrastructure. The overall competitiveness ranking of Thailand compared with other Asian countries is shown in Figure 4.7.

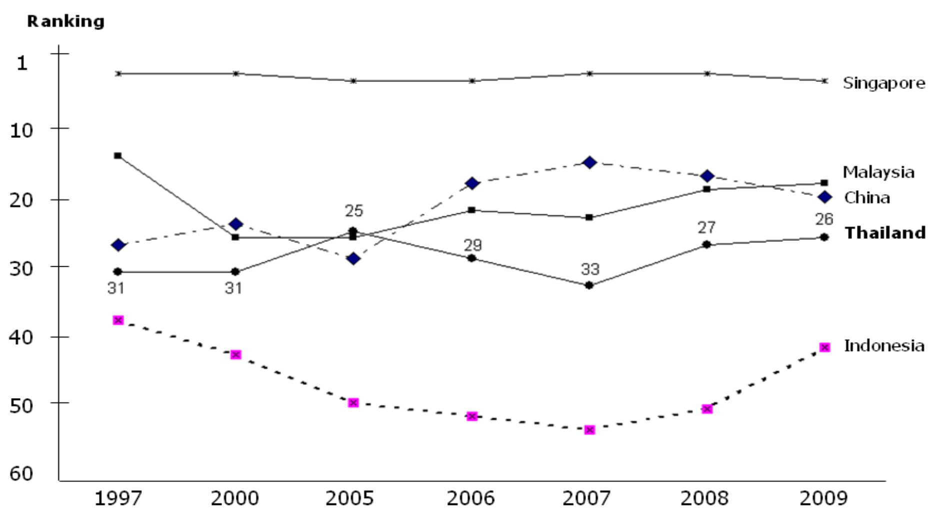

Figure 4.7 Ranking of Thailand competitiveness and other Asian countries
Source: IMD world competitiveness yearbook (IMD, 1997-2009)

Table 4.4 Thailand competitiveness raking by criteria

	1997	2000	2005	2006	2007	2008	2009
Overall competitiveness	**31**	**31**	**25**	**29**	**33**	**27**	**26**
Economic performance	28	14	7	19	15	12	14
Government performance	23	26	14	20	27	22	17
Business performance	33	38	25	25	34	25	25
Infrastructure	40	41	39	42	48	39	42
- scientific infrastructure	41	42	47	45	49	37	40
- technological infrastructure	38	44	37	41	48	43	36
Number of countries	**46**	**47**	**51**	**53**	**55**	**55**	**57**

Source: IMD world competitiveness yearbook 1997 – 2009

Table 4.4 shows that even though Thailand's overall competitiveness has improved in recent years, its competitiveness on science and technological infrastructure has not. Deficiencies in S&T and technological infrastructure appear to account for Thailand's failure to match or even excel the competitiveness of countries in Asia like Singapore, China and Malaysia. Thailand's relative weakness in the provision of S&T and technological infrastructure has been a result of the absence of effective national innovation system. Lack of effective facilities for promoting technological innovation leads to low absorptive capacity of SMEs and poor connectivity and linkage development within and among public (knowledge and government agencies) and private (service enterprises and industry) sectors. It is largely for this reason that the 10th National Economic and Social Development Plan had taken on board the development of national innovation system in Thailand as the way forward for enhancing the economy's competitive performance in an increasing globalising world.

4.2 Thailand National Innovation System (NIS)

In Thailand, as in many other developing countries, the NIS is at an early stage of development. Consequently, linkages and networks between key actors in the NIS are weak and few and far between. The absence of a coherent network means that there is ineffective coordination and collaboration between individual agencies and institutions in the public and private sectors of the economy, and hence little or no knowledge exchange.

Although the significance of NIS as a policy framework is gaining increasing recognition in Thailand, it has not been comprehensively studied and hence well understood yet. What little study there is draws on the work of Arnold et al. (2000).

The main actors shaping the NIS in Thailand are the government, universities and knowledge organisations, and private sector firms. Other important components are institutions; financial intermediaries/markets; and technology and innovation intermediaries, as shown in Figure 4.8 below.

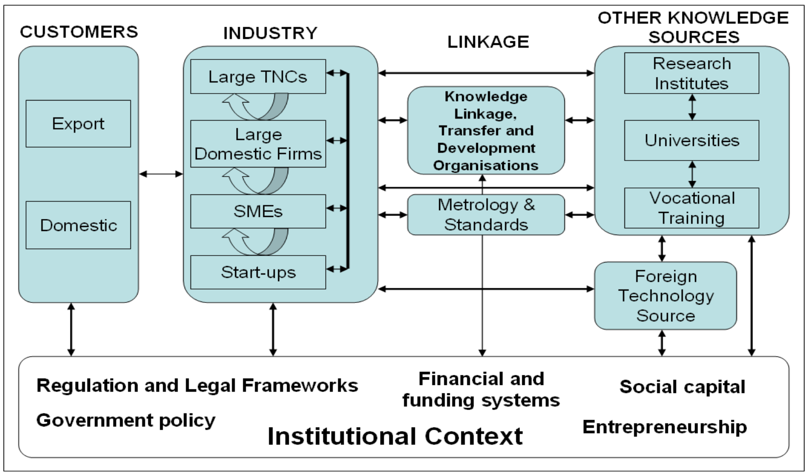

Figure 4.8 Framework for analysing national innovation system in Thailand

Source: adapted from Arnold et al. (2000) and Intarakumnerd (2006)

What makes the 10th NESDP different from its predecessors is its explicit recognition that planning for the years ahead would be incomplete without setting in place the framework for the national innovation system.

The remainder of this chapter will explore the various aspects of the NIS in Thailand using the data and information obtained from the Thailand R&D, technology and innovation survey conducted in 2002, 2003, 2004 and 2005 by the National Science, Technology and Innovation Policy Office.

4.2.1 Keys actors

4.2.1.1 Government and policy formulation

Government policy plays important role in the development of science, technology and innovation in Thailand. The first National S&T Strategic Plan (NSTSP), which was drawn up by the National Science and Technology Policy Committee[7], covered the period of 2004 – 2013 and was adopted as a rolling plan to be revised periodically. The plan provides directions for policy implementation and monitoring, and seeks to promote science, technology and innovation, so that Thailand can evolve as a fully fledged knowledge-based society (KBS) and economy.

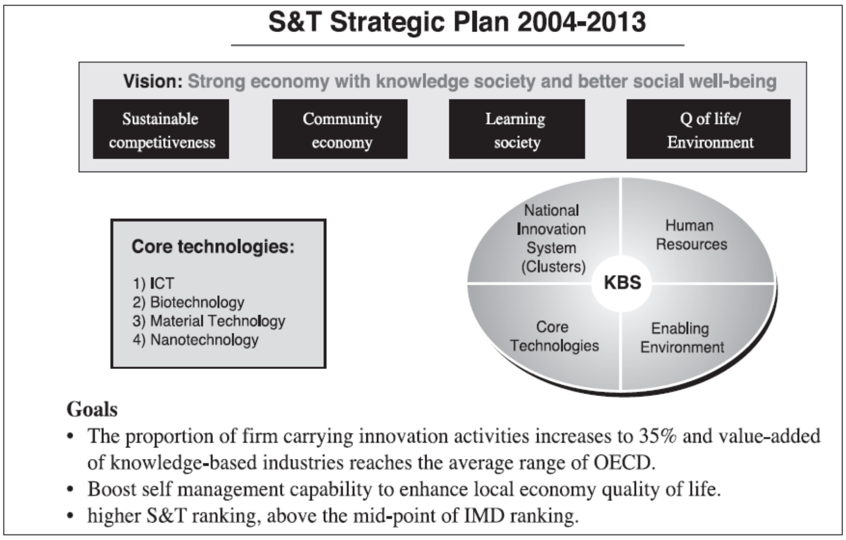

Figure 4.9 Framework of Thailand's science and technology development in the next ten years (2004-2013)
Source: National Science and Technology Development Agency (NSTDA) (2004, p. 27)

The commitment of the Thai government to invest in science and technology development over a ten year period was aimed to enhance the long-term competitiveness and sustainable development of the Thai economy. The industrial sector was targeted as a focal point for the development of innovation activities. Consequently, the industrial cluster approach was adopted to strengthen the technological capability of specific industries. As shown in Box 4.1, the NSTSP involved five main strategies of which industrial cluster development is one.

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[7] In 2008, National Science and Technology Policy Committee was expanded and transformed to National Science Technology and Innovation Policy Office.

Box 4.1 Five strategies of National Science and Technology Strategic Plan (2004 - 2013)

Strategy 1: Develop clusters, community economy, and quality of life to enhance technological capacity and productivity in industrial sectors and also to upgrade community economy and quality of social services.

Strategy 2: Develop science and technology manpower to serve economic and social demands.

Strategy 3: Develop infrastructure and institution to stimulate and promote science, technology and innovation development.

Strategy 4: Promote public awareness on science and technology to encourage people to support S&T.

Strategy 5: Reform science and technology management system to create unity and effective S&T management system.

Source: National Science and Technology Development Agency (NSTDA) (2004)

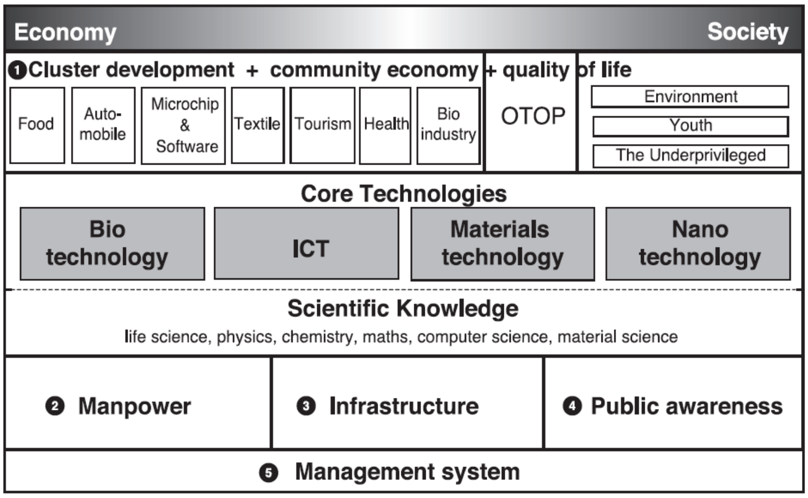

Figure 4.10 A framework of the National Science and Technology Strategic Plan (2004 - 2013)
Source: National Science and Technology Development Agency (NSTDA) (2004, p. 31)

For the National Science and Technology Strategic Plan to be successfully implemented, monitoring and evaluation systems had to be put in place; and ministries and government agencies had to be charged with the responsibility to ensure that the aims of each strategy are met.

4.2.1.2 Private firms

The private sector plays an important role in the Thai NIS as an innovation generator. In 2008, there were 2,836,377 private firms (manufacturing and non-manufacturing) in Thailand of which 99.7% were small and medium-sized enterprises (SMEs). The number of manufacturing enterprises was 547,614 or 19.3% of all firms (OSMEP, 2009b). From the innovation survey conducted by NSTDA (2005b), 2.6% of all firms in 2001 engaged in innovation activities. This had increased to 5.8% in 2003. The private sector's expenditure on innovation activities was 0.16% of GDP in 2003, which is very low when compared with Singapore's (~1.32%) and Sweden's (~2.96%). This shows that Thai firms have low R&D and innovative capability.

In the past, the growth of most Thai firms was not based on their technological capability building but rather on the expansion of production capacity, given technology, to meet the demand from rapid economic growth (Sripaipan, 1991; Intarakumnerd & Virasa, 2004). Firms' investments concentrated on production plant and facilities in order to produce more products and their interest was focused on short-term return on investment. The persistence of this practice limited the scope for technological learning and absorption, especially for SMEs that have laggard considerably in technology development (Arnold et al., 2000; Lauridsen, 2002; NSTDA, 2004; Berger, 2005).

According to the National Science and Technology Strategic Plan (NSTSP) 2004 – 2013 (NSTDA, 2004) and Arnold et al. (2000), technological capability levels in the industrial sector in Thailand is conceptually categorised into four levels as shown in Figure 4.11. Firms are expected either to evolve through these stages or else categorised into any one of these stages.

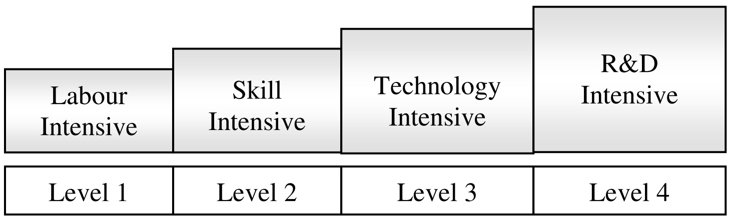

Figure 4.11 Levels of technological capability in Thai firms
Source: Adapted from NSTDA (2004) and Arnold et al. (2000)

Level 1: Labour-intensive industry: low demand of technology

Firms in this category have the lowest technological adaptation, and typically require a large number of employees in production processes. They would usually apply technology without any clear understanding of it. They have low awareness of technological changes and low demand for new technologies and would consequently respond slowly to changing market conditions. Generally speaking, they would not know if they have technological problems at all, so they have less opportunity to improve their technological capabilities. The products of firms in this category are basic products that do not require complex or high technologies, such as basic assembly line of flip-flops or other products with simple components.

Level 2: Skill-intensive industry: ineffective demand of technology

Firms in this category would apply technology through the employment of skilled workforce. They can select technologies that are appropriate to their circumstances, but they have limited adaptation capability. They are not clear as to how to improve technology to gain from its application and develop their technological capabilities. Latent knowledge and intrinsic technology are, however, embedded in their workforce and internal resources.

Level 3: Technology-intensive industry: active demand but limited capability

Firms in this category are capable of adapting and modifying their technologies. They are usually active in responding to the demand of technological changes but have limited capability to do a research and development and to experience major shifts in technology paradigms. Typically, S&T human resources such as scientists, engineers, and technical staffs are found in technology intensive firms.

Level 4: R&D intensive industry:

Firms in this category have high demand for technology and they are technology and knowledge sensitive in their activities. They clearly understand the technology application and are capable of modifying main characteristics of technology and innovate through R&D initiatives.

The majority of Thai firms are SMEs which belong to the first and second categories. Their technology threshold is low since they have little or ineffective demand of technology. Some SMEs, large enterprises and transnational enterprises are found to be at the technology intensive level. They can upgrade their technologies and perform reverse engineering (design and engineering). There are not many firms capable of performing successful research and technology development. Moreover, Thai firms considerably rely on imported technologies largely in the form of turn-key technologies and machine purchases without however, the intention to absorb the knowledge embedded in the technology (Intarakumnerd et al., 2002). This makes firms unable to adapt or change production parameters with the result that they eventually fail to develop their internal capabilities.

4.2.1.3 University

Universities and other higher education institutions are the main sources of knowledge production and human resource development through the provisions of teaching and research activities. In 2006, the number of graduates in Thailand totalled 337,369, of which 85% were from public universities. Thailand has a tertiary education capacity of around 2 million students (HEC, 2007) which are concentrated in the area of social science and humanities. The proportions of doctoral and master student enrolment in 2007 were 0.79% and 8.89% of total enrolment respectively, while the bachelor students constitute for 86.95%. In 2009, there were 121 Ph.D. and 468 Master graduates in the area of science and technology (PERDO, 2010).

The first public university in Thailand was established in 1917. The number of public universities increased to five in 1942. At the beginning, all public universities were under government control. Since the 1960s, many universities have been established, including public and private universities, colleges and technology institutes operating in central and regional areas. The Higher Education Institution was established in 1972 to govern all universities. This became the Office of the Higher Education Commission (HEC) in 2003 operating under the Ministry of Education. There are now three types of universities in Thailand: public universities, autonomous public universities and private universities. So far, there are a total of 147 higher education institutes, including 65 public universities[8];13 autonomous public universities; and 37 private universities (HEC, 2008).

Under the Education Reform Act of 1999, a new generation of public university, the autonomous public university came into being. Such universities were expected to minimise public expenditure, and increase performances and competitiveness of the public universities. The aim of the government is to transform public universities to

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[8] 50 public universities were upgraded from 40 teacher colleges (Rajabhat institutes) and 10 technology institutes during 2004-2005.

autonomous universities. Autonomous universities have flexible administrative systems and are least bureaucratic. Even though autonomous universities still receive financial support for administrative activities from the government, they have to find their own resources through charging of tuition fees, and attracting research grants to be worthy enough to be considered going ventures. Autonomous universities are required to engage in research addressing the needs of social and economic development. Therefore, Technology Transfer Offices have been established in most of autonomous universities in Thailand.

Kantabutra et al. (2010) show the research performance of autonomous universities to be better than that of public universities measured in terms of publications and doctoral graduates. Public universities are, however, known to perform better than the autonomous ones in teaching.

4.2.1.4 Public Research and Technology Organisations (RTOs)

Public RTOs have an important mission in the development of S&T capabilities. Public RTOs in Thailand mainly operate under the Ministy of Science and Technology (MOST). Various public RTOs have been established over many years. These include, among others, the National Research Council of Thailand (NRCT) established in 1959; the Office of Atomic Energy for Peace established in 1961; the Thailand Institute of Science and Technology Research (TISTR) established in 1979; and the National Science and Technology Development Agency (NSTDA) established in 1991. Some specific centres operate under Ministry of Industry (MOI), such as the National Food Institute; the Textile Institute; the Thai Automotive Institute; and the Electrical and Electronics Institute. Apart from R&D, the provisions of RTOs include training and technical services such as testing laboratories, product testing and calibration laboratories. There has, however, been duplication of activities, especially in R&D and consultancy activities, among these institutes, thus accounting for ineffective use of resources. This is a result of the absence of networking between the institutes, which impairs possibilities for collaboration between them. This structure of RTOs reflects the government's failure to reorganise or restructure the duplicate institutes to make them coherent and effective (Arnold et al., 2000; Intarakumnerd & Brimble, 2007).

Previously, the research generated from public RTOs in Thailand concentrated only on basic and advanced research and was not in response industrial demand. Nor was the research compatible with industry's technological threshold (Intarakumnerd et al., 2002). Under the new government policy, Thai RTOs are, like universities, required to conduct research which is relevant to industrial demand through cooperation and coordination between public and private sector agencies. Several public RTOs have been transformed to autonomous agencies to be able to set their own regulations, and administrative and management systems. Some of them became independent revenue centres after a start-up period with a provision of seed fund such as the National Food Institute and the Thai Automotive Institute, while the main national research centres like the National Science and Technology Development Agency (NSTDA) and the Thailand Institute of Science and Technology Research (TISTR) still receive budget allocations from the government.

A major leading RTO in Thailand is the National Science and Technology Development Agency (NSTDA). Established in 1991, NSTDA is the first generation of an autonomous centre aiming to strengthen national S&T capability by conducting R&D relevant to social and industrial demands; providing research funding to academic and private sectors, and supporting S&T infrastructure to private sector activities. In 2009, NSTDA's staff was 2,573. Among these 1,048 held masters degrees, and 401 PhDs. and higher degrees. According to the NSTDA performance report in 2009, the agency conducted almost 500 programmes relating to social and economic development, including collaboration between university and industry; and it funded 1,733 R&D projects with total budget allocation of 4,476 million Baht (81.38 million Pound). NSTDA research generated 431 international journal publications and 145 patents.

NSTDA comprises of five national centres: Genetic Engineering and Biotechnology; Metal and Materials Technology Center; Electronics and Computer Technology Center; Nanotechnology Center; and Technology Management Center (TMC). TMC is aimed to be a knowledge broker and intermediary bridging the gap between industry, RTOs and university. The ability to be a knowledge broker requires multidisciplinary skills and competencies in terms of technological knowledge, business perspectives, and good personal communication skills, honesty, norms and cultures. This is a new challenge Thai RTOs have to cope with to be more effective in promoting science, technology and innovation towards a knowledge-based economy.

4.2.2 Linkages between actors

NIS in Thailand is still in its infancy; so, the linkages between major actors in the system are weak and innovation networks are limited. Most of the linkages are primarily based on personal relationships. Institutional links have yet to emerge from this through the establishment of networks to bridge the large gaps between knowledge sources and industry. The gaps that hamper collaboration between the major NSI actors are shown in Table 4.5 below.

Table 4.5 Gaps in collaboration between industry and knowledge sources

INDUSTRY	GAPS	ACADEMIA	RTOs
• Passive actors in initiating cooperative projects • No tangible/ substantial activities that might lead to collaboration with education institutes • Low absorptive capability of technology and limited skilled worker. • Low technology threshold and unaware of internally technological capability development	• Lacking continuous cooperative projects or activities and motivation for collaboration • Clear goals and objectives of the collaboration are missing • Lacking mediators who can understand both sides, coach, and foster the relationship • Lacking analysis of problems from the industry's perspective • Lacking mutual trust	• Major activities are not two-way cooperation. Education institutes usually initiate and dominate the relationship • Linkage are more in terms of asking for help than achieving the project together from maximum benefit of both parties • No substantial linkages in term of R&D projects	• Research orientation is concentrated on advance technology which is more technology push rather than demand pull from industry • Mainly focus on R&D, and laboratory & calibration services but no specific mission to assist the development of firms' technological capability • Lacking technology transfer and diffusion mechanism

Source: adapted from Intarakumnerd et al. (2008); and College of Management, Mahidol University (2003) cited in Intarakumnerd (2006)

A survey of R&D and innovation conducted by NSTDA in 2003 showed that firms do not consider universities and RTOs as an important source of knowledge. Instead, they would resort to their internal resource; clients and the Internet. External collaborations relating to R&D and innovation occur mainly on the basis of customer-supplier relationship and are rarely found in inter-firm relationships.

Under a new scheme adopted by the government, research and technology organisatons (RTOs), and universities are under pressure to respond to the demand of industry as autonomous agencies. Government intervention is acting as a catalyst for the emergence of interactions between firms, government agencies and agencies in the knowledge sector (universities and RTOs). Government agencies have initiated programmes aimed at enhancing industrial innovation and competitiveness through consultation and the funding of University and RTO research projects. Some universities also have added industrial internship courses to motivate academic staff and students to participate in industry-based research. The length of industrial internship agreed upon by government, university and RTOs representatives ranges from as short as 10 weeks to 2 year of study (see, for example, Virasa, 2007).

The "Invigorating Thai Business" scheme (ITB) is one example of government funded programmes in which academics with relevant expertise and experience would be recruited to perform an *ex-ante* analysis as the basis for a detailed project proposal and conduct a six-month project with the aim to indentify areas in production, marketing and auxiliary services where significant improvements can be made (Schiller & Diez, 2007).

The effectiveness of government interventions and initiatives has for the most part been limited, because the initiatives were somewhat ad hoc and were least geared to promoting sustainable coordination and cooperation among university, industry and government. Moreover, the duration of projects supported by government funds would extend over only few weeks and could not therefore be expected to impact local producers in any significant way. With respect to consultancy programmes, the expertise would usually be drawn from a limited pool of university lecturers, but supply often falls short of demand for the services of experts arising from industry.

Moreover, such programmes are not even available all year round, and so the number of firms served each year is limited. In the circumstances, the focus of consultation and industrial internship has often been limited to more generic topics, like loss reduction, which, however, limits the scope for innovation (Yuwawutto et al., 2010).

Even though these interventions were not very successful with respect to innovation capability development, they helped to increase firms' awareness of the importance of indigenous technology development as a basis for forging external linkages and enhancing firms' competitiveness. Moreover, the active role of the government in the Thailand innovation system ensures that the supply of knowledge and knowledge support systems (public agencies and knowledge institutes) and demand (private sector and industry) are well connected. There is in Thailand a wide scope for institutional and infrastructure capacity building, which means appropriate institutions and the provision of supporting infrastructure that favour the development of science, technology and innovation have to be put in place.

4.2.3 Financial system

Commercial banks feature as a major actor in the innovation system as they are sources of credit supply to firms. Financial loans from banks sometimes involve bureaucratic and time-consuming processes. High risk projects like innovation are more likely to be rejected than, for example production expansion projects, which have lower risk and higher potential for success. Newly established firms and SMEs may not have the creditability and sufficient collateral to borrow; and this limits their access to financial loans from commercial banks.

To meet the credit requirements of SMEs, the government established, through Ministries of Industry and Finance, the Small and Medium Enterprise Development Bank of Thailand or the SME bank. The SME bank aims to *"develop, promote and assist SMEs to start-up, expand or improve their business by providing loans, guarantees, venture capital, counseling and other necessary services"* for the development of SMEs (SME Bank, 2010). Another financial institute established by the Ministry of Finance is the Small Business Credit Guarantee Corporation (SBCGC). These financial institutes have evolved shedding their bureaucratic and traditional organizational characteristics and becoming more flexible and efficient in their operation and management. Thus, SME bank creates a new scheme loan by using intellectual property rights such as patents, trademark and copyrights, as collateral. The Small Business Credit Guarantee Corporation has provided credit guarantee to 12,831 SMEs from 2004 to 2008 (only 1,366 SMEs in 2008) (SBCG, 2008); and the SME bank provided loan for 7,436 SMEs in 2007 (SME Bank, 2007).

Kasikorn Bank, a leading commercial bank, has recently launched a new financial service under the "KSME"[9] scheme that provides financial loans, training, and information for start-up firms and existing SMEs. Overall, the bank has been a good source of information and consultancy services relating to doing business and financial matters throughout the loan period.

Even so, the impact of financial institutions has been limited to a small group of SMEs that can, for instance, produce guarantors or the collator requirement for borrowing. SMEs in remote areas would have less information and unable to access the services (Bank of Thailand, 2008). Moreover, the risk associated with economic uncertainty and instability would make smaller SMEs in particular rather hesitant to expand or invest in business and development.

4.2.4 Regulations and Legal framework

Thailand has a legal framework for the protection of intellectual property rights (IPRs). The Department of Intellectual Property (DIP) under the Ministry of Commerce is charged with the responsibility of regulating intellectual property (IP) laws. The current patent law, Patent ACT B.E. 2522 (1979), was amended to give way to first to Patent Act (No.2) B.E. 2535 (1992) and then to the Patent Act (No.3) B.E. 2542 (1999). Up to 2009, DIP had registered 27,580 patents (Thai 28.7%); 5,299 petty patents[10] or utility models (Thai 93.5%); 207,689 copyrights; and 235,150 trademarks (DIP, 2010).

[9] http://www.ksmecare.com/, accessed date 30 March 2010.
[10] Petty patent or utility model is similar to "invention but the level of technological innovation is not high or it is a result of minor innovation" (DIP, 2010), accessed date 27 July 2010.

The country's concern with IPRs is consistent with its objective to evolve as a knowledge-based economy. Already, Thailand has participated in international conventions for IP laws: the Paris convention (2008); and the Patent Cooperation Treaty (2009). And plans are afoot to join the Madrid Agreement by 2015. Thailand's international participation and adoption of international regulations clearly shows that Thailand IP law is in transition to be fully integrated into the international IPR framework. This would allow the IP system and IP owners in Thailand to exercise their rights more efficiently with a wider scope and frame of reference (Vachanavuttivong & Indananda, 2010). However, the study of Intarakumnerd et al. (2010) indicates that IPRs, especially invention patents, have little role to play in the process of technological catching up in Thailand. There are reasons for this. First, the co-evolution of Thai IP laws with international laws and the pressure from developed countries for Thailand to go for strong IP laws would be inappropriate to SMEs and can even slow down the development of indigenous technological capability. For instance, the enforcement of the petty patent law in 1999 had the effect of pre-empting opportunities for unprotected small development, which occurred in the form of inventions or incremental innovations before the period of enforcement. On the other hand, it may be argued that the arrangement had provided opportunities for diffusion of foreign technology which most firms had been learning about through imitation. The firms, however good at imitation, were unable to progress to creative imitation due to their low absorptive capacity and insufficient indigenous technological capability (Charoenporn, 2007).

Secondly, it is not the small firms that constitute to the majority of the population of firms in Thailand that are keen on and benefit from IP protection, but the foreign-dominated, hi-tech, large firms that are in the minority, with respect to the total number of firms, who gain from IP protection (Sorg, 2009).

Apart from IP laws, the government has also announced tax reduction schemes for promoting technology and innovation activities in the private sector. For instance, the Ministry of Labour introduced tax reduction of 150% for training expenses. The Revenue Department under the Ministry of Finance also introduced tax reduction of

200% for R&D expenses. Since 2002, about 900 projects have been registered to take advantage of this scheme (RDC, 2009).

4.3 Conclusion

This chapter has discussed Thailand's economy and its transition from agriculture to industrialising economy. It is also noted that Thailand aspiration to evolve into a fully-fledged knowledge economy by 2020. Thailand's current structure of the industrial sector is dominated by SMEs that constitute 99.5% of the total population of manufacturing firms, although they contribute only to 33.65% of total manufacturing GDP. Also, Thailand's economy is open and export orientated. Export of goods and services contributed 65% to total GDP in 2009. The industrial sector contributes 84% to total export. This means that the Thai economy is as it is potentially vulnerable to the risks posed by high degree of concentration in the growing industrial sector and also in the export sector. In the industrial sector, large firms of the multi-national type, which constitute 0.5% of the total number of firms, contribute 66% to total manufacturing GDP. Export concentration is also apparent, as the large proportion of exports is deriving from the small number of high-tech, large industrial firms. To introduce economic stability, it would be proper for government policy to focus on the promotion SMEs' capabilities. This would call for the incorporation of SMEs into the national innovation system, so that SMEs can play an important part in the development of Thailand as a knowledge-based economy.

The national innovation system in Thailand is gradually evolving and has now come to a stage where it is providing firms a framework, however weak, for technological learning, adaptation and innovation. The task for policy would be to use this framework for promoting technology and innovation in the industrial sector, particularly SMEs, whose capabilities are constrained by institutional legacies, traditional cultures and bureaucratic systems of operation. The NIS itself has yet to be strengthened to be able to play an effective role in promoting knowledge-driven growth. This can start with intermediaries and hybrid agencies playing innovative roles by way of strengthening linkages and creating knowledge networks between knowledge sources, industry (mainly SMEs), and RTOs. This will increase SMEs' ability to access support services from government and other local and international agencies.

In view of the apparent of imbalances in the industrial and export fronts of the Thai economy, where few firms account for industrial GDP and export income growth, there is good reason to believe that SMEs would make a significant difference to prospects for sustainable development in Thailand as they could play a key role in industrial and export competitiveness. This is however conditional on their effective incorporation into the national innovation system and the development of the NIS itself. It is in this context that the next chapter will discuss the scope for technological development and innovation in the SME sector, with particular focus on the Thai dessert industry.

CHAPTER 5

Profile of the SME Sector in Thailand and the Thai Dessert Industry

This chapter provides an overview of the SME sector in Thailand with particular reference to the Thai dessert industry. The discussion in the chapter is based on information obtained from government agencies, like the Office of Small and Medium Enterprises Promotion (OSMEP). The latest complete information provided by OSMEP is in the year 2008 published in 2009. Information on firms in the Thai dessert industry is obtained from the reports and publications of the Industrial Technology Assistance Program (ITAP); the Thai Confection Industry (TCI) company; and the National Food Institutes. As there is no official database on SMEs in this subsector and their activities, the data on the Thai SME sector is fragmented, so that any conclusion on SMEs drawn the basis of available data is at best tentative.

This chapter is organised in two parts. The first part presents the definition of SMEs in Thailand and its significance for the Thai economy. The importance of SMEs for community business development and government policy for SME technology development and innovation are also addressed in this part. Discussion in the second part is focused on the characteristics of Thai dessert industry; the significance and growth of the industry; and the scope for technological capability development and innovation in this industry.

5.1 Definition of SME in Thailand

The official definition of SMEs in Thailand is provided by the Office of Small and Medium Enterprises Promotion (OSMEP) in the Ministry of Industry. There are four categories of SME definitions classified by business types: manufacturing, wholesale, retail and service. As shown in Table 5.1, the definitions are based on the number of employees and the value of registered capital or fixed asset excluding land.

Table 5.1 the definitions of SMEs in Thailand classified by types of business

Business sector	Number of employee	Fixed asset (Thai Baht)	Fixed asset (British Pounds[11])
1. Manufacturing			
Small enterprise	< 50	50 million	0.91 million
Medium enterprise	51 – 200	>50 - 200 million	>0.91 - 3.64 million
2. Wholesale			
Small enterprise	< 25	50 million	0.91 million
Medium enterprise	26 – 50	>50 - 100 million	>0.91 – 1.82 million
3. Retail			
Small enterprise	< 15	30 million	0.55 million
Medium enterprise	16 – 30	>30 - 60 million	>0.55 – 1.09 million
4. Service			
Small enterprise	< 50	50 million	0.91 million
Medium enterprise	51 – 200	>50 - 200 million	>0.91 - 3.64 million

Source: OSMEP (2006)

The official definitions of SMEs for a manufacturing and service sectors are the same. Enterprises in these sectors with less than 50 employees and fixed assets less than 0.91 million Pounds are considered small. Medium enterprises are those where the number of employees is between 51 - 200 and fixed assets, between 0.91 - 3.64 million Pounds. The criteria of SME in the wholesale and retail sectors are lower both in terms of employment and fixed asset. In the wholesale sector, enterprises with less than 25 employees and fixed asset less than 0.91 million Pounds are considered small. Medium enterprises are those with total number of employees between 26-50 and fixed asset between 0.91-1.82 million Pounds. In the retail sector, enterprises with less than 15 employees and fixed asset less than 0.5 million Pounds are considered as small. Medium enterprises employ between 16-30 persons and have fixed asset between 0.91-3.46 million Pounds.

These definitions of SMEs are based on the prevailing economic, social and technological conditions in Thailand and may not, therefore, necessarily concur with SME definitions elsewhere.

[11] 1 British Pound Sterling is approximately 55 Thai Baht (average exchange rate of 2009)

5.2 The contribution of SME to the Thai economy

SMEs contribute to Thai economy in various ways. This section discusses the importance of SMEs in four major aspects: the proportion of SMEs, contribution to gross domestic product (GDP), contribution to employment, and contribution to export market.

5.2.1 The number of SME in Thailand

According to OSMEP, the number of SMEs in 2008 was 2,827,633 or 99.7% of total number of firms. Of these, 99.3% were small enterprises. The total number of SMEs in 2006 was 2,274,525 or 99.5% of the total number of firms. Table 5.1 summarises the number and proportion of SMEs in Thailand from 1994 – 2008. There are information gaps for the periods between 1998 and 2002 and after 2008 as can be seen from the Figure 5.1.

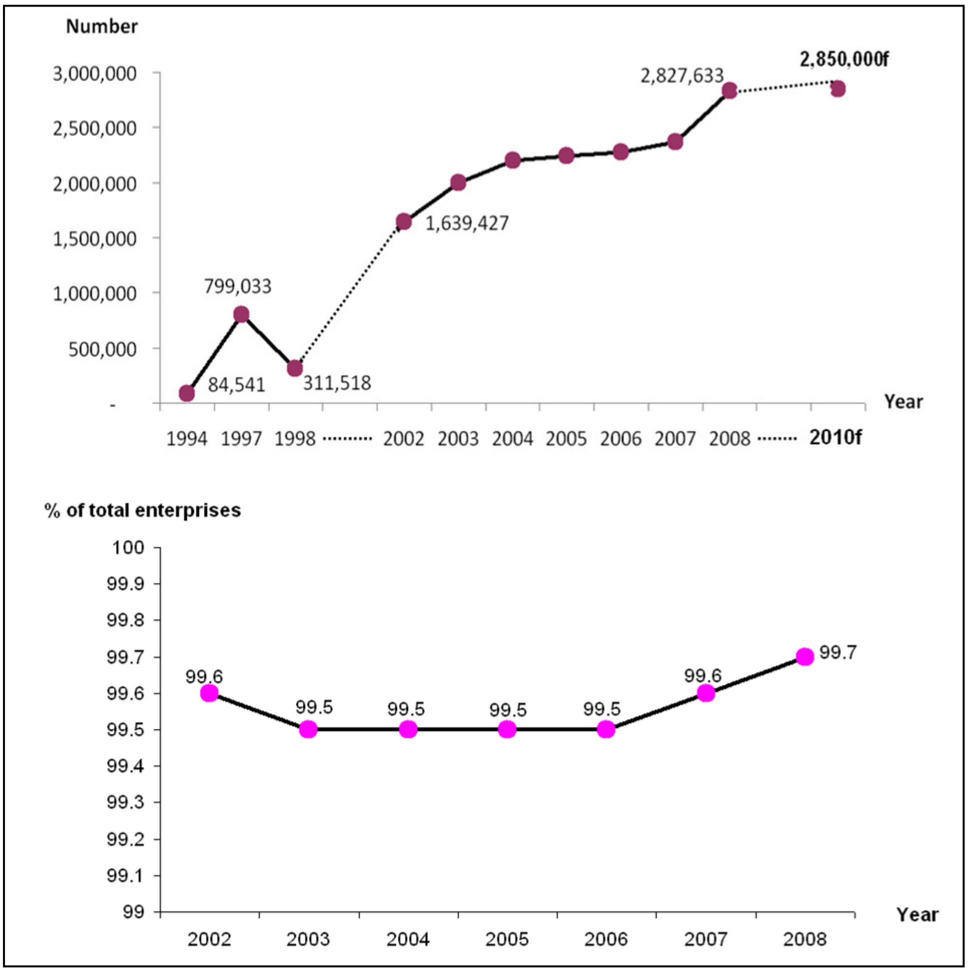

Figure 5.1 The number of SME in Thailand (1994 – 2008)
Source: OSMEP (2009b)

Figure 5.1 shows that the number of SMEs decreased from 799,033 in 1997 to 311,518 in 1998. This is largely attributable to the occasion of the economic crisis in 1997. After the height of the crisis, the number of SMEs continually increased and reached 2,827,633 in 2008. The number of SME is projected to reach 2.85 million enterprises in 2010, assuming an underlying growth rate of 1.74% per annum. The number of SMEs has been increasing because of policy support in favour of the growth of SMEs pursued by public agencies such as the Office or the Board of investments, the National Science and Technology Development Agency (NSTDA); and OSMEP. The nature of these support agencies set up by the government is discussed in later section.

Table 5.2 Distribution of SMEs number by sectors in 2008

Sector	Number	% of SMEs
Trade and repairs	1,321,634	46.7%
Service	956,836	33.8%
Manufacturing	544,762	19.3%
Unidentified	4,401	0.2%
Total	**2,827,633**	**100.0%**

Source: OSMEP (2009b)

Table 5.2 shows the distribution of SMEs across sectors in 2008. Most SMEs are in the trade and repairs sector, which accounts for 46.7% of all SMEs, followed by the service sector (33.8%), and the manufacturing sector (19.3%). The number of SMEs in the manufacturing sector constitutes 99.5% of the total number of enterprises in this sector. The contribution of SMEs to total manufacturing GDP is 12%, which means growth of manufacturing GDP is contingent upon a handful of large enterprises that constitute only 0.5% of the total population of firms in the sector.

5.2.2 SME contribution to GDP

As shown in Table 5.3, the SME contribution to GDP is around 40% (based on data for the period 2003 – 2008). While SMEs in manufacturing sector contributed 12% to total GDP in 2008, non-manufacturing SMEs' contribution amounted to 26%.

The contribution of SME to GDP gradually decreased from 40.0% in 2004 to 37.9% in 2008. GDP growth rate decreased from 7.1% in 2003 to 6.2% in 2008. The lowest growth rate was 4.5% in 2005. According to a recent survey of OSMEP (2009a), there are two main reasons for the continuous decrease in SME contribution to GDP and GDP growth rate. The first is the unstable economic situation during the period which saw increase in fuel price that cascaded into a 6% price inflation. This had the effect of decreasing investment confidence. Secondly, the political crisis that beset the country had adverse effects on economic confidence, tourist turnover and consumer behaviour in that consumers would prefer saving to spending.

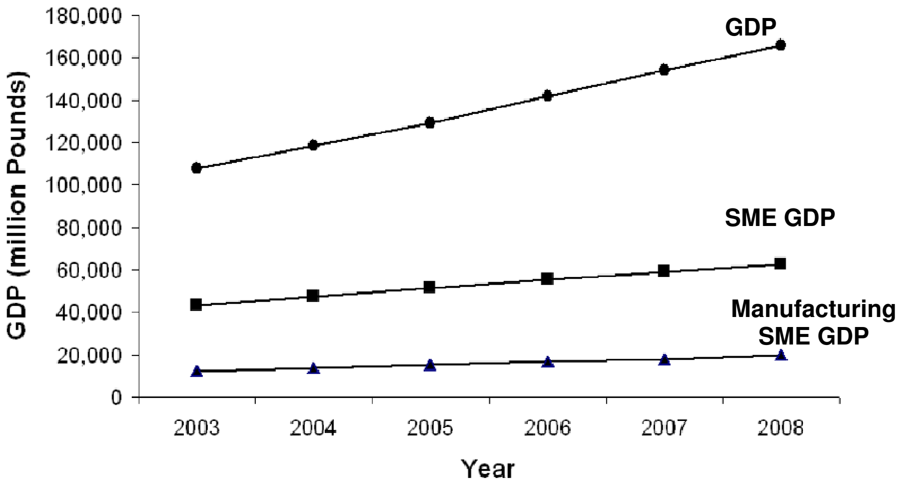

Figure 5.2 GDP of SMEs and manufacturing SMEs in Thailand (2003 – 2008)
Source: OSMEP (2009b)

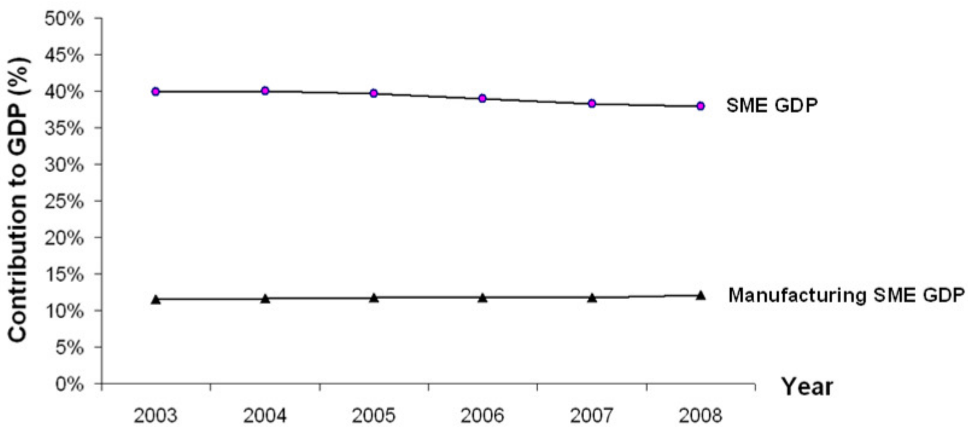

Figure 5.3 Contribution of all SMEs and manufacturing SMEs on GDP (2003-2008)
Source: OSMEP (2009b)

Table 5.3 The contribution of SMEs and manufacturing SMEs to GDP (2003-2008)

	2003	2004	2005	2006	2007	2008
GDP (mBaht)	5,928,974	6,503,487	7,104,228	7,816,474	8,469,060	9,104,959
GDP (mPounds)	107,800	118,245	129,168	142,118	153,983	165,545
GDP for SME (mBaht)	2,367,110	2,598,657	2,816,641	3,041,896	3,236,634	3,446,589
GDP for SME (mPounds)	43,038	47,248	51,212	55,307	58,848	62,665
GDP for manufacturing SME (mBaht)	682,640	755,130	830,247	921,924	992,617	1,101,480
GDP for manufacturing SME (mPounds)	12,412	13,730	15,095	16,762	18,048	20,027
SME GDP contribution (% of total GDP)	39.9%	40.0%	39.6%	38.9%	38.2%	37.9%
Manufacturing SME GDP contribution (% of total GDP)	11.5%	11.6%	11.7%	11.8%	11.7%	12.1%
GDP growth rate (%)	7.1%	6.3%	4.5%	5.1%	5.1%	6.2%
GDP growth rate (%) for SME sector	4.6%	7.6%	4.9%	5.5%	4.9%	1.9%

Source: OSMEP(2006, 2008, 2009b)

5.2.3 SME contribution to employment

Table 5.4 shows that over the period 2004-2008, the SME sector contributed around 76% to total employment of all enterprises in Thailand. The average annual growth rate of employment in the SME sector during the period was 2.6%. Employment in the SME sector increased from 8.9 millions in 2007 to 9.16 million in 2008 and the growth rate of employment in the SME sector for the period 2007-2008 was 2.94%. Actual data for the years after 2008 are not available; but projections made on basis of past experience show the contribution of the SME sector to total employment to reach 76% by 2010.

Table 5.4 Employment of the SME sector (2004 – 2010)

Employment	**2004**	**2005**	**2006**	**2007**	**2008**	**2009e**	**2010f**
SME (person)	8,357,493	8,458,160	8,637,126	8,900,567	9,042,662	8,943,343	9,129,748
% of total employment	76.17%	76.06%	76.57%	76.00%	75.98%	75.99%	76.05%
Total employment	10,972,156	11,120,703	11,280,654	11,711,334	11,901,719	11,769,340	12,005,242

Source: OSMEP (2009b)

Table 5.5 shows the distribution of SME employment by sectors. Even though the manufacturing sector has the lowest number of enterprises (19.3% as shown in Table

5.2), its contribution was the highest (38%) in total SME employment in 2008. The growth rate of employment in the manufacturing sector is around 2.57%.

Table 5.5 Employment by SME sectors in 2008

SME sectors	SME employment (person)	% of employment by SMEs
Manufacturing	3,477,512	38%
Service	3,070,977	34%
Trade and repairs	2,493,969	28%
other	204	0%
Total	**9,042,662**	**100%**

Source: OSMEP (2009b)

5.2.4 SME contribution to export market

In 2008, the total export value of Thailand was about 106,430 million Pounds, which yields an 11.7% growth rate on export value for 2007. The SME export value for 2008 was 30,748 million Pounds, which is 28.9% of the total export value.

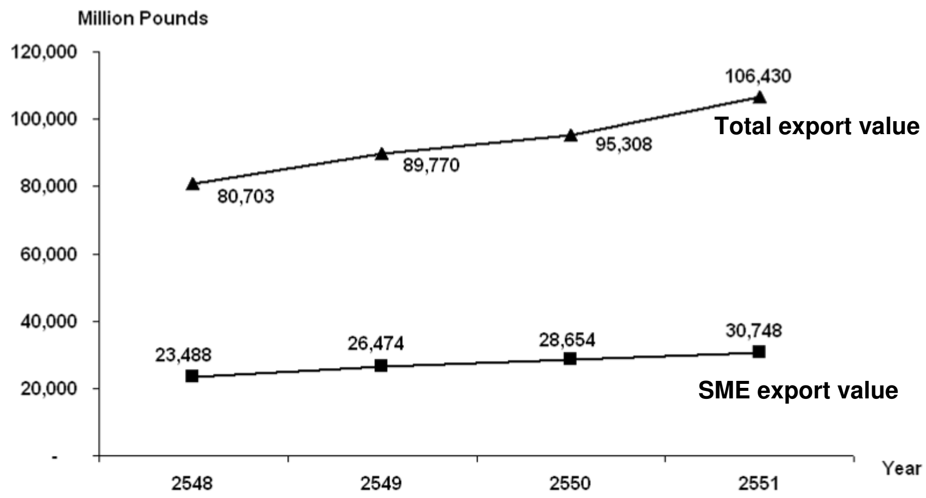

Figure 5.4 SMEs export and total export value in Thailand (2005 – 2008)

Source: OSMEP (2009b)

Table 5.6 Contribution of SME to the export market in Thailand (2005 – 2008)

	2005	2006	2007	2008	Growth 08/07
SMEs export (mPounds)	23,488	26,474	28,654	30,748	7.30%
Total export (mPounds)	80,703	89,770	95,308	106,430	11.70%
GDP (mPounds)	129,168	142,118	153,983	165,545	
SME GDP (mPounds)	51,212	55,307	58,848	62,665	
SME export value/total export (%)	29.1%	29.5%	30.1%	28.9%	
Total export value/GDP (%)	62.5%	63.2%	61.9%	64.3%	
SME export value/SME GDP (%)	45.9%	47.9%	48.7%	49.1%	

Source: OSMEP (2009b)

From the figure in Table 5.6, it is apparent that Thailand's economy is sensitive to changes in export market conditions. Export contributes 64.3% to GDP (2008); and SMEs constitute about 29% to total export value, which suggests that the SME sector offers wide scope for export growth and diversification. The proportion of SME export value to SME GDP is shown to have gradually increased from 2005 to 2008. That nearly 50% of total SME GDP derives from exports is attributable to government policy which is aimed at vigorously promoting SME exports, particularly after 2005.

SMEs also play a significant role in the development of Thai economy in terms of rural and community development. This role played by SMEs is considered to be is more significant than the role played by large firms, particularly at the early stage of development (Huang, 2003).

5.3 Weaknesses of the Thai SMEs

Even though the SME sector is significant for the Thai economy, its potential has not been fully realised yet because it is subject to factors which mitigate prospects for the development of technological capability and competitiveness. These factors include lack of access to capital fund; lack of entrepreneurial and managerial skill; and lack of access to government support, which will be discussed seriatim in the remainder of this section.

5.3.1 Lack of finance and access to capital fund

A major problem of Thai SMEs is their limited access to sources of finance and capital (Wiboonchutikula, 2001). According to a study by the Bank of Thailand (2008), the reasons that limit SMEs' access to financial support include: inability to produce feasibility of business plans, and lack of credibility in the absence of guarantor and adequate collateral. Most of the financial institutions use the collateral-credit-loan regulation, which, however, excludes many SMEs from access to such loan facilities. In the after match of the 1997 economic crisis, most of financial institutions have been lumbered with non-performing loans; and the weight of this burden has made them tight and risk-averse. As a result, they have been reluctant or else too caution to approve loans to SMEs. Financial incentives for research and development are more focused on ‘top end’ firms that have high technology capability and neglect firms at the lower end who are struggling to develop their technological capabilities (Turpin et al., 2002). This has intensified the problem of financial access for technological capability building in the SME sector. Even though some new financial schemes to support SMEs are now available, these too require guarantors or intellectual property valuation as mortgage securities.

5.3.2 Lack of entrepreneurial and management skill

Limitations of resources and capital would make Thai SMEs tend to be risk-averse and conservative (Swierczek & Ha, 2003). Entrepreneurs are, however, assumed to be risk takers, forward looking, proactive and creative with the ability to spot opportunities and turn weaknesses into strengths. But this can hardly be said to be the case with most SMEs not because they are inherently incapable of entrepreneruial attributes, but because they lack the support services that would enable them to overcome the cultural barriers of tradition and to give them the security against the risk-element involved in new and progressive ventures. Proactive entrepreneurship would, needless to say, result in higher business performance as owners/managers of firms would be motivated to invest in new ideas and the application of new technologies.

The limited scope for entrepreneurial development means that SMEs also have limited access to information about new ideas and market opportunities. The majority of Thai SMEs are family-based and owner-managed, so that they do not have the organisational and managerial competence that would enable them to compete beyond local markets (Mephokee, 2006)

5.3.3 Lack of access to government supports

Another problem that limits the growth of SMEs as innovative and competitive ventures is the absence of policies geared to the promotion of technological capability building at the level of the firms (Brimble et al., 2002). Even when this is not a problem, SMEs, especially in remote areas, have difficulty in obtaining information support from government and pubic agencies, such as local authorities, universities, and research and support institutes (Ellis, 2007). This limits the provision of support facilities to a small group of SMEs who have networks and close links with public organisations. The existing arrangement appears to favour SMEs that are geographically close to the location of the public agencies that support SMEs and their laboratories and testing services, calibration services and public research and development institutes, most of which are located in the central part of Thailand. What is more, even though the competence of the local research institutes and universities has increased, the support provided is inadequate seen in relation to the number of SMEs across Thailand.

The problem relating to the inadequate provision of support to SMEs is also due to the institutional structure of the relevant government and support agencies and the administrative problems thereof. There are some public agencies providing SME supports similar to what others offer. This has been a cause of conflict among agencies. It is found that when public agencies compete with each other, they would cause unnecessary confusion to SMEs. The problem of SMEs with respect to lack of access to government support is amplified by the casual nature of government policy towards SMEs, particularly when policies are inconsistent and incoherent due to the prevalence of weak governance (Sahakijpicharn, 2007).

5.4 Government policy for promoting SMEs technology and innovation

Before the economic crisis in 1997, industrial policy in Thailand focused on the development on large enterprises, high-tech industries and the agricultural sector. Even though the government recognised the importance of SMEs, this acknowledgement did not translate into effective policy until the government's priority focused on the task of successfully promoting growth and capacity building in the SME sector (Brimble et al., 2002). After 1997, the national policy framework emphasised the promotion of science, technology and innovation for overall competitiveness of Thailand. At the same time, recognising their contribution to the Thai economy, government policy focused on SMEs as part and parcel of an overall strategy for recovery from the economic crisis, in the short run, and for promoting the culture of innovation and competitiveness, in the long run. However, not until 2002 has the official SME promotion plan been issued followed by a raft of government interventions through the institution of various support agencies. The master plan for SME promotion focused on the task of strengthening technological development and innovation in the SME sector, as discussed below.

5.4.1 The SMEs promotion plan

The first master plan for SMEs promotion (2002 – 2006) was approved in 2002. It aimed to promote growth and competitiveness of the SME sector in Thailand as well as mitigating the effects from economic collapse in 1997. The plan comprised of two main sections: the broad strategy for all SMEs and the specific strategy for target industries. The former aimed to improve the infrastructure and policy environment in the ways that favour the growth of SMEs. The latter focused on strengthening three groups of SMEs - enterprises with high export potential; new start-ups; and community enterprises. The First Plan succeeded in increasing SMEs' awareness about growth and development; but the impacts of interventions were limited, partly because of the inadequacy in the capabilities of the supporting agencies; partly because of insufficient infrastructures; and partly because of the consequences of the economic crisis in 1997 which adversely affected most of the SMEs, making it difficult for them to be impacted positively by policy. However, it set a good basis for the second plan which was implemented from 2007-2011. The second plan comprises of six main strategies as shown in Figure 5.5

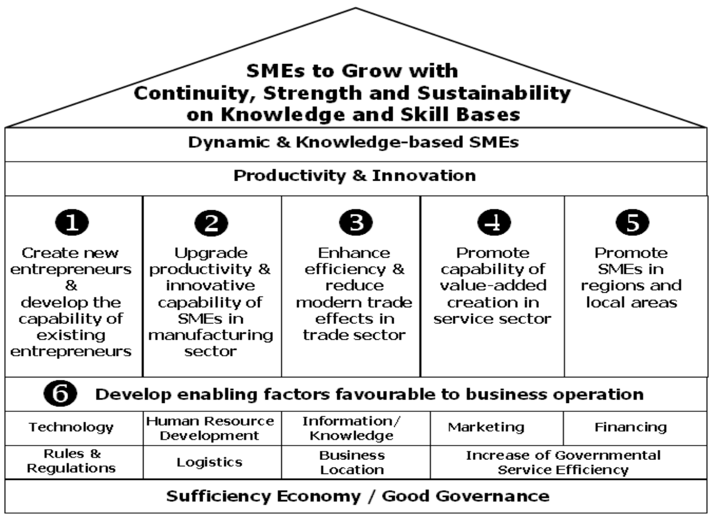

Figure 5.5 The strategic framework for SMEs promotion in 2007 - 2011
Source: The Office of SMEs Promotion (2007, p. 52)

Strategy 1: Create new entrepreneurs and develop the capability of existing entrepreneurs

This strategy aims to develop the overall capability of SMEs, both new and existing ones, by orchestrating success stories; and offering information and other support services such as tax exemption, advisory and training services for business start ups. It also aims to improve the technological capabilities of SMEs by providing supports relating to science and technology based knowledge and skill development. In addition, the strategy addresses provisions of business opportunities, marketing knowledge and information by promoting industrial linkages and business matching.

Strategy 2: Upgrade productivity and innovative capability of SMEs in manufacturing activities

This strategy aims to enhance the technological and innovative capability of SMEs by increasing product differentiation through new product development, and increasing the value added of existing products. The target industries are indigenous industries and "new wave" industries. The indigenous industries cover light industries (e.g. textiles, shoes and gems), engineering industries (e.g. steel, alloy, mould and dies, automobiles and electronics); and natural resource-based industries (e.g. food, furniture, pharmaceuticals and herbs). The "new wave" industries include alternative energy and products that can be positioned at the higher value chains than those from the first category.

Strategy 3: Enhance efficiency and development of fair competition in trade sector

This strategy aims to strengthen the competitiveness of the wholesale and retail sectors by promoting the application of information technology (IT) to increase business management efficiency. The strategy also focuses on the development of fair competition by formulating trading regulations (i.e. franchising law, retail business) and promoting cooperation among public, private and academic sectors including customers in the supply chain and regional network.

Strategy 4: Promote capability of value-added creation in service sector

This strategy targets seven sectors of service industries, which are: information and software; consultancy and business support services; health and beauty services; design and construction services; logistics service providers; entertainment; and educational services. The objectives of this strategy include: development of human resources; creation of links and networks of high potential services; promotion of appropriate IT management systems that suit for businesses; and improvement of the standard of service quality in order to add value and ensure the provision of reliable services to customers.

Strategy 5: Promote SMEs in regions and rural areas

Since SMEs are concentrated in the central parts of Thailand, this strategy aims to create links with SMEs in the various regions and develop networks to provide services that would enable SMEs to have better business opportunities and market channels. With access to support agencies, regionally distributed SMEs would apply technologies that would enable them to be competitive enough to compete in a wider market. The strategy is based on the principle of cluster development which supports the integration of community businesses and links them with support agencies in order to create sustainable networks in the regions. Government supports provided through the agencies include technological services, consultancy services and provision of infrastructures for promoting the use of knowledge in business and manufacturing management.

Strategy 6: Develop enabling factors favourable to business operation

This strategy involves interventions that support SMEs to adopt technology and innovation. The supports include financial provision, skill development, marketing and logistic management and human resource development. The strategy also involves the creation of a database of SMEs and community businesses are to be created in order to facilitate dissemination of information across the SME network.

The above discussed six strategies focus on the promotion of good entrepreneurship, technology and innovation through network development and external linkages. The main agency responsible for implementing the SME promotion plan is the Office of Small and Medium Enterprises Promotion (OSMEP), which comes under the Ministry of Industry. To implement the strategies, action plans and implementing mechanisms are set. This process involves the participation of various agencies of regional, national and international status. The academic sector and research and technology institutes also play important roles in the production of knowledge and technology transfer.

5.4.2 The NSTDA strategic plan

Apart from the plan for SME promotion, the National Science and Technology Development Agency (NSTDA) is also charged with the responsibility of the NSTDA strategic plan that focuses on the long term aspect of the development of science and technology in Thailand. The most recent NSTDA strategic plan is the fourth plan (2005 – 2009) based on the master plan of the Science and Technology Strategic Plan for 2004 – 2013. Figure 5.5 shows that the NSTDA strategic plan is based on cluster management strategy focusing on national core technologies and industrial clusters. This cluster-based approach is supported by research and development focused on platform technologies and basic knowledge including essential driving tools such as infrastructure development and technology transfer to industry.

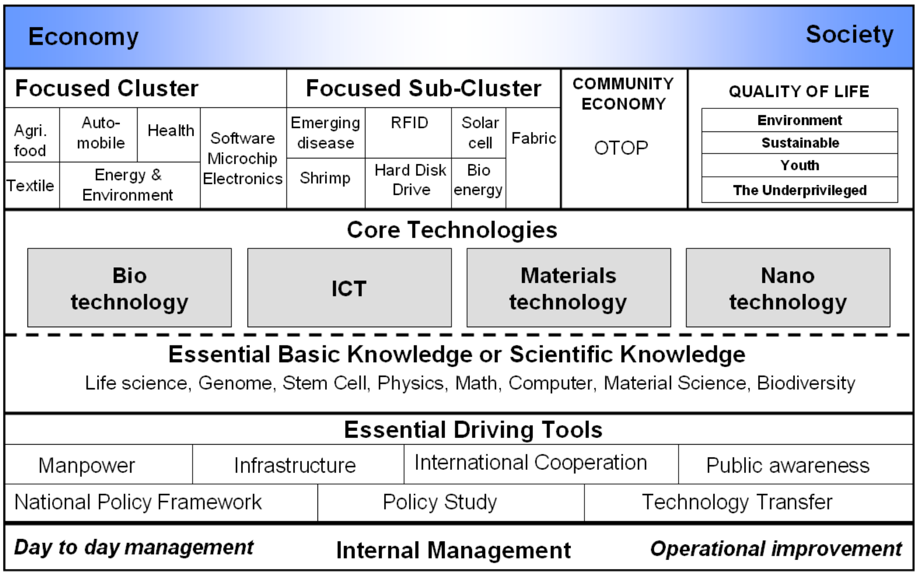

Figure 5.6 A framework of the NSTDA Strategy 2005- 2009

Source: Tanpipat (2009)

The mission of industrial development and technology transfer programmes are under the Technology Management Centre (TMC) functioning under NSTDA. The programmes designed specifically for SMEs include technological consultancy services, business development, human resource development, and financial and infrastructure support as shown in Figure 5.7.

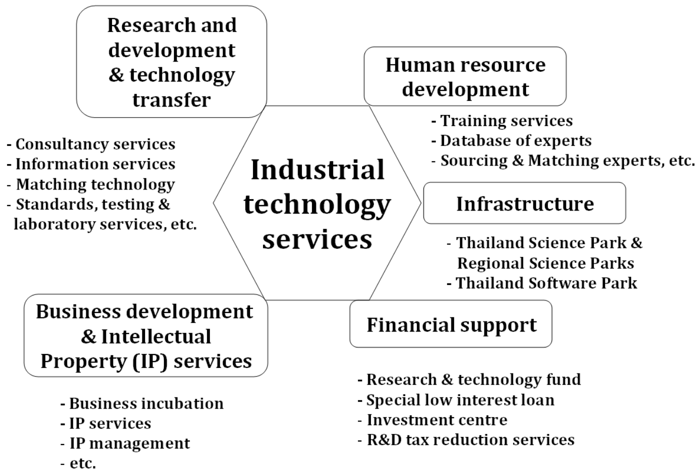

Figure 5.7 NSTDA industrial technology development services

There are more than 2,500 SMEs receiving supports from this scheme (NSTDA, 2009). The TMC strategy is to create a network of SME services across Thailand through nine service nodes located in five regional science parks and local universities. TMC acts as an intermediary bridging between industrial needs and knowledge resources. The information feedback from the industrial sector is also important for national research orientation as it ensures that the research projects would address social needs.

5.5 Significance of the Thai dessert industry

It is only recently that the Thai dessert industry has evolved from fragmented traditional cottage industry status to a more modern SME and industrial status. Thai dessert was originally a home-made cottage industry product sold only in local markets in every part of Thailand. This feature of the industry is still apparent in the household-based firms which as already noted constitute the bulk of the sector. Presently, however, the growth in demand for Thai dessert both inside Thailand and outside the country has prompted decision to upgrade production of the homemade traditional products to industrial level. Thirdly, the Thai dessert industry has a very important role to play in Thailand’s economic growth and development, especially at local and community levels. The range of activities and the social network in this sector are a reflection of the institutional context and hence of the extent of social capital and the scope for growth and technological development in this industry. Some examples of Thai desserts are shown in Figure 5.8.

Figure 5.8 Examples of Thai desserts

There is no official database and information of the capital and production and sales values for the Thai dessert industry. The data obtained from the survey in this study shows that the total sales turn over of 145 firms in 2008 is approximately 558.5 million Baht or 10.2 million Pounds. Other estimates of market values are obtained from various sources of information such as articles, interviews, reports and news from the Internet. A study by Bansomdej Chaopraya Rajabhat University in 2006 indicates that the value of a Thai dessert market could be more than 40 million Bath or 0.73 million Pounds (ISRA Institute, 2008a). Another way to observe the value of Thai desserts is the sales revenue of a pilot shop operation, which was operated by the Thai Confection Industry (TCI) company, at the previous Thai International Airport (Don Mueng). After its opening in 2003, the TCI sales revenue increased considerably as seen in Figure 5.9. Unfortunately, the TCI pilot shop closed in September 2007 since the airport was moved and the TCI could not reserve any area in the precinct of the new airport. Based on eight months of operation in 2006, sales revenue is estimated to be approximately equivalent to 1 million Pounds.

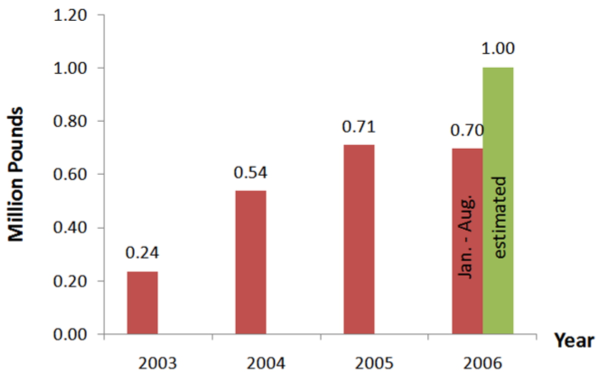

Figure 5.9 Sale revenue of the Thai Confection Industry Company
Source: TCI sale revenue annual report (TCI, 2007)

From an interview with a small household firm called Uncle Wan, which caters for the Amphawa floating market, it was found that the firm had an average sales revenue over 2 million Bath (~26,264 Pounds) per year. In addition, the export of the Thai dessert made from banana in 2004 is 3.75 million Pounds of which 2.97 million Pounds is solar dried banana (Kluay Tak) and 0.78 million Pounds is preserved banana (Ministry of Agriculture and Cooperatives, 2005). Solar dried banana is mainly exported to the United States and China. Data from the firm producing dried banana -the Bupha Kluay Tak community-based firm in the north of Thailand- show that the firm had a sales revenue of more than 190,900 Pounds in 2008 (Chanama, 2009). Another example showing the growth of the Thai dessert industry is a Thai rice cracker firm known as Kao Tan Mae Bua Chan in Lampang, the north of Thailand. The growth rate of the firm has increased 30% each year since 2005. The firm covers 80% of the domestic market; and its products are exported to 28 countries such as US, Germany, Taiwan and Singapore. The market value only in Lampang province is around 5.45 million Pounds; while the market value overall Thailand could be over 18.19 million pounds (Chaturongakula, 2008b).

As mentioned earlier in this section, even though the Thai dessert is a small subsector, the market value is significant to the Thai economy at community, regional and national levels. The export market is far from saturated as there is a growing demand for the product in foreign countries, especially in Asia (ISRA Institute, 2008b). Prospects for growth of the industry would largely depend on the extent of technological capability development and the support the industry can elicit in this endeavour from the government and relating agencies as well as the academic sector within a ‘triple helix’ framework.

5.6 Firm categories in the Thai dessert industry

Most of the firms in the Thai dessert industry are SMEs. The Thai dessert industry can be categorised into three main groups: namely, household-based firms; community-based firms; and factory-based firms. These three categories of firms are expected to have huge differences in character and attributes; and innovativeness and creativity, which together would influence their technological capability development.

5.6.1 The household-based firms

By the definition of the National Statistical Office (1999), the household-based firms have less than 10 employees and operate within the bounds of the household. The survey of household industry in 1999 indicates that there were at the time 1,188,482 household firms or 7.6% of all households in Thailand. According to the report, household-based firms producing foods, drinks and tobacco totalled 193,723 or 16.3% of all household-based firms. However, there is no information about the number of the household-based firms producing Thai desserts which is anyway classified under the food industry.

The household-based firms are essentially traditional in character, and so operate on a cottage industry basis using traditional technology. They are family-based businesses in which skills and tacit knowledge of production are passed on from generation to generation. Hence, their knowledge is typically limited in scope and in proprietorship. The social and economic status associated with such firms would make them seek to work within limited targets, so that the scope for innovation and growth is limited, or, in the extreme, non-existent. But not all household-based firms are essentially the same in behaviour and performance, as some are more proactive and forward looking than others and would, therefore, prefer to move on rather than remain locked in traditional practice. Why some household-based firms seek to move on and others do not is an open question for sociological investigation. It can, however, be argued that exposure to new ideas through networking and access to government support would have significant implications for differences among firms in terms of the effectiveness of their management and organisation systems; the quality of their products and services; and the degree of their competitiveness.

5.6.2 The community-based firms

According to the Community Enterprise Promotion Act, B.E.2548 of 2005, the community enterprise refers to an enterprise that comprises of at least 7 members from different households in the same community. Community-based firms produce and sell goods or services based on their resource endowment to improve the socio-economic welfare of communities. Their products are usually based on the uniqueness of local resources and indigenous knowledge of community members. Apart from produced for household use, the products are sold and able to compete in the market. The government established the Secretariat Office of Community Enterprise Promotion Board (SCEB) whose main responsibility is to promote community business development. At present, there are 66,773 registered community enterprises in Thailand (SCEB, 2009), of which 820 enterprises (1.23%) produce Thai desserts (ThaiTambon.com, 2009).

Community-based firms engage in social and economic relations within the community. Their social activities involve interaction, communication and cooperation with each other in every day life. These activities promote social capital and networking development in the community. By contrast to household-based firms, community-based firms would be expected to be innovative. They have social and economic advantages over household-based firms in that their community network facilitates access to finance and to sources of knowledge and information. This gives them the additional benefit of reduced risk in their activities because risk is spread out across members of the community. Thus, community-based firms would often find themselves engaged in knowledge exchange and knowledge sharing within the community of firms. The government has been promoting this category of SMEs as a better alternative to household-based firms. As a result, many household-based firms have opted to operate as community-based enterprises.

5.6.3 The factory-based firms

About 10% of all firms in the Thai dessert industry are known to fall into the factory-based category (Yuwawutto, 2009). The firms classified as factory-based firms usually have more than 10 employees. Also, they are considered to have higher potential for innovation as they are operating in a competitive environment.

The factory-based firms are by definition expected to have the entrepreneurial flair that would enable them not only to withstand the pressure of competition, but also to innovate and set new standards in the industry as pioneers. But they also share the culture of household-based firms in that they tend to be somewhat reclusive and reluctant to sharing and exchanging knowledge, particularly with firms in the same industry. This is not surprising considering the imperfection of the market within which they operate. They would, however, share knowledge and best practices, albeit to a limited extent, with firms in the supply chain; and they would use their supply networks largely as a conduit for obtaining knowledge and information from other firms and organisations.

5.7 Scopes for technological capability development and innovation

The ITAP survey on the needs for technology and innovation from 2005 – 2009, shows five main aspects for technological capability development in the Thai dessert industry. These focus on extending shelf life; product development; production machine development; process development; and quality management system (Yuwawutto, 2009). The technological needs of the sector brought out by the survey of 49 Thai dessert firms are shown in figure 5.10. The survey found the highest need to be product development which constitutes 47% of all needs expressed by this industry. The second highest need (26%) is product shelf life extension, followed by machine development (15%), process development (6%), quality management system (3%), and others (3%).

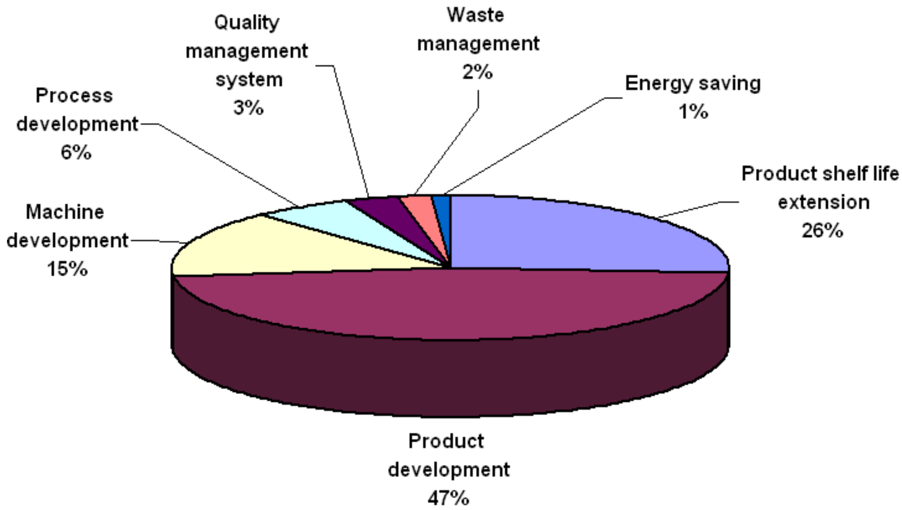

Figure 5.10 The needs of the Thai industry for technology development
Source: Yuwawutto (2009)

5.7.1 Product development

With increase in the competition due to new entrants in the Thai dessert market, firms would need their products to be distinctive from others, e.g. by introducing new products, and changing product appearance to suit for new and niche markets. New products can be developed by changing appearance of existing products and focusing on new targets of consumers such as children and healthy products. However, developing new products is not straightforward for SMEs in general and the Thai dessert industry, in particular, because of the limited knowledge of and practice in research and development. Even if firms come up with a number of new ideas, they usually do not know how to translate these ideas into commercial production. Package design plays a crucial role in product differentiation and product marketing by making products attractive to people, especially children. Packages are not only for protecting products and making them attractive but also serve as a communication channel (Robertson, 2006). Information on packages - e.g. history of products, nutrients and instructions - could also draw consumers' interests to the health and other precautions communicated through the packages.

5.7.2 Product shelf life extension

Because of its natural ingredients such as coconut, coconut milk, sugar, milk, oils and flours which are sensitive to light, moisture and oxygen, traditional Thai dessert is only suitable to be consumed fresh; and as such it has short shelf life (OSMEP, 2004).

In addition, Thai desserts are mainly handmade products which are susceptible to contamination by non-proper handling and non-hygienic manufacturing processes. Therefore, traditional Thai desserts have been limited to local markets. If firms wanted to extend their markets, they would need to supply products with longer shelf life as marketing beyond the local zones becomes time dependent involving storage and delivery processes. Importantly, the export market requirement for food shelf life is necessarily long, ranging three to six months, depending on product types. Therefore, many dessert firms would require to extend the shelf life of their products to enter the wider national and even export markets. A major area of innovation is to find ways of preserving the product without adulterating its texture, taste, appearance, and quality. Chemical preservation is least considered since it would compromise the image of products which trade on their being fresh, based solely natural ingredients. Freezing, heat treatment, canning are sometimes used as ways of increasing shelf life for some products. However, heating and freezing could destroy the taste, appearance and texture of products; so what is needed here is investment in process innovation (National Food Institute, 2003). Also, packaging technology and ingredient substitution are as important as the application of good manufacturing practices to give the products longer shelf life as well as adding to their values. Recently, researchers have shown interest to develop appropriate packaging technologies suitable for each type of product. One such technology is the Modified Atmospheric Packaging (MAP) technology, which uses specifically, designed plastic film to create suitable atmosphere that prolongs shelf life of products in packages. Other techniques include using moisture absorber and oxygen absorber.

A detailed discussion of innovation in the Thai dessert industry is given in Chapters 7 and 8. What is important to note here is that the question of product shelf life associated with Thai dessert is a major point of departure for considering innovation possibilities in the sector with respect to production management and marketing activities.

5.7.3 Machine and process development

Originally produced in backyards or in small cottages, production involves basic processes using kitchen utensils. Generally, Thai desserts are handmade, and so, mostly rely on skills based on tacit indigenous knowledge passed from generation to generation. Production capacity depends on the availability of people with the requisite tacit knowledge and skills; and these are often rare to come by. Machines could be designed embodying the knowledge. This would remove the scale constraint and productivity posed by the rarity of people with the traditional skills unique to Thai desserts. However, machine-paced approach to the production of Thai desserts may cause market unease - at least initially - on grounds that what is produced using machines cannot be a perfect substitute for the meticulously processed, handmade products. The perception that machine-made products would not have the same appearance, fineness and taste as the handmade ones could create a problem for marketing. But this problem cannot be considered to be perennial.

Most of the machines required by the Thai dessert firms do not currently exist in the market. The challenge then is how to specifically design and develop such machines and make it function successfully, particularly in the face of the preconceived view that machine-made Thai desserts are not a good substitute for the handmade ones.

The introduction of machine-paced approach to the production of Thai dessert would involve the design of specific machines and processes, and hence the introduction of a new culture in Thai dessert manufacturing. In the design of the production process, new and innovative layout and production plans can be explored to increase machine utilisation rates and reduce production costs. This would call for the availability of machine part substitution and regular maintenance schedules. However, the production and maintenance problems mostly occur in the factory-based firms, but such firms are few and far between in the Thai dessert industry. Cost-effective processes would be attractive, but cost-effective options may not be the best or appropriate options if they cannot deliver products to the required standard.

5.7.4 Quality management system

Many Thai dessert firms are household-based and community-based firms which are not likely to implement product and process control. Consequently, they are likely to face some bottlenecks when they decide to increase production capacity as they would need to contend with the ability to control product quality and process parameters and handle and store raw materials, semi-products and final products. High export potential firms would also need to satisfy international standards like Good Manufacturing Practices (GMP). GMP is an internationally well-known quality system applied to food industry. Apart from quality control, firms seek to be GMP certified not only for purely quality control purposes but also for product reputation and marketing purposes. However, GMP requirements are too complicated and exacting; and it is costly to get GMP certification for small firms. The Thai government has announced a local guideline of Good Hygiene Practices (GHP) for small firms and community-based firms. GHP follows the GMP guideline, but the requirements are adapted to suit the conditions of small firms. However, not many of the Thai dessert firms are interested in GMP and GHP since they are very small and their products are limited to small local markets.

Apart from the above mentioned areas of production concern, there are other development aspects for the Thai dessert industry to consider, such as waste management and energy saving. This is to reduce cost of production and increase income from by-products. The applications of food science and food technology can help firms to improve the quality of products and process efficiency. Scientific knowledge can be applied to natural ingredients such as rice, flour, and fruit to improve production process and extend product shelf life. There is a wide scope for innovation and growth in the Thai dessert industry since the market for the products of the industry is expanding both locally and globally. For the industry, there is great benefit to be had from the application of modern technology to indigenous knowledge, as discussed in Chapter 3.

5.8 Government support for the Thai dessert industry

The promotion of the Thai dessert industry was officially initiated in 2003 by the former Prime Minister Taksin Shinawatra (PM: 2001–2006). The promotion fair called 'Sending Love by Thai desserts", or "Kanom Thai Song Jai Rak", was aimed to promote the consumption of Thai desserts by encouraging, creative Thai dessert firms to exhibit their products. This scheme has improved the image of Thai desserts both in Thailand and abroad. The promotion fair in 2003 culminated in the establishment by the Ministry of Industry of the Thai Confection Industry (TCI) as a corporate entity operating under the Office of Small and Medium Enterprise Promotion (OSMEP). TCI's mission was to promote the growth of the Thai dessert industry by creating a network between firms, government agencies and universities; providing knowledge and information to business enterprises; performing joint research; and offering market channels, especially for the international market. In the same year, TCI opened a pilot outlet at the Thai International Airport to survey the take up of Thai desserts among international visitors, which would be a good proxy for export demand. The pilot outlet revealed useful information about the creativity and value of the Thai desserts which has never been acknowledged before. TCI operated for six years in liaison with Thai dessert entrepreneurs, and ceased operation in 2009 when the new government decided to restructure its intervention strategy for industrial development.

Many support schemes for SMEs have, however, been formulated under various government agencies, although these are not specific to the Thai dessert industry. The Industrial Technology Assistance Program (ITAP), operating under NSTDA, has a specific mission to promote technological capability and innovation in the Thai SMEs. ITAP and TCI collaborated and performed research development projects for the SMEs in the Thai dessert industry. After working with TCI from 2005 to 2009, ITAP recognised a potential for development in the Thai dessert industry. ITAP now targets the Thai dessert industry as one of the strategic industries under the food and agricultural sector. ITAP provides technological and financial supports to the sector. For technological support, ITAP matches the supply of experts from various sources with the needs for product and process development at the level of the firm. For financial support, ITAP provides grants of at least 50% of the total project budget. The proportion of support is higher for the community businesses. However, the ITAP financial support does not cover non-registered or individual businesses. This means household-based firms are excluded from access to financial support unless they form a group with other firms in the community and register as a community-based business.

Another important project is “One Tambon One Product” or the OTOP campaign launched by the government in 2001 to strengthen a community-based business. The OTOP project plays an important role in promoting the growth of the Thai dessert industry as well as other industries. The project encourages people in each community to earn money by developing products from the use of locally available natural resources using indigenous knowledge. The mission of the OTOP project in the first and second years (2001-2002) focused on public awareness about the significance of project promotion. In later years, emphasis was also put on the development of products and on improvement of the quality of marketable products, and the setting of product standards.

There are a number of public agencies, like NSTDA, OSMEP and various academic institutes, which operate following the OTOP policy. Among the factors that hamper the full success of such agencies are limitation of human resources and financial constraints.

5.9 Conclusion

It is widely recognised that SMEs play an important role in Thailand's economic development. In 2008, Thai SMEs constituted about 99% of all firms, and approximately 19 % of SMEs were in the manufacturing sector. Thai SMEs also account for approximately 40% of total GDP and 76% of total employment. The contribution to total export value of SMEs is almost 30%; and the growth rate of SMEs' export value is around 7% each year. It is apparent from all these metrics that SMEs are so important for the Thai economy that policy cannot afford to have the marginalised.

However, like in other developing countries, the Thai SME sector has major weaknesses that limit its scope for technological capability development and innovation. First, lack of access financial support and capital funds is found to be a major problem for most SMEs in Thailand. Second, many of the Thai SMEs lack good entrepreneurial and management skill and this constrains their competitiveness in both domestic and international markets. Third, Thai SMEs have low technological capability because of low absorptive capacity, limited network with external knowledge sources, and limited internal resources. Lastly, SMEs in remote locations lack access to government support due to discontinuous and ineffective channels of communication with policy and market players in the political economy of Thailand. The government has recognised these problems and has established strategic plans to promote SMEs, namely the SME promotion plan and the NSTDA strategic plan for technology and innovation.

The Thai dessert industry is a traditionally indigenous knowledge-based industry with the potential for technological capability development. Most of the firms in the industry qualify as SMEs. It is believed that this small subsector can contribute significantly to the Thai economy but if only well promoted and its creative and innovative attributes are brought out and commercially exploited. There is evidence of export demand for products of the Thai dessert industry but firms would need to upgrade the quality of their products to tap into this market. This, however, begs the question about their competitiveness and raises the issue of how best policies and strategies can be designed to accommodate the needs of SMEs.

There are three main categories of the Thai dessert firms, which will be studied in this research, namely household-based, factory-based, and community-based firms. The household-based firm is the smallest unit with less than ten employees and very limited resources. The community-based firm has at least seven persons from different families, all in the same community. Community-based firms are expected to have high social relations which enhance the effectiveness of their engagement in economic activities. Factory-based firms constitute to the smallest proportion of all Thai dessert firms but they have higher entrepreneurial capability than firms in the other two SME categories. Because they are entrepreneurially driven, they are expected to be more innovative and competitive in wider markets. This hypothesis will be put to the test in Chapter 8.

There is nonetheless scope for technology development and innovation in the Thai dessert industry. For example, product packaging, product shelf life, product design, process design, organisation and management, are areas on which innovation initiatives in the sector can focus. Government support for the Thai dessert industry was formally initiated in 2001. However, these interventions have yet to be fine-tuned to enhance their effectiveness to promote technology and innovation and the competitiveness of the Thai dessert industry.

CHAPTER 6

Research Design and Methodology

This chapter discusses the research design and methodology used in this study. The data used was largely of primary nature deriving from sample surveys of firms based on the administration of questionnaires and the conduct of series of interviews before and concurrently with the questionnaire administration. At the meso or institutional level, interviews and observations were employed to investigate the patterns of intervention mechanisms and industrial technology development projects promoted by public agencies. Public policy, reports and relevant documentation were reviewed and used as information sources to construct a questionnaire based survey.

6.1 Research design

Research designs aimed in general to explore empirical evidences by using various methods. This study involved both qualitative and quantitative methods with a focus on the activities of firms. A combination of two main approaches, questionnaire administration and face-to-face or in-depth interviews were used. Most of the data were elicited through the administration of questionnaires. The interviews aimed to obtain in-depth information from some of the firms covered in the sample survey of firms and relevant supporting agencies. These two approaches were designed to complement and strengthen each other. While the questionnaire survey provided 'a cross-sectional' view, the interview gave 'longitudinal data'. Because of their respective advantages, these two approaches have been used widely in social science and management research projects (Meyer et al., 1997; Temsiripoj, 2003; O'Regan et al., 2006). The research also aimed to collect data from macro and meso levels as a supplement to the data collected at the micro (firm) level. This multilevel data collection offers a comprehensive scope for the analysis of top down and bottom up activities and governance policy at all levels of economic activities. The schematic approach for the research design is shown in Figure 6.1.

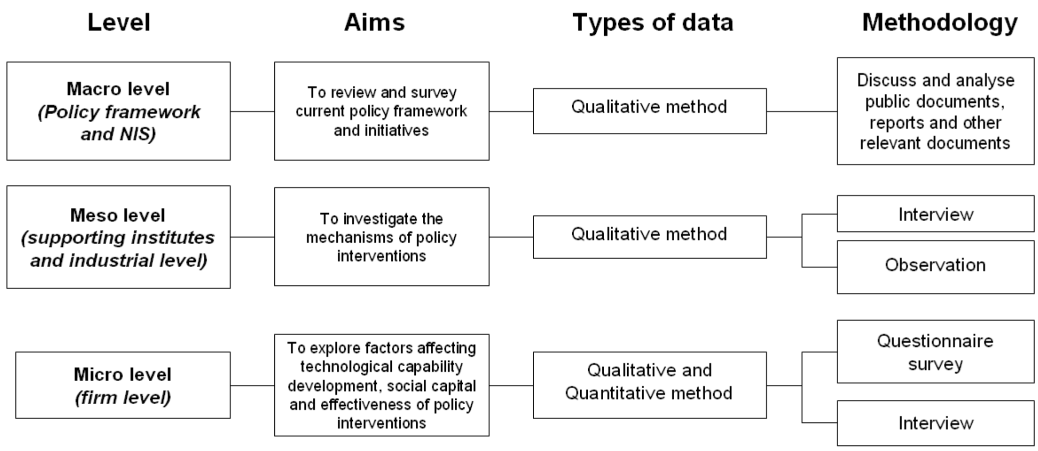

Figure 6.1 A schematic approach for the research design

6.1.1 Macro level

The macro level study was aimed to elicit data and information from public policy papers and other documents that focus on the effort of the government to promote technology and innovation in the industrial sector, particularly the SME sector. Public policies in Thailand were designed and developed by the Ministry of Industry and the Ministry of Science and Technology. These two ministries play crucial roles in the Thai national innovation system through their contributions to the formation of policy frameworks and infrastructures for capacity building, innovation and competitiveness of the economy as a whole.

6.1.2 Meso level

The meso level data were obtained through interviews and observation techniques. The interviews with the representatives of supporting agencies aimed to investigate the mechanisms of policy interventions and the ways policy has been implemented targeting the Thai dessert industry. The interview sought to explore attitudes and characteristics of operators working in intermediary and supporting agencies, and also to bring to light the critical success factors and barriers associated with policy interventions, collaboration, project and organisation management, resource allocations, staff and management perspectives. However, these explanatory factors are complex and cannot be fully obtained through staff interviews only. Therefore, participation in the collaboration processes and onsite projects was required to be able to observe individual attitudes, behaviours, interactions, and other factors facilitating and hindering intervention programmes and social capital development. This method allowed the researcher to investigate social behaviour, social capital and networking, and supporting mechanisms.

Observation technique is used to observe social phenomenon and social activities (Mack et al., 2005; Tedlock, 2005). In this study, observation was carefully conducted to minimise the possibility of conflict of interests between and any bias from the researcher and key actors. The researcher must avoid participating in any conversation at all. Experience and skill of the researcher who conducts the observation are also important. In this study, the researcher has been working closely with industry for more than eight years[12] and attended research methodology courses. Therefore, the researcher has considerable skill to understand the behaviour of the key actors under observation. In addition, an observation guideline (see appendix 10) was established as a framework for the researcher to cover interest topics as quickly as possible.

In this study, observation is conducted through the technology development programme administrated by the Industrial Technology Assistance Program (ITAP) on selected cases both individual firms and community development projects. The data gained from observations were used to support questionnaire survey and interviews and the results were also presented as case studies.

6.1.3 Micro level

A postal questionnaire method was used to elicit information and data from respondents. This approach is quick and practical to access remote areas, thus providing an overview of the sample population (Bryman, 2008). Cooke and Wills (1999) applied a postal survey to investigate the extent to which social capital affects small firms' innovation performance. More recently, Cooke (2005) studied the relationship between social capital and SME innovation and growth at the firm level, again using the postal survey method.

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[12] The researcher worked with the Standards, Testing and Quality Control Sections from 1997 – 2001, and with the Industrial Technology Assistance Program (ITAP) from 2001 – 2006. Both units are under the National Science and Technology Development Agency (NSTDA), Thailand, with which she is still associated. These units have main responsibility for industrial services and contact directly with industrial firms.

However, the main disadvantage of a postal survey approach is that sometimes it fails to elicit in depth information from respondents, while the face-to-face interview method can. Furthermore, the response rate of the postal survey method is usually lower than the face-to-face interview method. The questionnaire used in this study is constructed, verified and validated following the steps addressed by Sarantakos (1998).

In addition to the questionnaire survey, a series of interviews were conducted with the aim to capture insights from targeted firms. The face-to-face interview method involves open-ended questions eliciting information largely of qualitative nature relating to behavioural patterns. This method was used by Jack (2005) to explore the strength of the relationship of networking activities among enterprises with respect to their business performances.

6.2 Target population and Sampling Frame Selection for the questionnaire

This section explains how target population is set out and provides criteria for the sampling frame procedure for questionnaire administration. The target population was drawn from two main databases and stratified sampling frame based on firm category was used.

6.2.1 Target population

The study focused on small and medium-sized enterprises (SMEs) in the Thai dessert industry covering three categories: household-based firms, community-based firms, and factory-based firms, which have different profiles. It was difficult to determine the total population of the Thai dessert firms in Thailand because there was no population statistics and formal database for the Thai dessert industry. This is because this sector is considered as an informal sector, constituting mainly household-based and community-based firms. Therefore, a large number of firms in this sector, particularly those of the household-based type, were not likely to formally register with the Ministry of Industry.

The lists of the Thai dessert firms were obtained from two sources: the Thai Confection Industry (TCI) and the Thai Tambon[13] website. These sources are supported by the government to promote the growth of the Thai dessert industry and to provide information of local products across four regions[14].

TCI was exclusively established by the Office of Small and Medium Enterprises Promotion (OSMEP) with the aim to promote the growth of the Thai dessert industry and the consumption of Thai dessert both in domestic and foreign markets. While TCI targets specially the Thai dessert industry, The Thai Tambon website has a wider coverage of all communities and local products across Thailand such as food and drinks; textile, fabric and dresses; handicrafts and souvenirs; and herbs. The website is established by a private company and is partially supported by the government. It functions as a social and community network to promote local products providing links between customers and producers including useful links of social events, various supporting agencies and knowledge institutes. The TCI lists a total of 424 Thai dessert firms. The Thai Tambon website screens a total of 1,284 dessert firms. Therefore, the total population of firms targeted in this study covered 1,708 firms.

6.2.2 Sampling procedure

Target firms in this study were small and medium enterprises (SMEs) as defined according to the criteria adopted by of the Office of Small and Medium Enterprises Promotion (OSMEP). To explore technological capability development and innovation network, the study focused on manufacturing firms having production and engineering activities. Trading firms and private shops which had no production process and R&D section were not included in the scope of this study. This was done

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[13] Tambon is a small local authority in Thailand. The Thai Tambon website (http://www.thaitambon.com) highlights OTOP projects (One Tambon One Product) which has been official launched by the government to promote local and community products in all regions of Thailand.

[14] A region classification is set by the Office of the National Economic and Social Development Board (NESDB) based on cultures, traditions, lifestyles, and social and economic development. There are four regions in Thailand which are the Central, the Northern, the North Eastern and the Southern parts of Thailand.

on the perception that most of the innovation activities tend to occur where there are some forms of production and engineering capabilities or aross to such capabilities.

All 424 firms from the TCI database were used in this study since they were potential entrepreneurs engaged in or, at least, having interest in growth and innovation. Most of the Thai dessert firms of TCI membership were SMEs that aim to improve competitiveness of their businesses. They contacted TCI to receive information; to have access to new marketing channels; and to gain more opportunity to improve their products through research and development services.

In the case of the firms from the Thai Tambon database, stratified sampling plan was used to draw 321 firms (25%) of all firms. The stratified sampling procedure was based on firm categories in the Thai dessert industry as shown in Table 6.1.

Table 6.1 Stratified sampling frame for the Thai Tambon website

Firm category	No. of firms	Sample firms (25%)
Household-based	422	106
Community-based	820	205
Factory-based	42	11
Total	**1,284**	**321**

The sample size used in this study (25% of total population) was acceptable because it was more than the acceptable sample size according to on Yamane's sample size calculation at 95% of confidence level (Yamane, 1964; Israel, 1992) which was 305 firms as calculated below.

Yamane's sample size formula:

$$n = \frac{N}{1+N(e)^2} = \frac{1{,}284}{1 + 1{,}284\ (0.05)^2} = 304.99 = 305 \text{ firms}$$

Where as:

n	=	Sample size
N	=	Population (1,284 firms in this study)
e	=	Sampling error (0.05)

In this formula, the 305 firms that constitute the sample size accounted for nearly 25% of the total population.

After removing the firms that occur in both the TCI database and the Thai Tambon website (19 firms), the total number of firms in the sample was reduced to 726, as shown in Table 6.2.

Table 6.2 Sampling frame and sample size

Database sources	Target population (firms)	Sample firms
TCI	424	424 (100%)
Thai Tambon website	1,284	321 (25%)
	Deducted repetitive firms from both sources	-19
	Total sampling firms	**726**

Of the 726 sample firms used in this study, 56% (405 firms) were from the household-based sector; 34% (249 firms) from the community-based sector; and 10% (73 firms) from the factory-based sector. Questionnaires were sent to all firms and the response rate is 22.31%, or 162 firms. This response rate was rather impressive since this is the first time that questionnaire survey on innovation networking was conducted specifically for this traditional industry.

6.3 Data collection procedures

The fieldwork for this study was done in Thailand and was conducted in two phases. The first phase was a preliminary study (first interview and questionnaire verification), which was carried out during the period between July and September 2008. The second phase was survey of firms through questionnaire administration and second interviews; and this was done during the period between March and June 2009.

6.3.1 Phase I: Preliminary study

The preliminary study in Thailand was conducted from 1 July to 25 September 2008. The purpose of the fieldwork at that time was to interview some firms in order to construct robust questionnaire, and to verify and validate the questionnaire that was suitable for Thai dessert firms which are very small indigenous firms. The results showed that the questionnaire itself proved too complicated for very small firms. In addition, the results of the questionnaire survey provided the basis for an in-depth study of specific firms.

The activities in this phase also involved interviews with public agencies responsible for the promotion of the Thai dessert industry and individual firms. As part of the pilot survey, questionnaires were reviewed by firms and experts familiar with the Thai dessert industry with the aim to validate the first draft of questionnaire and improve the quality of the information and data obtained through the administration of it. The first draft of questionnaire was evaluated by five Thai experts who work in public organisations and academia such as National Science and Technology Development Agency, Mahidol University and the National Food Institute. The experts were asked to evaluate the questionnaire against the criteria adapted from Sarantakos (1998):

1) The questionnaire meets the objectives of the study;
2) The questionnaire will gain the needed information for the study;
3) Words are not redundant or misleading;
4) Questions are clear and understandable;
5) Questions are appropriate for respondents (in this case, the survey will be sent to the top manager, the owner or firms); and
6) A questionnaire structure is appropriately constructed and arranged

The Pilot survey including interviews and questionnaire trials was carried out on seven private companies, the result of which led to revision of the questionnaire. Questionnaire trial was performed by the researcher quiding firms to fill in the questionnaire, time recording, and clarifying some questions if asked. This trial provided information for revision of the questionnaire making it easy to answer, without taking much time, and reduce language complexity and confusion. Some questions relating to networking; innovation activities; and technological capabilities and innovation outputs, were found to be too difficult and not suited to the conditions of small indigenous firms, especially for household-based firms. These questions were revised and simplified to make them relevant to the conditions of the three categories of the Thai dessert industry, which are household-based, community-based and factory-based firms. A new section relating to growth and evolution of firms was also added to the questionnaire to collect wider aspects of the Thai dessert industry.

6.3.2 Phase II: Survey

A field survey was conducted during the period between 1 March and 10 June 2009. The survey was divided into two parts. In the first part, questionnaires were sent to all target firms. In the second part, interviews were conducted to supplement the information obtained through the administration of questionnaires. The interviews covered public agencies and observations of technology development projects.

6.3.2.1 Questionnaire survey

Questionnaires were administered to firm owners or firm managers of the Thai dessert firms together with an introductory letter from Technology Management Center (TMC) of the Science and Technology Development Agency (NSTDA) (see appendix 8). In order to increase the response rate, follow-ups were conducted through e-mails, telephone calls, and complimentary gifts such as books and cotton carrier bags with the ITAP logo. The questionnaire was also accompanied with a stamped and addressed return envelop to make it convenient for respondents to respond.

Prior to the survey, in order to test clarity of a new questionnaire and maximise response rate and minimise the risk of confusion, the final draft of questionnaire was reviewed and trialled on 19 firms and five experts who worked closely with the firms on the industrial technology development programmes. Following the comments and suggestions received, the questionnaire was revised again, making the questionnaires simple and clearer, cutting out jargons and changing the layout, so that it becomes easier to read, understand, and to respond to.

The questionnaire is divided into eight main parts comprising of structure and attitude variables. The structure variables include general information of firms such as types of business, years of establishment, location, registered capital, employees, sales revenue, profit, and firm performance indicators. The attitude variables comprise of simple questions with checklists and five-Likert scales and also some open questions. The questionnaire is designed to gauge the attitude of respondents on the factors affecting technological capabilities; innovation; social capital; and growth of firms. The questionnaire used in this study is shown in Appendix 1 (English version) and Appendix 2 (Thai version).

6.3.2.2 Firm interviews

Concurrent with the questionnaire administration, an in-depth interview was conducted with the managers of firms covered in the sample survey. An introductory letter was issued by Technology Management Center (TMC) (see appendix 9). The interviews involved open-ended questions that would allow interviewees to express their views on the innovation performance of their respective firms and the problems and prospects they envisaged with respect to innovation activities, collaboration with other organisations and network development. As it would not be practical to cover all firms included in the sample of the Thai dessert firms, the interviews were aimed at few firms selected from each of the three categories of the Thai dessert industry. The sample size for the interviews is determined in such a way that there is a reasonable balance between the time the study would take, the cost it would involve and the quality of the data to be collected.

In all, 27 firms were approached for interview. In the event, only 22 firms were interviewed as shown in Table 6.3.

Table 6.3 Number of firm interviews and category

Region	**Firm category**			**Total**	**Trip period**
	Household	Community	Factory		
North	1	3	3	**7**	17-19 March 2009 25-29 May 2009
South	1	1	2	**4**	21-22 April 2009
Central	6	2	3	**11**	5 March – 10 June 2009
Total	**8**	**6**	**8**	**22**	

The information gained from the interviews provides substantial information to complement the data obtained through the administration of questionnaires. Interviews conducted in individual firms took around 1.30 hours – 3 hours; but in some cases, it took more than one visit at each firm.

6.3.3 Agency interviews and observation techniques

Interviews were used in this study as a method of eliciting relevant data from public agencies, support agencies and academic institutions associated with technology and innovation promotion in the Thai dessert industry. The interviews were held with top managers, project managers and staff who work directly with firms. The interviews were designed to explore the intervention mechanisms adopted by public agencies, support agencies and academics to impact the Thai dessert industry; and to generate data that would allow evaluation of the effectiveness of government intervention to promote technology, innovation and network development in the Thai dessert industry.

Interviews were conducted formally and informally with various public agencies and academics involved in ITAP projects and ITAP networks in the central, the northern and the southern regions of Thailand. The formal interviews were timed and pointed to specific issues. The informal interviews were conducted as conversations and small talks at work sites, during coffee breaks and lunch times. Interviewees expressed themselves more freely and gave more information than what they would do in formal interviews. Individuals that were interviewed were representatives of the following public organisations, support agencies and academic institutions:

- Industrial Technology Assistance Program (ITAP), National Science and Technology Development Agency (NSTDA)
- ITAP northern network
- ITAP southern network
- The Thai Confection Industry company limited (TCI)
- King Mongkut's University of Technology Thonburi (ITAP western network)
- Naresuan University
- Bansomdejchaopraya Rajabhat University
- Kasetsart University, Kamphaeng Saen Campus

In addition to the interviews, an observation technique, using the observation guideline (see appendix 10), was used to learn more about the process of industrial development programmes conducted by ITAP in collaboration with other support agencies. This method was used to observe individual techniques and approaches applied to such projects to develop trust and social relationships which are important for collaboration. Besides, the technique can be used to observe the interaction and behaviour of firms responding to project supports offered by public agencies.

6.3.4 Other sources of data

Secondary sources of data for the study were obtained from published documents of the government agencies that have direct responsibility for the technology and innovation promotion in the industrial sector in Thailand. Information was also collected from government organisations, Research and Technical Organisations (RTOs), the academic sector, related non-profit organisations, and previous studies.

Government policy documents were obtained from public agencies with the responsibility for science, technology and industrial development in Thailand. The main government agencies were the National Science and Technology Development Agency (NSTDA); the Office of Small and Medium Enterprises Promotion (OSMEP); the Ministry of Science and Technology; and the Ministry of Industry. The study focused on two major national policy frameworks – namely, the National Science and Technology Strategic Plan (NSTSP) 2004 – 2013 and the SMEs promotion strategies 2007 – 2011.

6.4 Questionnaire structure and content

This section discusses the structure of the questionnaire and its details including the relevant literature. The adequacy of the questionnaire in terms of robustness, internal consistency and reliability was also addressed.

6.4.1 Questionnaire structure

The questionnaire (see appendix 1) consisted of eight parts developed based on the review of the relevant literature and on the feedback from the first fieldwork done in phase I of the study (see Section 6.3.1). The eight parts related to: (1) general information; (2) firm growth; (3) business status and business perception; (4) social capital; (5) competitive pressure; (6) performance of technology and innovation; (7) government policy initiatives; and (8) access to finance. The details of questionnaire structure are shown in Table 6.4.

Table 6.4 Questionnaire structure

Questionnaire structure	Questions
Part 1 general information	• business category, year of establishment, registered capital, number of employees, reasons for starting the business
Part 2 firm growth direction	• decision on firm expansion in the past and in the future
Part 3 business status and business perception	• current business status and satisfaction • perception on running business as community-based firms and factory-based firms (secure business, knowledge and information sharing, transaction cost, profit, management) • business risk and uncertainty
Part 4 social capital	• network, trust, frequency of contact, strength of ties, knowledge and information sharing, norms and network activities
Part 5 competitive pressure	• competitive index (new entrants, new products, substitute products, competition, rivalry, and employee poaching) • attitude towards competition
Part 6 performance of technology and innovation	• technological development and innovation outputs • business performance (sale growth, employment growth, market expansion, investment performance) • technology monitoring
Part 7 government policy initiatives	• satisfaction of intervention • extent of supports received from government
Part 8 ability to access to finance	• ability to access supports from financial institutes and government

In order to determine as to which categories firms would fall into, respondents were asked in part 1 to provide basic information about their business, production processes and also reasons for starting the business. The control variables were firm categories determined by registered capital (if applicable), number of employees and business registration.

The questions in part 2 related to firm growth experience and direction of growth. Respondents were asked to provide only questions that relate to their respective categories. Household-based firms were asked their preferences for business expansion and reasons for their decision. The community-based and factory-based firms were asked which category of firms they belonged to when they started the business. The questions for household-based and factory-based firms also included participation in community businesses. This section aimed to investigate firm growth trajectories and how household-based firms tend to evolve. These questions were based on the preliminary study phase and also adapted from previous studies such as Covin and Slevin (1991) and Simon et al. (1999).

Part 3 raised main questions relating to the business status and perception of firms. In the first question, respondents were asked questions relating to their business status and their satisfaction. This question was based on the basic assumption that if they are satisfied with their current business status, they would not be enterprising enough to aspire for growth and improvement. In the second question, respondents were asked about their attitudes towards running business as community-based and factory-based firms. This question related to perceptions about business security, knowledge and information sharing, transactions cost, network building and alliance creation, negotiation power, and income. The last question on risk and uncertainty involved in running businesses sought to elicit the risk propensity of respondents. These questions were adapted from the contributions of Norton and Moore (2006), Simon et al. (1999) and Tan Litschert (1994) to the relevant literature.

The questions in part 4 were associated with the extent of social capital at the disposal of firms, including networking with other organisations, trust, frequency of contact, strength of ties, knowledge and knowledge and information sharing, transactions cost, norms, and network activities. These questions were based on the presumption that social capital facilitates interactive learning, knowledge sharing across the network, thus stimulating innovation at the firm level. Most of questions were adapted from previous studies on social capital and industrial development such as Sahakijpicharn (2007) and UNIDO (2006).

Part 5 focuses on the extent of competitive pressure the individual firm was subject to. The questions were based on Porter's five forces for competition (Porter, 1990) – namely, competition on price, quality, delivery, packaging and promotion; and employee poaching. Respondents were also asked if they would consider competition a threat or opportunity for improvement. This was based on the argument that truly entrepreneurial firms were those that would seek to turn the threats they face into opportunities, and would therefore perceive competition as an opportunity and motivation for improvement and innovation (Hostager et al., 1998).

Part 6 intended to elicit data that would enable measurement of and comparison between the technological capability development and innovation performances of the community-based and factory-based firms. It should be noted that most of the household-based firms were very small (i.e. less than ten employees by definition) with weak technological capability and hardly any innovation activities. Therefore, they were not in a position to be compared with the other two categories. Variables used in this part were adapted from the OSLO manual (OECD, 2005a), and Link and Bozeman (1991). For small indigenous firms, some innovation outputs such as patent and academic publications were omitted. This part also measured sales growth and employment growth.

In part 7, questions were asked to elicit data and information that would allow us to evaluate the impact and effectiveness of government policy and interventions. The indicators used were extracted from the two government policy documents: the National Science and Technology Strategic Plan (NSTSP) 2004 – 2013; and the SMEs Promotion Strategies 2007 – 2011. Respondents were also asked about the extent of government supports received by their firms.

Finally, the questions asked in part 8 aimed to elicit data that would enable the researcher to assess the ability of firms to access finance from external sources. Respondents were asked to indicate the extent of financial support such as grants, loans or special schemes they receive from government and financial institutions. This section was based on the current SME financial support scheme in Thailand.

6.4.2 Adequacy of the questionnaire

Data obtained from the survey can be categorised into three groups: quantitative, qualitative and categorical data. Respondents were asked to provide information during the period between 2006 and 2008 about technological capability, innovation outputs, and business performance. The quantitative data were obtained from the actual numerical values of new or improved products and processes, and the percentage share of exports in the total output of firms. The study also used rating scales (5-Likert scale) for attitude measurement to quantify abstract issues such as business perception, risk propensity, business perception, and social capital. Information on these was gained from open-ended questions - for example, provision of information that was not specified in particular questions and suggestions for government intervention and network development. The categorical data were obtained from the 'yes' or 'no' answers to questions, such as "do you currently join your local business community?" This type of data was also gained from valid cases when answers to a particular question asking, for example, reasons for starting business, come in more than two categories.

The internal consistency and reliability test (the Cronbanch's alpha coefficient) of the Likert scale applied in each section of the questionnaire is shown in Table 6.5. The Cronbanch's alpha coefficient ranges from 0 to 1. The higher the score of this coefficient, the more reliable of the constructed scale. Pallant (2007) and Santos (1999) indicate that scores greater than 0.7 would be considered robust. However, the Cronbach's alpha test for part 6 (technology monitoring) is 0.389 and part 8 is 0.45, which do not pass the robustness test. Low Conbanch's alpha is commonly found when the topic contains fewer items. Moreover, whereas the value of the mean inter-item correlation should lie between 0.2-0.4 to be robust (Briggs & Cheek, 1986 cited in Pallant, 2007;95), in part 6, the mean inter-item correlation of 'technology monitoring' is only 0.175 and in part 8 is 0.204. Consequently, the topic of 'technology monitoring' was not included in the multiple regression analysis but it was involved in the discussion.

Table 6.5 Cronbach's alpha of 5-Likert scale used in the questionnaire

Questionnaire section	Topic	Items	Cronbach's alpha	Robust
Part 3	Perception of running business as community-based and factory-based firms	6	0.75	Yes
Part 3	Risk and uncertainty	10	0.73	Yes
Part 4	Social capital and networking	16	0.76	Yes
Part 5	Competitive pressure	10	0.83	Yes
Part 6	Degree of technological capability development	3	0.88	Yes
	Technology monitoring	3	0.389 (0.175*)	No
Part 7	Government support	10	0.78	Yes
Part 8	Ability to access finance	3	0.45 (0.204)	Yes

* mean inter-item correlation is in parenthesis

6.5 Methods of data analysis

The results of the questionnaire survey were analysed using statistical methods with the SPSS (Statistical Package for the Social Sciences) programme. Summary of the statistical techniques is shown in Table 6.6. The data analysis involved comparative study (using non-parametric statistics) and investigation of relationship (using parametric statistics).

Table 6.6 Summary of statistical techniques used in the study

Statistical technique	Features	Application in the study
Comparative study		
Descriptive statistics: Frequency, mean, mean rank, percentage, standard deviation	Descriptive analysis Comparison	Compare numerical data among 3 categories, especially in part 1 – 3 and some in other parts
Kruskal-Wallis Test (non-parametric)	Compare among more than 2 groups	Compare continuous variables between 3 categories of the Thai dessert industry
Mann-Whitney U test (non-parametric)	Compare between 2 groups	Compare continuous variables between 2 categories of the Thai dessert industry
Chi-square test (non-parametric)	Compare categorical variable, crosstabulation, independence test	Compare categorical variables between two or three categories firms
Exploring relationship		
Multiple regression (parametric)	Explore relationship (1 sample on more than 2 different variables)	Explore relationship (risk perception, social capital, competitive pressure, government intervention, access to finance VS technological capability and innovation)

Source: extracted from Pallant (2007)

A comparative study was conducted to investigate, the factors that affect innovation networking and technological capability development of the community-based and factory-based firms. Comparative analysis was used to examine the differences and similarities between two or more groups, and the factors contributing to these differences. For example, the study of Kingsley and Malecki (2004) used a comparative methodology to study factors affecting industrial networking and competitiveness in urban and rural small firms in Florida, US. That study was conducted using the interview approach, which also involved administration of questionnaires.

Descriptive statistics were used to analyse general characteristics of firms such as firm age, registered capital, number of employees, reason for starting the business, sales revenue, etc. The parameters used for analysis include frequency, mean, percentage, standard deviation and ranking. Descriptive statistics was also used to analyse data in some other parts of the questionnaire such as firm growth and current business status, business perception and technology and innovation performance. The data were analysed using the cross-tabulation method. This method is straightforward and useful for presenting statistical analysis of two or more groups.

Apart from descriptive analysis, three main statistical tools of analysis were used in the comparative study - namely Chi-square, Kruskal-Wallis and Mann-Whitney U tests. These techniques were selected based on the characteristics of the data obtained from the questionnaire survey and the objectives of the study. These techniques are of non-parametric tests widely used in social science when data are varied, skewed and of non-normal distribution type. The Chi-square test was used to compare groups with one categorical dependent variable, via the 'yes' or 'no' questions. The Kruskal-Wallis test was used to compare more than two groups with one continuous dependent variable such as attitude scores, while Mann-Whitney U test was used to compare between two groups.

In addition to the comparative study, multiple regression analysis was employed to explore the relationship between technological capability development (TCD) and innovation performance, and factors affecting such performances. Multiple regression analysis is a parametric test offering great advantages. The main advantage is that it can be used to explore relationships between one dependent variable and many independent variables or predictors (Pallant, 2007). It is used to determine how a group of variables and each variable are important to or affect a dependent variable in the study. However, this technique has a number of limitations in that it assumes variables are normally distributed, and the independent variables used are not collinear. Despite its tight limitations, it serves as a useful tool for analysing relationships between factors. The multiple regression analysis was therefore selected to explore relationships between factors affecting innovation and innovation performance in the Thai dessert industry.

6.6 Conclusion

This chapter has set out the research design, which involved fieldwork based data collection through interviews and questionnaire administration. It has discussed how the questionnaire was constructed, verified and validated with reference to the feedback on the survey. The Chapter also provides methodological framework for analysing the data obtained from the fieldwork survey. Data analysis would seek to compare behavioural modes and growth evolution in the three categories of firms in the Thai dessert industry, and to explore relationships between technology and innovation performance and factors affecting this performance in community-based and factory-based firms.

Nonetheless, similar to the nature of most social science research, this study has a number of limitations relating to the research methodology it has adopted. Firstly, the method for questionnaire survey to measure key variables cannot definitely avoid bias sources. The rating scale used in the questionnaire may constitute individual biases. Mail survey also has limitations affecting quality and validity of the findings such as low response rate and high rate of missing values. Low response rate and bias could affect the normal distribution, hence making the samples less random. Thus, to make up for this weakness, case study and interview methods were used as complementary sources to gain broader and deeper information including causality of phenomenon. Secondly, the robustness of the regression analysis could be improved by increasing the sample size. With the limitation of sample size at the firm category level, the results of the regression analysis can fairly be expected to be tentative at best. However, the response rate (22% in this study) is still higher than expected, considering that this is the first innovation survey ever for this small traditional industry.

Thirdly, language is another limitation. Even though the questionnaire was translated to the official language in Thailand and validated by some firms, respondents could misinterpret the context and terms used in the questionnaires. Indeed, understanding of the basic concepts and contexts may vary due to cultural differences in the backgrounds of respondents and the nature of the industry. Therefore validation of the questionnaire with firms was deemed necessary to make the questionnaire relevant to the small indigenous firms. The interview method and the questionnaire facilitator helped to enhance understanding of the content of the questionnaire upon its administration; but this involved high cost and time to cover all in the sample.

Lastly, the indicators used to measure technological capability and business performance also have limitations. Measurement of technology development in very small and low-tech firms is not straightforward. It involves both conceptual and practical problems. What would qualify as innovation in the context of such firms? Innovation performance indicators such as patents, publications, R&D expenditure are not easily measured and are not relevant to the Thai dessert firms. Very small firms are mostly on by day-to-day basis. They do not have formal records and proper accounting system, and they are seldom conscious of the extent of their innovation activities. Therefore, some variables based on the survey data have built in biases due to the absence of objectiveness in individual judgements and attitudes.

In sum, these limitations point to the tentativeness of the conclusions based on the survey data and the need for future research and development, as will be proposed in the final chapter. The next two chapters analyse the survey and discuss the findings thereof. Three cases of the Thai dessert firms are also discussed in chapter 9.

CHAPTER 7

Discussion of the Survey Data

This chapter is devoted to the discussion of the data obtained from the survey of firms in the Thai dessert industry for their growth pattern. Salient features of the survey data are presented in simple tabular forms in ways that would make it possible for the three broad categories of firms in the Thai dessert industry to be compared and contrasted. The descriptive data presented in this chapter will provide the basis for parametric and non-parametric tests to be conducted in the Chapter 8.

The remainder of this chapter is organised into four parts. The first part discusses the basic characteristics of respondent firms in the three SME categories, namely the household-based, community-based, and factory-based firms. The second part discusses survey data on reasons for the establishment of businesses. In the third part, the survey data are used to discuss firms' prefered of growth trajectories. The last part discusses the perception of entrepreneurs about running businesses as community-based and factory-based firms.

7.1 The study sample

The questionnaire survey, which was administrated to a sample of 726 firms, received a response rate of 22.31% or 162 firms. Respondent firms from three firms were omitted because they are traders and their activities do not involve production processes. This reduces the total number of respondents considered in this study to 159. Of these, 90 are household-based firms (57%); 43 are community-based firms (27%); and 26 are factory-based firms (16%). This section provides the general profiles of responding firms in terms of age, production type and export capability, number of employees, legal status and business registration, and reasons for starting the business.

7.1.1 Age profile of firms

Table 7.1 shows the age distribution of firms. Overall, 43% of firms are between 4 – 10 years old; 29% are between 10-20 years old; 19% are between 21-50 years old; 7% are less than 3 years old; and 2% are more than 50 years old. The overall average of firm age is about 14 years. The average age of factory-based firms is about 16 years, while those of household-based and community-based firms are 15 years and 12 years, respectively. The community-based firms are the youngest, on average. This corresponds to the emergence in recent years of community business in response to the government policy, which brought forth community-based businesses in 1997.

The age profile of firms may affect their absorptive capacity in such a way that the older they are, the more experiences they may have to be able to assimilate new technologies (Bosch et al., 1999). However, the Kruskal Wallis test in Table 7.1 shows that there are no statistically significant differences between the ages of the three categories of firms in our sample population. If the assumption that observations across the sample are normally distributed can be sustained, the age factor cannot be counted as a significant discriminator between firms when it comes to variations in technological capability development across firms. Such an assumption is however tentative at best and sweeping at worst.

Table 7.1 Age profile of Thai dessert firms classified by firm categories

	Household-based		**Community-based**		**Factory-based**		**Total**		**Kruskal Wallis test**
Age of firms	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
0 - 3	9	11%	1	2%	1	4%	11	7%	Chi-square
4 - 10	32	38%	20	49%	12	48%	64	43%	= 0.539
10 - 20	22	26%	15	37%	7	28%	44	29%	df. = 2
21 - 50	19	23%	5	12%	4	16%	28	19%	Sig. = 0.764
> 50	2	2%	0	0%	1	4%	3	2%	(p > 0.05)
Total (n)	**84**	100%	**41**	100%	**25**	100%	**150***	100%	
Mean	14.62		11.59		15.52		**13.94**		
Std. Dev.	12.19		6.31		18.02		**12.16**		
Median	11.00		10.00		10.00		**10.50**		

*Missing data = 9 (5.66%), p > 0.05 no statistical significance at 0.05 level of significant

7.1.2 Type of production and export capability

We started with the hypothesis that while all firms in the three categories are capable of production - albeit to varying degrees - export capability is limited to market-based and, to a certain extent, community-based firms. Household-based firms are generally very small (less than 10 employees) and resource-constrained, and hence have limited production capability. The market of household-based firms is assumed to be limited to local consumers since their products do not meet the export standard in terms of quality, shelf life and appropriate packaging, in view of their limited technological capability. On the other hand, factory-based firms have higher ability to upgrade the quality of their products to exportable standard.

Table 7.2 Types of production and export capability

	Household-based		Community-based		Factory-based		All firms		Chi-Square test
	No.	%	No.	%	No.	%	No.	%	
Type of production									
- fully production	75	84%	40	93%	24	92%	139	88%	χ^2 = 2.652
- partially production	14	16%	3	7%	2	8%	19	12%	df = 2
Total (n)	**89**	**100%**	**43**	**100%**	**26**	**100%**	**158***	**100%**	sig. = 0.266
Export									
Yes	23	26%	11	26%	10	38%	44	28%	χ^2 = 1.808
No	67	74%	32	74%	16	62%	113	72%	df = 2
Total (n)	**90**	**100%**	**43**	**100%**	**26**	**100%**	**159**	**100%**	sig. = 0.405

* Missing data = 1 (0.6%), p > 0.05 no statistical significance at 0.05 level of significant

The evidence does not however appear to bear out fully our assumption about the distribution of export capability across firms in the three SME categories. Table 7.2 shows the types of production and export capability of firms in the sample. Overall 88% of the firms produce independent of supply chains, while 12% of firms produce within a supply chain framework. Some of the latter firms receive products of semi-products in bulk from other producers and assemble and repack these as final products to be marketed bearing their own brands. Over 90% of the community-based and factory-based firms and 84% of household-based firms produce their own products. As regards export capability, it is apparent from the sample that 28% of the Thai dessert firms are capable of exporting. Whilst export capability may be expected of the community-based (26%), and factory-based firms (38%), the observation that 26% of the household-based firms have export capability comes as a surprise, although it can fairly be argued that those with this capability represent the 'proactive minority' amongst the household-based firms, who are likely to evolve into community and/or factory-based firms. In addition, a Chi-square test for independence indicates no statistically significant association between firm categories and their export capability and production types.

7.1.3 Number of employees

Table 7.3 shows the number of employees of the three categories of firms. There is a clear distinction between household-based firms, on the one hand, and community-based firms and factory-based firms, on the other, in terms of employment profile. The majority or 84% of household-based firms have employees less than 5 people; and most of them involve only family members. The community-based and factory-based firms mainly have around 11-30 employees. While the workforce of community-based firms is drawn from family and community members, the workforce of the factory-based firms is generally drawn from the open labour market without family or community prejudice. The average factory-based firm has 38 employees, which is higher than that of community-based firms (27 employees). Moreover, the Mann-Whitney U test in Table 7.3 confirms that there is a significant difference between factory-based and community-based firms in terms of employment profile.

Table 7.3 Number of employees classified by firm categories

	Household-based		Community-based		Factory-based		Total		Mann-Whitney U test
Employee	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
1 - 5	71	84%	0	0%	0	0%	71	46%	(for community-
6 - 10	14	16%	10	23%	0	0%	24	16%	and factory-
11 - 30	0	0%	22	51%	14	54%	36	23%	Based firms)
30 - 50	0	0%	7	16%	8	31%	15	10%	Z = -2.597
> 50	0	0%	4	9%	4	15%	8	5%	df = 2
Total (n)	**85**	100%	**43**	100%	**26**	100%	**154***	100%	sig. = 0.009**
Mean	4		27		38		16		
Std. Dev.	2.12		28.53		28.30		23.52		
Median	3		18		30		7		

*Missing data = 5 (3.1%), ** $p < 0.05$ statistical significance at 0.05 level of significant

7.1.4 Legal status and business registration

Table 7.4 shows the legal status of the three categories of firms according to their business registration. The three categories of firms are significantly differentiated on this profile as shown by the Chi-Square test in Table 7.4. Only 2% of household-based firms have registered their businesses with the government, while for the community-based and the factory-based firms the corresponding proportions are 72% and 58% respectively. Overall 70% of the Thai dessert firms, most of which are household-based, are not registered with the government which means that they do not qualify to receive information and financial support from the government. The highest proportion of registered firms belongs to community-based firms. This is so because of the government's policy to target community businesses for financial and technological support.

Table 7.4 Legal status and business registration classified by firm categories

	Household-based		Community-based		Factory-based		Total	
Legal status/ registration*	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
No legal status/no registration	*88*	*98%*	*12*	*28%*	*11*	*42%*	*111*	*70%*
Single owner	88	98%	8	19%	11	42%	107	67%
Partnership	0	0%	4	9%	0	0%	4	3%
Registered business	*2*	*2%*	*31*	*72%*	*15*	*58%*	*48*	*30%*
Limited liability partnership	2	2%	1	2%	1	4%	4	3%
Company Limited	0	0%	0	0%	12	46%	12	8%
Community/club/cooperation	0	0%	30	70%	0	0%	30	19%
Registered partnership	0	0%	0	0	2	8%	2	1%
Total (n)	**90**	100%	**43**	100%	**26**	100%	**159**	100%

Chi-Square tests, χ^2 = 78.56, df = 2, sig. = 0.000* (p<0.01) statistical significance at 0.01 level

7.1.5 Capital fund

When firms are compared on the profile of capital fund, (i.e. the capitalised values of fixed assets and machinery and equipment), the firms in the factory-based category stand out differently from those in the other two categories. Most of the factory-based firms (62%) have capitalised values between 1 million and 50 million Baht. On the other hand, 75% of household-based firms have capital value less than 100,000 Baht (or 1,818 Pounds) since they are very small and use only basic kitchen utensils. The capital value of community-based firms range from less than 1000,000 - 1 million Baht, but the majority of firms in this category (82%) have their capital valued from less than 100,000 to 500,000 Baht. The bulk of the capital for firms in this category derives from family, community and/or cooperative sources. The Chi-Square test for independence in confirms significant association between the categories of firms and their respective capital values, and that the three categories of firms are significantly different from one another on capital value profile.

Table 7.5 Capital fund classified by firm categories

	Household-based		Community-based		Factory-based		Total		Chi-Square test
Capital fund (Baht)	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
< 100,000	57	75%	14	50%	1	5%	72	58%	χ^2 82.218
100,000 – 500,000	14	18%	9	32%	2	10%	25	20%	df = 6
500,001 – 1M	4	5%	5	18%	5	24%	14	11%	sig. = 0.000**
1M – 50M	1	1%	0	0%	13	62%	14	11%	(p < 0.01)
Total	**76**	**100%**	**28**	**100%**	**21**	**100%**	**125***	**100%**	

*Missing data = 34 (21.4%), **p < 0.01 statistical significance at 0.01 level of significant

7.1.6 Sales turnover

Table 7.6 shows annual sales turnover for the Thai dessert firms in 2008. Here too there is broad similarity between firms in the household-based and community-based categories in that in each case the majority of firms (72% and 46% respectively) have sales turnover of less than 500,000 Baht. By contrast, the majority of firms in the factory-based category (76%) have sales turnover between 1 m - 25 m Baht. The Kruskal Wallis test shows that sales turnover distribution across the three categories are significantly different at less than 1% level.

Table 7.6 Annual sale turnover in 2008 classified by firm categories

Sale turn over (Baht)	Household-based		Community-based		Factory-based		All firms		Kruskal Wallis test
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	
< 500,000	58	72%	18	46%	2	8%	78	54%	Chi-Square
500,000 – 1M	9	11%	9	23%	0	0%	18	12%	= 51.872
1M – 25M	14	17%	12	31%	19	76%	45	31%	df = 2
25M – 50M	0	0%	0	0%	1	4%	1	1%	p = 0.000**
> 50M	0	0%	0	0%	3	12%	3	2%	(p < 0.01)
	81	100%	**39**	100%	**25**	100%	**145***	100%	
Mean		0.63M		1.64M		17.74M		3.85M	
Std. Dev.		0.93M		2.78M		25.9M		12.4M	
Median		0.20M		0.70M		10M		0.45M	

*Missing data = 14 (8.8%)
** statistical significant at 0.01 level

The extent of sales turnover is an important indicator of the economic size of the market accessed by firms. The larger the size of the market, the wider the scope for competition and competitiveness and hence the wider the scope for growth and technological capability development as firms will have the resources to invest in the accumulation of knowledge.

7.2 Reasons for starting business

Table 7.7 provides the reasons firms in each firm category gave as to what motivated them to start the business. Their responses were much in line with expectation. The Chi-Square tests show statistically significant differences between positions of the three categories on three of the eight possible reasons for starting business: namely personal interest, market opportunities, and inspiration from the success of other businesses.

Table 7.7 Reasons for starting business classified by firm categories

Reasons for starting business	Household-based		Community-based		Factory-based		All firms		Chi-Square test (df. =2)	
	n	%	n	%	n	%	n	%	χ^2	Sig.
• Carry on family-own business	38	42.2%	12	27.9%	7	26.9%	57	35.8%	3.67	0.160
• Inspired by parents who own other business	16	17.8%	6	14.0%	3	11.5%	25	15.7%	0.582	0.723
• *Personal interest**	*64*	*71.1%*	*25*	*58.1%*	*11*	*42.3%*	*100*	*62.9%*	*7.74*	*0.021**
• *See market opportunities***	*28*	*31.1%*	*27*	*62.8%*	*21*	*80.8%*	*76*	*47.8%*	*25.25*	*0.000***
• Persuaded by friends	5	5.6%	3	7.0%	0	0%	8	5.0%	1.45	0.472
• Persuaded by relatives	3	3.3%	5	11.6%	1	3.8%	9	5.7%	3.49	0.158
• *Inspired by other success business***	*5*	*5.6%*	*11*	*25.6%*	*3*	*11.5%*	*19*	*11.9%*	*10.21*	*0.004***
• Others (sideline job, need more income etc.)	9	10.0%	8	18.6%	4	15.4%	21	13.2%		
Total responding firms		**90**		**43**		**26**		**159**		

Significant difference at * $p < 0.05$ level, and ** $p < 0.01$level

Community-based and factory-based firms tend to start their businesses mainly driven by market opportunities and significantly enough also by personal interest - a factor which, however, appear to have more bearing on household-based firms. Market opportunities are also significant for household-based firms, but even more significant for this group of firms is the option for ‘carrying on family-owned business’. From the data in Table 7.7, it is apparent that firms in the factory-based and community-based categories are more sensitive to changes in market opportunities than firms in the household-based category. Community-based firms also tend to be inspired by the success of other businesses more than factory-based and household-based firms. A number of factors could have combined to determine the emergence of a business; but the evidence borne out by the three factors (namely, personal interest, market opportunities and interest in carrying on family business) suggests that there is no reason to presume that businesses in all the three categories emerged motivated by the same set of reasons. It is however apparent from the profile of responses by all firms covered in the survey that there is scope for the development of entrepreneurial capability in the Thai dessert industry.

7.3 Growth of business

This section discusses the results of the questionnaire on the growth experience and aspirations of household-based firms and the evolutionary growth of community-based and factory-based.

7.3.1 Growth experience of household-based firms

Table 7.8 shows that 43% of the household-based firms desire to expand their businesses mostly because they believe that they have the capability and the necessary resources, and also because they consider the market condition is favourable.

Table 7.8 Desire for business expansion of household-based firms

	Number of firms	% of firms
Desire to expand	37	43.02%
Desire not to expand	49	56.98%
Total	**86**	**100.00%**

*Missing data = 4 (4.4%)

In table 7.9, only a few firms (14%) want to expand because they would like to take advantage of the support from public agencies in terms of finance and technology. The rest of the household-based firms (57%) do not want to expand as most of them (90%) appear to be already satisfied with present level of operation. Other reasons why firms do not want to expand their businesses include: lack of capability to cope with complicated and larger systems; fear of the risk of failure; and problem of access to investment funds.

Table 7.9 Reasons underlying household-based firms' decision for growth

Reasons for expansion*	No. of answers	% of total no. of answers	% of firms
• Have capability and resources to expand the business	31	46.97%	83.78%
• Favourable market conditions	22	33.33%	59.46%
• Take advantages of the supports received from public agencies (financial and technology supports)	5	7.58%	13.51%
• Other (desire more success, more income etc.)	8	12.12%	21.62%
Total	**66**	**100.00%**	**-**
Reasons for NO expansion*			
• Satisfied with present level of operation	44	63.8%	89.80%
• Afraid of failure and facing high risks	9	13.0%	18.37%
• Liquidity problem	5	7.2%	10.20%
• Do not have capability enough to cope with complicated and larger system	7	10.1%	14.29%
• Other (political crisis and commotion, no inheritor and retired, maintain the quality)	4	5.8%	8.16%
Total	**69**	**100.0%**	**-**

*Multiple answers

Apparently, receiving supports from government and public agencies is a minor reason for firms' decision to expand their businesses. Household-based firms looking for expansion may have more entrepreneurial talent than the rest who were not interested in further expansion of the business as most of them were satisfied with their current position. Satisfaction, however, pre-empts the desire to improve or change, and would consequently preclude growth opportunities (Wiklund et al., 2003).

From the information obtained through the interviews, age of the owners of firms also contributes to lack of motivation for growth. The owners may consider terminating the business at old age (more than 60 years old) particularly if there is no one in the family to take over management of the business. More than half of household-based firms lack the entrepreneurial flair, so that they cannot be expected to take risk to invest and grow, much in contrast with factory-based and community-based firms. This was also supported by survey which brought out the market opportunities as a reason for starting business to be higher in factory-based (81%) than in community-based firms (63%) and household-based firms (31%).

However, with respect to the choice of trajectories for business expansion, Table 7.10 shows that 48% of the household-based firms inclined to operate as factory-based businesses; while only 16% of firms would like to grow as community-based firms; 33% would not be keen to grow their businesses at all; and 4% would like to expand, but as franchise of branch businesses.

Table 7.10 Growth preferences of household-based firms

Growth preferences	Number of firms	% of firms
Factory-based firms	39	47.56%
Community-based firms	13	15.85%
No interest and satisfy with current status, not decided or terminate	27	32.92%
Expand franchise or branch business	3	3.66%
Total	**82**	**100.00%**

*Missing data = 6 (6.7%)

The interviews also revealed that some household-based firms would rather prefer to grow as factory-based firms since running as community-based firms which involves sharing experiences, benefits and facilities many people is perceived to lead to conflicts and to undermine the security of the business. However, nothing can be further from the truth as it is household-based firms that are more prone to risk than community-based firms. Indeed, such attitude of household-based firms, which underplays the significance of community-based firms, does not guarantee the security of business in the long run. It means that household-based firms opt out of venues for knowledge network development because they lack commitment to collaborate with other firms, sharing information, knowledge and experiences in management and organisation of business (Meerod, 2006).

In relation to interactions with community businesses, Table 7.11 shows that 24% of household-based firms had liaison with community businesses by way of area/facility sharing, training, supplier-producer relations or other relating activities. Table 7.12 indicates that they engaged in such liaisons mainly in the knowledge that 'participation would increase opportunities to expand business' and enable them to 'earn more income' and to forge useful or strategic links with other firms and support agencies. Further benefits arising from participation include knowledge and information sharing; access to new and better ideas about organisation and management of production and marketing and about the art of negotiations in business deals; increased opportunities for household-based firms to receive support from public agencies; and reduced transactions cost of running businesses alone. In contrast, Tables 7.11 and 7.12 show the majority of household-based firms (76%) did not prefer to be involved with community businesses mainly because they thought that it would be rather difficult to liaise with community businesses they consider to be bureaucratic and unwilling to share any useful information with them. Some of firms had no interest in community businesses since they already had their own businesses. Some even felt that they would be put in a position to give away much of what they would rather keep to themselves if they engaged in interactions with or exposed themselves to the community-based businesses.

Table 7.11 Liaison with community businesses

	Number of firms	% of firms
Have liaison	21	23.60%
No liaison	68	76.40%
Total	**89**	**100.00%**

*Missing data = 1 (1.1%)

Table 7.12 Household-based firms' desire for liaison with community-based firms

Reasons for liaison	No. of answers	% of total no. of answers	% of firms
• Participation generates benefits such as knowledge and information sharing, technology, knowledge transfer and negotiation power	10	16.39%	47.62%
• Participation reduces the transactions cost of running business alone	10	16.39%	47.62%
• Participation creates opportunities for good business alliances	14	22.95%	66.67%
• Participation increases opportunities of supports from public agencies (financial and technology supports)	10	16.39%	47.62%
• Participation increases opportunities to expand business and earn more income	14	22.95%	66.67%
• Other (Learning community business and help community)	3	4.92%	14.29%
Total	**61**	**100.00%**	**-**
Reasons for NO liaison			
• No interest	16	18.39%	23.53%
• Risk of losing privacy	12	13.79%	17.65%
• Difficult to connect with the community businesses (no information or complicated procedures)	27	31.03%	39.71%
• Do not see any benefit arising from liaison	4	4.60%	5.88%
• No resources and facilities to support larger production	2	2.30%	2.94%
• Already have own businesses	20	22.99%	29.41%
• No time	4	4.60%	5.88%
• Other	2	2.30%	2.94%
Total	**87**	100.00%	

*Multiple answers

7.3.2 Evolutionary growth of community-based and factory-based firms

Table 7.13 shows that about 60% of community-based firms had started as community businesses, influenced by the government promotion of community-based businesses that encouraged and supported community members to earn more income and make use of their local resources. About 25% of the community-based firms originated from small household-based firms, while 10% of community-based firms started business from a small syndicate of individuals. Only a small proportion of community-based firms (15%) said they previously operated as factory-based firms, and found the change in the mode of business convenient.

Table 7.13 Origination of community-based firms

Originating business categories	No. of firms	%
Community-based firms	25	60.98%
household-based business	10	24.39%
factory-based business	2	4.88%
small group of people	4	9.76%
Total	**41**	**100.00%**

*Missing data = 2 (4.65%)

Table 7.14 shows that a significant proportion of community-based firms (67%) desire to run their businesses as community-based businesses without any need to split off and start their own businesses, while 18% see the need to split-off. Only 3% expressed that they would prefer to run their businesses alone, but still linked with community-based business in a supply chain relationship. Surprisingly, 13% of the community-based firms expressed they would consider leaving the community of businesses to which they belong, although they did not have any clear idea as to what they would do with their businesses after that.

Table 7.14 Desire of community-based firms to continue as community-based firms

Desire to continue as community-based firms	No. of firms	%
Yes	26	66.7
No desire	5	12.8
Expand to factory-based firm	7	17.9
Expand to factory-based firms but have liaison with community	1	2.6
Total	**39**	**100.0**

*Missing data = 2 (4.65%)

Table 7.15 Origination of factory-based firms

Originating business categories	No. of firms	%
household-based business	24	96.00%
Community-based firms	0	0%
Trader	1	4.00%
Total	**25**	**100.00%**

*Missing data = 1 (4.00%)

Table 7.16 Liaison with community businesses

	Number of firms	% of firms
No liaison	16	66.67%
Have liaison	8	33.33%
Total	**24**	**100.00%**

*Missing data = 2 (7.7%)

Table 7.15 shows that most of the factory-based firms (96%) originated from household-based firms, apart from one firm that operated as a trader at the beginning.

None of the factory-based firms covered by the survey had their origins as community-based firms. Table 7.16 shows that 67% of them did not have any links with community businesses. However, some of factory-based firms (33%) said they had business interactions with community businesses because this provided them with the channel to meet their demands for labour and raw materials from local bases. This would save them the cost of searching and sourcing labour and raw materials.

7.4 Business perception

This section discusses firms' perception of risk and uncertainty and their confidence in running business. This is explored from perspectives of the three categories of firms.

7.4.1 Growth and business

Most of the firms seem to have underestimated their business growth performance - especially the community-based and factory-based firms. Because household-based firms are very small, their expectation with respect to growth is different from that of firms in the other two categories. Household-based firms have a high proportion of firm owners who think that their current growth is equal to or lower than they had expected.

As seen from Table 7.17, in the case of 75% of community-based firms, 73% of factory-based firms, and around 39% of household-based firms, growth performance has exceeded the expectation the businesses had at the beginning. This would make community-based and factory-based firms more enterprising than household-based firms. The Chi-Square test confirms the statistical significance of differences in growth expectation across the three categories of firms. Many small firms rather cautious with growth expectation and tend to underestimate their full potential because they are risk averse (Scott & Rosa, 1996).

Table 7.17 Growth of business comparing to what the owner had expected before starting the business

Growth expectation	Household-based		Community-based		Factory-based		All firms		Chi-Square test
	No.	%	No.	%	No.	%	No.	%	
Higher	32	39.02%	30	75.00%	19	73.08%	81	54.73%	χ^2 = 21.15
Lower	25	30.49%	2	5.00%	2	7.69%	29	19.59%	df = 4
Equal	25	30.49%	8	20.00%	5	19.23%	38	25.68%	sig. = 0.000**
Total	**82**	**100%**	**40**	**100%**	**26**	**100%**	**148**	**100%**	($p < 0.01$)

*Missing data = 11 (6.9%), ** $p < 0.01$ statistical significance at 0.01 level of significance

Table 7.18 Expected risk and uncertainty underlying business: past and present

Expected risk & uncertainty	Household-based		Community-based		Factory-based		All firms		Chi-Square test
	No.	%	No.	%	No.	%	No.	%	
Higher	21	25.93%	10	27.03%	5	20.83%	36	25.35%	χ^2 = 4.21
Lower	25	30.86%	16	43.24%	6	25.00%	47	33.10%	df = 4
Equal	35	43.21%	11	29.73%	13	54.17%	59	41.55%	sig. = 0.378
Total	**81**	**100%**	**37**	**100%**	**24**	**100%**	**142**	**100%**	($p > 0.05$)

*Missing data = 17 (10.7%), $p > 0.05$ no statistical significance at 0.05 level of significance

Table 7.18 shows that factory-based firms (54%) tend to correctly estimate risk and uncertainty better than community-based (30%) and household-based firms (43%). Most of the community-based firms (43%) thought that they had, looking back in the light of experience, understated the risk and uncertainty involved in the setting up of their respective businesses. This apparent distortion in their perception of risk and uncertainty is a result of the positive interventions that came their way in the form of financial aid and mentor schemes from support agencies that had the effect of mitigating the extent of risk and uncertainty. However, the Chi-Square test shows that there is no statistically significant difference between the three categories of firms with respect to their expectation of risk and uncertainty. This means that we can conclude from the average for all firms that 42% of the firms tend to correctly estimate risk and uncertainty while 33% tend to overstated and 25% to understate risk. This evidence suggests risk aversion as the underlying behaviour of firms in the industry.

It transpired from the interviews, for example, that some firm owners had concerns about workload and ability to cope with crisis, risk and uncertainty in relation to capacity increase. Some firms worried about quality of products, wanted to maintain their unique and exclusive products, recipes and know how.

Table 7.19 Present market status of Thai dessert firms

Current market status	Household-based		Community-based		Factory-based		All firms		Chi-Square test
	No.	%	No.	%	No.	%	No.	%	
Niche market	40	47.06%	31	73.81%	20	76.92%	91	59.48%	χ^2 = 13.08
Decline market	5	5.88%	2	4.76%	0	0%	7	4.58%	df = 4
Not stable/ change over time	40	47.06%	9	21.43%	6	23.08%	55	35.95%	sig. = 0.010**
Total	**85**	**100%**	**42**	**100%**	**26**	**100%**	**153***	**100%**	

*Missing data = 6 (3.8%), ** statistical significance at 0.01 level of significance

Table 7.19 shows the current market status of firms in the three categories of firms. About 74% of community-based and 77% of factory-based firms have niche markets. The corresponding proportion for household-based firms is 47%. This difference between the three categories is confined by the Chi-Square test for the statistical significance of differences on the profile of market status.

The extent of the niche markets that firms command is indicative of the strength and stability of demand for the products of the firms. It is also a mark of the uniqueness of the products that does not make them vulnerable to the threats of competition through price, income and substitution effects. Thus, it can be inferred from the data in Table 7.19 that community-based and factory-based firms have more stable markets than household-based firms. But, at least, 47% of the household-based firms are trying hard to maintain their foothold in the market they have carved out for themselves.

Table 7.20 shows that most of the firms in all three categories are satisfied with their current business growth but would still like to see some changes. But while household-based firms seem to be really satisfied with their current business more than firms in the other two categories, factory-based firms are least satisfied compared to firms in the other two categories. This observation is very much in keeping with the theoretical expectation about household-based and factory-based firms. Generally speaking, household-based firms are 'target operators' least given to entrepreneurial culture; factory-based firms, have, on the other hand, evolved in entrepreneurial culture, and so, would be more enthusiastic than household-based firms to improve their businesses. However, a Chi-Square test does not confirm the difference between three categories of firms to be statistically significant.

Table 7.20 Overall satisfaction of current business condition in term of firm's growth

Overall satisfaction	Household-based		Community-based		Factory-based		All firms		Chi-Square test
	No.	%	No.	%	No.	%	No.	%	
Really satisfied	24	27.91%	10	23.26%	5	19.23%	39	25.16%	χ^2 = 3.83
Satisfied up to a certain level but would need to see some changes	58	67.44%	33	76.74%	18	69.23%	109	70.32%	df = 4
Dissatisfied and need to see major changes	4	4.65%	0	0%	3	11.54%	7	4.52%	sig. = 0.209
Total	**86**	**100%**	**43**	**100%**	**26**	**100%**	**155**	**100%**	($p > 0.05$)

*Missing data = 4 (2.5%), $p > 0.05$ no statistical significance at 0.05 level of significance

None of community-based firms are dissatisfied with their business growth. This may well be because success in business had far exceeded their expectation in view of the cushioning effect of interventions by the public support agencies. However, it cannot be inferred that the satisfaction expressed by the community-based firms can be sustained over the long-term period. Nor, therefore, that satisfaction is evidence of the firms being creative and innovative with the requisite entrepreneurial capabilities that would warrant long-term competitiveness.

7.4.2 Firms' perception of confidence in community-based and factory-based firms

This section provides observations on the perception of firms in the three categories about their confidence in the organisation and management of business as community-based and factory-based firms. Perception of confidence is expressed in terms of six profiles, including business security; knowledge and information sharing; transactions cost; convenience for the creation of business networks and strategic alliances; negotiation power; and income. Consideration of these factors would help shed light on why the three categories have chosen to grow in the different ways. A Chi-Square test is used to identify similarity and difference in the perception of confidence across the three categories of firms. The test results in Table 7.21 show that the three categories of firms can be considered to be similar only on the income profile – i.e. running factory-based businesses would yield higher income than running community-based businesses.

Table 7.21 shows that more than 60% of the community-based firms agree that running businesses as community-based firms has more advantages than running them as factory-based firms. These advantages are perceived to occur in the form of business security; opportunities for knowledge and information exchange; less transactions cost; opportunity to forge strategic business alliances; and increased negotiation power in business dealing. The majority of factory-based firms agree that community-based firms would have an edge over them with respect to factors relating to less transactions cost; opportunities for forging new business alliances; and increased negotiation power. So also do many household-based firms (more than 37% of them); but more than 33% of household-based firms feel unsure about these advantages. This may be because they have little or no information and knowledge about establishing and operating community-based businesses. They would rather prefer to manage their own businesses alone.

However, the majority of firms in the three categories (68%) agree that income obtained from operating factory-based firms is higher than community-based firms. This is because income from factory-based firms does not need to be shared with other shareholders or community members.

Table 7.21 Perception of three categories of the Thai dessert firms in running business between the community-based and factory-based firms

		Household-based		Community-based		Factory-based		All firms		Chi-Square
		n	%	n	%	n	%	n	%	df = 4
1) Running community business is more secure than running factory-based firm alone	Agree	18	21.7%	24	60.0%	5	19.2%	47	31.5%	χ^2
	Disagree	19	22.9%	5	12.5%	11	42.3%	35	23.5%	= 25.04
	Neutral	46	55.4%	11	27.5%	10	38.5%	67	45.0%	sig.
	Total	83	100.0%	40	100.0%	26	100.0%	149	100.0%	= 0.000**
2) Running community-based business has more opportunities for knowledge and information exchange	Agree	30	36.1%	28	70.0%	7	26.9%	65	43.6%	χ^2
	Disagree	15	18.1%	3	7.5%	9	34.6%	27	18.1%	= 19.33
	Neutral	38	45.8%	9	22.5%	10	38.5%	57	38.3%	sig.
	Total	83	100.0%	40	100.0%	26	100.0%	149	100.0%	= 0.001**
3) Running community-based business has less transaction cost than running as a factory-based business	Agree	35	42.2%	30	75.0%	13	50.0%	78	52.4%	χ^2
	Disagree	19	22.9%	2	5.0%	6	23.1%	27	18.1%	= 12.90
	Neutral	29	34.9%	8	20.0%	7	26.9%	44	29.5%	sig.
	Total	83	100.0%	40	100.0%	26	100.0%	149	100.0%	= 0.012*
4) Running community-based business saves more time to find and create business networks and alliances than running as a factory-based business	Agree	33	39.8%	31	77.5%	17	65.4%	81	54.4%	χ^2
	Disagree	20	24.1%	2	5.0%	4	15.4%	26	17.5%	= 17.72
	Neutral	30	36.1%	7	17.5%	5	19.2%	42	28.2%	sig.
	Total	83	100.0%	40	100.0%	26	100.0%	149	100.0%	= 0.001**

Table 7.21 Perception of three categories of the Thai dessert firms in running business between the community-based and factory-based firms (continue)

		Household-based		Community-based		Factory-based		All firms		Chi-Square
		n	%	n	%	n	%	n	%	df = 4
5) Running community-based business has more power to negotiation with other parties than running factory-based business	Agree	31	37.4%	30	75.0%	15	57.7%	76	51.0%	χ^2
	Disagree	24	28.9%	5	12.5%	3	11.5%	32	21.5%	= 17.16
	Neutral	28	33.7%	5	12.5%	8	30.8%	41	27.5%	sig.
	Total	83	100.0%	40	100.0%	26	100.0%	149	100.0%	= 0.002**
6) Running factory-based business has higher income than running community-based business	Agree	57	68.7%	24	61.5%	19	73.1%	100	67.6%	χ^2
	Disagree	9	10.8%	5	12.8%	0	0.0%	14	9.5%	= 3.96
	Neutral	17	20.5%	10	25.6%	7	26.9%	34	23.0%	sig.
	Total	83	100.0%	39	100.0%	26	100.0%	148	100.0%	= 0.412

* $p < 0.05$ statistical significance at 0.05 level, ** $p < 0.01$ statistical significance at 0.01 level

Of significance here is the perception of the household-based firms as this would determine the trajectory for their evolution. From Table 7.12, the majority of household-based firms are not convinced about the advantages accruing from the organisation and management of businesses as community-based firms. As noted above, the only point of decisive agreement is on the income advantage factory-based firms offer. This observation provides the basis for the presumption that, all other factors remaining unchanged, most household-based firms would choose to evolve as factory-based firms. It may well be that the benefits arising from community-based firms are not effectively communicated to the majority of household-based firms, so that their knowledge about community-based firms is not complete. But then, it is quite possible that household-based firms are neither convinced nor attracted enough by the community-based development of SMEs to follow that route.

7.5 Conclusion

The major features of the survey data obtained through the administration of questionnaires have been presented and used to characterise the three categories of firms in the Thai dessert industry in terms of similarities and differences on a range of profiles.

It was found that the choice of household-based firms for growth trajectory were most likely to be based on personal characteristics, experiences, attitude and behavioural patterns; government policy had however small effect on household-based firms' decisions. Community-based firms may be a good choice for start-up firms but it would need commitment to community harmony, strong ties and proximity to facilitate the effect of agglomeration in terms of growth and success of the business in the long run. Expansion to factory-based firm is found to be the choice for growth of household-based firms that have more capital fund and capability.

It was also found that only half of household-based firms were interested in expanding their businesses because they had the capabilities enough to do so and the market for their products was favourable to boot. Even some of firms realised the benefit of running as community-based firms in terms of knowledge sharing and security. They preferred to expand as factory-based firms to gain higher income and preserve their privacy. Most of firms had little knowledge of community businesses because they were not interested in and it is anyway difficult to connect with community-based businesses. Since the period around the turn of the century, community-based firms had been growing rapidly because of a new direction of government policy that promotes community members to earn more income. As a result of policy measures, 61% of community-based firms started their businesses as community-based firms from the beginning. This policy helped to create new entrepreneurs and to gain substantial income to their communities and families. Government interventions have created opportunities for local people to develop their businesses and technological capabilities.

Even though factory-based firms share some aspects of the culture of household-based firms, the former were found to be much more enthusiastic to improve their business than the latter. Respondents of factory-based firms seem to well understand the pros and cons of running businesses as community-based firms (e.g. opportunity to create network, access to local resource and workforce). Therefore, they would readily consider the option of having liaison with community business to access these benefits.

The survey data have been particularly useful to show the position of firms and how household-based firms would choose to evolve. This is however only part of the issue. Even more important is the question about the long-term development of the firms in the Thai dessert industry, which will be discussed in the following chapters.

CHAPTER 8

Analysis of Factors Affecting Technology Capability Development in Thai Dessert Firms Using Survey Data

This chapter aims to explore empirically the range of factors affecting technological capability development in Thai dessert firms. The explanatory factors considered are social capital; risk taking propensity; competitive pressure; ability to access finance; and government interventions. The chapter engages in statistical analysis to investigate (a) how the set of factors indicating technological capability development vary across the three categories of firms; and (b) the factors that have significant bearing on technological capability development. Multiple regression analysis is used to shed light on the significance of the various factors, including social capital components to explain technological capability development in the Thai dessert industry.

The remainder of this chapter is in four parts. The first part discusses dependent factors, reflecting the technological capability development of firms by focusing on the comparison between two categories of firms, namely community-based and factory-based firms. Household-based firms are excluded from the comparative analysis because they are technologically retrograde. The second part explores five independent factors postulated to have direct bearing on technological capability development across the three categories of firms. The third part explores the relationship between dependent factors and technological capability development by using multiple regression analyses. This section also investigates the relationship between social capital elements and technological capability development. The chapter is concluded in the fourth part.

8.1 Indicators of technology and innovation capabilities in the Thai dessert firms

This section provides survey results of dependent factors, namely technological capability development, and innovation performances with particular focus on community-based and factory-based firms. The comparisons are made between these two categories in order to determine which category performs better in terms of technological capability development. The null hypothesis here is that community-based firms would perform better than factory-based firms on account of higher level of endowment of social capital and government support.

Firms were asked to provide information of various indicators relating to their technological development and innovation performances in terms of categorical and numerical data, with ratings on a scale 1 to 5. Table 8.1 shows the measurable variables used in this study to indicate the technology and innovation performance of firms.

Table 8.1 Measurable variables of technology and innovation performances

8.3	Performances	Measurement
8.3.1	Technological capability development	Degree of technological capability development
8.3.2	Product and Process development	Number of new/developed products and process
8.3.3	Organisation and marketing development	Indication of organisation and market development
8.3.4	Official product standards and product awards	Indication of product standards and product awards
8.3.5	Technology monitoring	Mean score of technology monitoring
8.3.6	Sale growth and employment growth	Mean percentage of sale and employment growth

8.1.1 Technological capability development

Firms were asked to rate the overall degree of improvement in their technological capability over the last three year in terms of process development, technological and business investment and research and development (R&D). The rating scale ranges from 1 (no improvement) to 5 (significant improvement). The survey results are shown in Table 8.2 in which factory-based firms have overall means of improvement (4.06) including all three indicators slightly higher than those of community-based firms (3.92). However, the test result of Mann-Whitney U test shows that there is no statistically significant difference between the two categories at 5% significance level. Therefore, it cannot be concluded that factory-based firms have higher degree of technological capability development than community-based firms. This result is startling considering that factory-based firms are considered to have higher capability than community-based firms in spotting market opportunities and opportunities for improvement of business.

Table 8.2 Degree of technological capability development of firms in the Thai dessert industry

Items	Community		Factory		All firms		Mann-Whitney U test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Z	Sig.
Process development	4.08	0.74	4.31	0.79	4.17	0.76	-1.407	0.159
Investment efficiency	3.87	0.86	3.96	1.04	3.91	0.93	-0.868	0.385
R&D capability	3.82	1.00	3.92	0.98	3.86	0.98	-0.371	0.710
Overall	**3.92**	**0.74**	**4.06**	**0.69**	**3.98**	**0.72**	**-0.578**	**0.563**
	N = 39		N = 26		N = 65			

p > 0.05 (not significant at 0.05 level)

Factory-based firms have considerably higher capital (registered capital and sale turnover) than community-based firms that enables them to consider improvement. They therefore tend to apply new technologies quicker than community-based firms do. Moreover, decision making in community-based firms involves many people and would require the achievement of group consensus – a process, which takes time and could even disagreements on what to do and how to proceed. The individual owners of factory-based firms can on the other hand decide by themselves to buy new machines of develop processes unlike the case of community-based firms who would need series of meetings to make decisions.

The overall degree of technological capability development shown in Table 8.2 is based on firm performance over the past three years, and should not be used to compare firms with one another because these indicators were measured by the extent of improvement in the performance of individual firms during the period considered. The indicators show how individual firms feel about their past and present performances. For comparison of performance across firms, other performance indicators based on a different set of information have to be used.

8.1.2 Product and process development

Firms were asked about the products and processes that have been developed or newly launched/applied over the past three years. Table 8.3 shows that factory-based firms perform better than community-based firms with respect to product and process development. The mean scores for new/developed products and new packagings introduced to the market is 18 for factory-based firms and 12 for community-based firms. The score with respect to new/development processes and equipment is 5.5 for factory-based firms and 4 for community-based firms. Even though the means show differences between the two categories of firms with respect to product and process innovation performance, these differences are not confirmed to be statistically significant by the Mann-Whitney U test. However, statistically significant differences were detected with respect to the number of newly installed processes.

Table 8.3 Product and process development in the Thai dessert industry

Number of	Community		Factory		All firms		Mann-Whitney U test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Z	Sig.
Product development								
Improved products	3.15	5.01	3.73	4.70	3.37	4.86	-0.189	0.850
New products	4.22	8.39	7.85	15.67	5.63	11.79	-0.900	0.368
New packages	4.61	8.87	6.19	9.95	5.22	9.26	-1.222	0.222
Total	**11.98**	**15.11**	**17.77**	**22.29**	**14.22**	**18.29**	**-1.128**	**0.259**
Process development								
Improved processes	2.85	3.54	3.27	4.46	3.01	3.89	-0.170	0.865
New installed processes/equipment	1.17	1.45	2.27	2.22	1.60	1.85	-2.320	0.020*
Total	**4.02**	**4.45**	**5.54**	**6.20**	**4.61**	**5.20**	**-1.110**	**0.267**
	N = 41		N = 26		N = 67			

* p < 0.05 (significance at 0.05 level)

The result indicates that factory-based firms applied new processes/equipment more than community-based firms. This would give credence to the view that factory-based firms would have higher degree of technological capability than community-based firms on grounds that they operate on or near the cutting edge of competition. Although this hypothesis is theoretically plausible, it is not borne out by evidence as shown in the last section where the Mann-Whitney test showed the apparent difference between factory-based and community-based firms are not statistically significant. Nor is the converse case – that community-based firms perform better than factory-based firms – sustained by the evidence provided by the survey data.

Even though community-based firms receive public support for product and package development served by local universities, the survey data show these firms have, overall, lower number of new products and processes than factory-based firms. It was observed that there were many collaborative projects between local universities and community-based firms aimed at developing new products and design packages; but not many projects were successfully commercialised for various reasons. Firstly, the collaborative projects supported by government funding are short term projects ranging from 1-3 months, with limited budgets and no scope for further development after project is finished. Secondly, there is no evidence of adequate transfer of knowledge and information from knowledge sources to firms during the course of the life of projects or even after the projects are terminated. Community-based firms found it was rather difficult to contact university staffs to gain information about the newly developed products/packages after the expiry of the projects' short life span. This reduces reliability and credibility of knowledge sources, and diminishes the trust base of the relationship, so that firms would be reluctant to collaborate with knowledge sources on other projects in the future.

In contrast, factory-based firms tend to outsource package designs to private companies or do these in-house using their own funds and resources. This would allow them to have effective control on the projects and on the successful delivery and commercialisation of the project outputs. This means that although community-based firms receive government support, it is not all too clear as to how far such supports would help promote commercialisation.

Therefore, it cannot be concluded on the basis of available evidence that community-based firms would perform better than factory-based firms in terms of product and process development.

8.1.3 Organisation and market development

Apart from product and process development, organisation management and marketing development are important indicators of technological capability development in the Thai dessert industry. Organisation management such as Good Hygiene Practices (GHP), Good Manufacturing Practices (GMP), and Hazard

Analysis and Critical Control Points (HACCP) would increase the credibility of products. GMP and HACCP are international standards required for export markets. These systems guarantee a specific production standard and ensure that products are manufactured under appropriate production conditions. Marketing development refers to strategies for expanding the market through brand development, access to new markets, exhibition and trade fairs, branching, franchise arrangements, pricing and promotion etc.

Firms were asked to indicate if they had implemented organisation or quality management systems. They were also asked to indicate if they had developed strategies to access to new markets. (The data in this section is categorical data, therefore the difference between community-based and factory-based firms are performed using Chi-square tests based on the number of "Yes" and "No" answers.)

Table 8.4 Organisational and market development by community-based and factory-based firms

Type of response	Community		Factory		All firms		Chi-Square test		
	N	%	N	%	N	%	χ^2	df	Sig.
Organisational Management							**0.145**	**1**	**0.703**
Yes	22	53.7%	16	61.5%	38	56.7%			
No	19	46.3%	10	38.5%	29	43.3%			
Total	**41**	**100%**	**26**	**100%**	**67**	**100%**			
Marketing development							**0.000**	**1**	**1.000**
Yes	40	93%	25	96.2%	65	94.2%			
No	3	7%	1	3.8%	4	5.8%			
Total	**43**	**100%**	**26**	**100%**	**69**	**100%**			

χ^2 test with Yates continuity correction (for overestimate of χ^2 value when used with 2 x2 table)
$p > 0.05$ (not significant at 0.05 level)

Table 8.4 shows slight differences between the proportions of firms implementing quality management system and marketing development in the two categories of firms. Factory-based firms perform slightly better on organisational and marketing development. However, the Chi-Square test does not confirm that these differences are statistically significant at 5% level. Therefore, it cannot be concluded that community-based and factory-based firms differ significantly with respect to organisation and marketing development.

The study then looks further into types of organisation management and marketing strategy; and it found interesting information. Considering types of systems, Figure

8.1 shows that 58% and 31% of factory-based firms have received GMP and HACCP certificates, respectively. In contrast, only 32% and 2% of community-based firms received GMP and HACCP certificates, respectively. The rest of community-based firms received domestic GHP standard. This result implies that factory-based firms are better positioned than community-based firms to enter into the wider and more competitive global market.

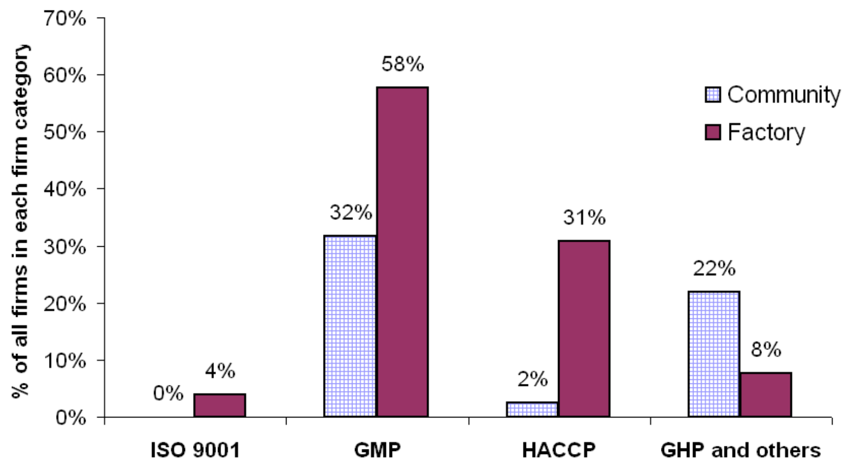

Figure 8.1 Percentage of firms with quality management system

The interviews brought out that many community-based firms did not have good standard production processes and good quality products when they started. However, many joint projects launched by the government and knowledge centres since 2005, have helped to promote implementation of modern management system in community-based firms, such as the National Biotechnology Center, local universities, the Ministry of Industry and other government agencies. This would be the reason behind the high number of firms implementing such a system. GHP is a reduced system of GMP and GHP requirements are less strict than that of GMP. However, if firms want to export their products, they would need to get GMP and HACCP certificates.

Factory-based firms tend to use better marketing strategies such as access to new market segments (foreign market, department store, and high street market), branching, and branding strategies for long-term effectiveness than community-based firms. Branding is a sustainable strategy for product differentiation since the registered brand cannot be copied and it is protected by law. It is also easy for customer recognition, for reputation and quality of products (Hooley et al., 2008). The survey data show that 88% of factory-based firms have registered brands/trademarks, but 76% of community-based firms have these. Moreover, most of community-based firms, focus on various domestic food fair organised by the public sector in the capital city (Bangkok). The trade fair is organised periodically for 3-7 days as part of the wider strategy of product promotion. Even though the government promotes participation in the international exhibitions, limited and partial financial supports have been provided to participating firms.

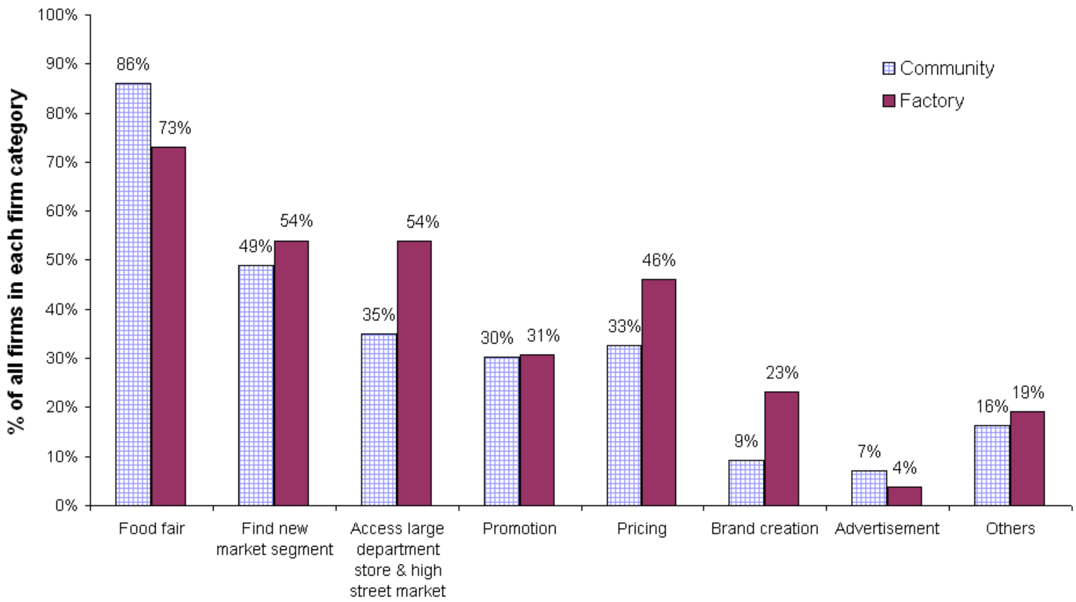

Figure 8.2 Percentage of firms with marketing development strategies

8.1.4 Official product standards and product awards

Product standards and product awards are used as proxies for quality of products. Official product standard certificate is issued by the Thai Food and Drug Administration and community product standard certificates are issued by the Thai Industrial Standards Institute. Product awards are issued by various organisations including public and private agencies. Firms were asked to indicate if their products were registered for official product standards (e.g. Thai Food and Drug standard and community product standards), including product awards from government or public agencies. Similar to organisational and marketing development, the data in this section is categorical based on “Yes” or “No” answers. Therefore, the differences between community-based and factory-based firms are performed by using Chi-square tests.

Table 8.5 Product standard and awards by community-based and factory-based firms

Type of response	Community		Factory		All firms		Chi-Square test		
	N	%	N	%	N	%	χ^2	df	Sig.
Official product standard							**0.529**	**1**	**0.392**
Yes	36	87.8%	25	96.2%	61	91.0%			
No	5	12.2%	1	3.8%	6	9.0%			
Total	**41**	**100%**	**26**	**100%**	**67**	**100%**			
Product award							**0.203**	**1**	**0.552**
Yes	42	97.7%	24	92.3%	66	95.7%			
No	1	2.3%	2	7.7%	3	4.3%			
Total	**43**	**100%**	**26**	**100%**	**69**	**100%**			

χ^2 test with Yates continuity correction (for overestimate of χ^2 value when used with 2 x2 table)
$p > 0.05$ (not significant at 0.05 level)

Table 8.5 shows that more than 90% of all firms have registered product standards and received product awards. The proportion of factory-based firms (96%) receiving official product standard is higher than that of community-based firms (88%), but number of community-based firms (98%) receiving products awards is higher than that of factory-based firms (92%). However, the result of Chi-square test does not confirm the differences to be statistically significant at 5% level.

Survey results show that factory-based firms received product standards more than community-based firms. Product awards are issued by various organisations both public and private. Unlike product standard which is the sole responsibility of the government, the qualification and requirements for product awards are varied. A low number of product awards in factory-based firms could be due to factory-based firms not being interested in obtaining product awards, especially star awards for local products. Many of them expressed in the interviews that the award was not of a high quality standard and it would lower their products value in the market if they had it tagged to their products. Rather, factory-based firms focus more on branding, package design, and advertising in magazines and newspapers.

8.1.5 Technology monitoring

Technology monitoring is also measured to represent firms' ability to cope with technological change by exploring their perception of new technology and how to catch up with it. Firms were asked to indicate on a scale of 1-5 the extent of their agreement with issues relating to: 1) mechanisms for the procurement of new technology information; 2) the difficulty of complexity involved in the application of new technologies; and 3) technology benchmarking. Higher mean scores indicate higher adaptability to cope with technological change and interest in new technologies.

Table 8.6 Technology monitoring by community-based and factory-based firms

Number of	Community		Factory		All firms		Mann-Whitney U test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Z	Sig.
1) Mechanism to obtain new technology information	3.90	1.01	3.88	1.18	3.89	1.07	-0.144	0.885
2) Ability to adapt to new technology	3.02	1.35	3.81	1.13	3.33	1.32	-2.402	0.016*
3) Benchmarking on production capability and product quality	4.15	.86	4.00	.94	4.09	0.89	-0.599	0.549
Overall	**3.69**	**0.63**	**3.90**	**0.69**	**3.77**	**0.66**	**-1.208**	**0.227**
	N = 40		N = 26		N = 66			

* $p < 0.05$ (significance at 0.05 level)

Table 8.6 shows that the overall means of adaptive ability in factory-based firms (3.90) is slightly higher than that of community-based firms (3.69). The Mann-Whitney U test was conducted to determine if the differences between these two categories of firms were statistically significant. The test result confirms that community-based and factory-based firms have similar overall ability to cope with technological change, but factory-based firms have ability to adapt with new technology significantly better than community-based firms tested at 5% level of significance.

The marginally higher score regarding 'benchmark' for community-based firms could be attributed to the fact that community-based firms are more open than factory-based firms to network members. This increases opportunities for knowledge and information sharing and business benchmarking. Another reason is the event of public programmes like technology and business trips that aim to bring community-based firms together to visit best practices adopted by other community businesses and even individual factory-based firms. In contrast, factory-based firms may have less chance to participate in such programmes; and they also have limited network within the same industry. So, they may have less chance to compare their capability with other competitors or they may have no need to compare themselves with others since they believe their capability to be higher than others any way. This apparent complacency and reluctance to learn from the experience of others would have the long term effect of slowing down the development and growth motivation and loss of market share to competitors and new development opportunities to strengthen their position in the market (Hooley et al., 2008). This is, however, more likely to be the exception than the rule that would ‘apply to’ a minority of factory-based firms.

Indeed, the survey data show that factory-based firms are better inclined than community-based firms to adopt and apply or adapt themselves to new technologies. Community-based firms tend to reject new technologies since they believe it is more complicated and difficult to operate such technologies, as the interviews with them brought out. Many community-based firms are like household-based firms, who are used to traditional production and small kitchen utensils, and they are not familiar with new technologies that involve complicated machines and production procedures.

8.1.6 Sales growth and employment growth

Sales growth and employment growth are variables indicating business performance and growth trends. Firms were asked about the level of sales growth and employment growth and to indicate these on a scale ranging from 1 to 5, (1 = decrease more than 50%, 2 = decrease between 1-50%, 3 = no change, 4 = increase between 1- 50%, 5 = increase more than 50%). Table 8.7 shows that factory-based firms have slightly higher sales growth than community-based firms, but the employment growth is almost similar for both categories. The Mann-Whitney U test was performed to find out if this difference between the two categories were statistically significant. The test result shows that there is no significant difference between the means of sales growth and employment growth. This evidence is surprising in view of the fact that factory-based firms are better positioned than community-based firms with respect to marketing opportunities, distribution capacity and marketing strategy. This is confirmed by the higher ratio of firms having marketing development, better marketing strategies and product and process development, better market in factory-based firms (see 8.2.2 and 8.2.3). Factory-based firms are seen to be more astute in capturing new positioning in the market through product differentiation and customer sensitivity.

Table 8.7 Sale growth and employment growth by community-based and factory-based firms

Performances	Community		Factory		All firms		Mann-Whitney U test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Z	Sig.
Sale growth	3.81	0.62	4.00	0.57	3.89	0.60	-1.372	0.170
Employment growth	3.56	0.50	3.58	0.64	3.57	0.56	-0.171	0.864
	N = 35		N = 26		N = 61			

- p > 0.05 (not significant at 0.05 level)
- Scale 1 = decrease more than 50%, 2 = decrease between 1-50%, 3 = no change, 4 = increase between 1- 50%, 5 = increase more than 50%

In conclusion, the statistical tests did not confirm that community-based firms perform better than factory-based firms in terms of technological capability development and innovation as summarised in Table 8.8. The factors affecting technological capability development are explored further in the next section.

Table 8.8 Summary of technology and business performances between community-based firms (CB) and factory-based firms (FB)

Indicators	Means/percentages Community (CB)	Means/percentages Factory (FB)	Significant differences at 5% level	Important notes
Degree of TCD	3.92	4.06	No	
Process cap.	*4.08*	*4.31*	*No*	
Investment cap.	*3.87*	*3.96*	*No*	
R&D cap.	*3.82*	*3.92*	*No*	
Product dev.	11.98	17.77	No	
No. of improved products	*3.15*	*3.73*	*No*	
No. of new products	*4.22*	*7.85*	*No*	
No. of new packages	*4.61*	*6.19*	*No*	
Process dev.	4.02	5.54	No	
No. of improved process	*2.85*	*3.27*	*No*	
No. of new process/ equipment installed	*1.17*	*2.27*	*Yes*	
Organisation development	53.7%	61.5%	No	58% of ***FB*** certified GMP 31% of ***FB*** certified HACCP 32% of ***CB*** certified GMP 2% of ***CB*** certified HACCP
Marketing development	93.0%	96.2%	No	***FB*** focuses on branding and expanding to new market segment ***CB*** focuses on domestic food fairs and promotion
Official product standards	87.8%	92.6%	No	
Product awards	97.7%	92.3%	No	
Sale growth	3.81	4.00	No	
Employment growth	3.56	3.58	No	
Technology monitoring	3.69	3.90	No	
Mech. to obtain new tech. info.	*3.90*	*3.88*	*No*	
Positive attitude towards new tech.	*3.02*	*3.81*	*Yes*	
Benchmarking	*4.15*	*4.00*	*No*	

8.2 Factors affecting innovation and technological capability development

Five independent variables shown in Table 8.9 are used to compare among the three categories of firms in the Thai dessert industry. These variables are postulated here to be crucial for the promotion of innovation and technological capability development at firm level. (The empirical significance of this relationship will be investigated in section 8.3.1 in this chapter, using multiple regression analysis.)

Table 8.9 Dependent variables and measures

	Items	Measurement/ indicators	Minimum	Maximum
8.2.1	Risk taking propensity	Total score of risk taking propensity	10	50
8.2.2	Social capital	Mean score of trust and network embeddedness	1	5
8.2.3	Competitive pressure	Mean score of competitive pressure	1	5
8.2.4	Financial access	Mean score of financial services received from government and financial institutes	1	5
8.2.5	Government support	Mean score of support and impact from government interventions	1	5

In this section, the Kruskal Wallis test (used to compare more than two independent groups) is performed to determine if there are any statistically significant differences between the three groups of firms at the 5% level of significance. Where significance at 5% or even 1% is obtained, differences between the three categories of firms are broadly confirmed; and the Mann-Whitney U test (used to compare two independent groups) will be performed to indicate which two groups of the firms are significantly different from the others. Thus, for example, given A, B and C as the three categories of firms, which the Kruskall Wallis test shows to be significantly differentiated in statistical terms, we would proceed to use the Mann-Whitney U test to show where the difference is more significant - between A and B or between A and C or between B and C.

8.2.1 Risk taking propensity

In order to determine firms' propensity to take risk, firms in each category are asked to indicate their agreement or disagreement to 10 statements corresponding to the risk taking behaviour of firms. The total score ranges from a minimum of 5 to a maximum of 50 (10 items x 5). The higher the total score, the higher the propensity of respondents to take risk. Table 8.10 shows average ranks, the means and standard deviations for the three firm categories on the issue of risk propensity.

Table 8.10 Statistical tests for risk propensity of firms

Firm category	N	Mean	Std. Dev.	Median	Mean Rank	Kruskal Wallis Test
Household-based	81	33.38	3.74	34	75.38	χ^2 = 1.409
Community-based	38	33.47	4.60	34	73.89	df = 2
Factory-based	26	32.15	6.12	32	64.29	sig. = 494
Total	**145**	**33.17**	**4.47**	**34**		(p > 0.05)

p > 0.05, not significant at 0.05 level

Surprisingly, the mean rank of household-based firms with respect to risk preference is found to be highest and that of the factory-based firms the lowest. This could imply that household-based firms tend to take more risk than factory-based and community-based firms with the risk preference of community-based firms in the middle. However, the result from the Kruskal Wallis test ($p = 0.494 > 0.05$) shows that there are no statistically significant differences among the three categories of firms at 5% significance level. Therefore, it can not be concluded on the basis of the available evidence that firms in the three categories of firms are different from each other with respect to risk taking or entrepreneurial behaviour. This, however, raises questions about the distribution of innovation and innovative behaviour across firms, and about the possibility of behavioural transformation of firms across categories in the course of entrepreneurial evolution; or else, it casts doubt on the robustness of the data.

From interviews conducted, some firm owners did not consider risk as a threat or did not even realise it at all. This may be because business risk is of negligible proportion for small size firms, as it is the case with household-based firms. Investment in production in such firms is low since the equipment used are simple cooking utensils. At community level, the provision of financial support and mentors from government and public agencies have helped to reduce risk and uncertainty by spreading risk and the cost of investment and technological development of projects (Veugelers & Cassiman, 2005). Running business in partnership with others helps to spread risk and uncertainty for the individual members of the partnership. Therefore, household-based and community-based firm categories may perceive risk in running business less than factory-based firms. In contrast, factory-based firms could be slightly more risk averse since they run business alone with no cushion at their disposal to mitigate the effects of risk and uncertainty. Compared with community-based firms, factory-based firms have less support from the government to reduce and spread risk arising in their investment and business operation. This would make them more risk conscious in their activities than the community-based firms.

However, the statistical test shows that the three categories have a moderate profile of risk taking behaviour being neither risk averse nor risk loving. Moreover, the size of firms is shown to have no effect on their risk behaviour. This finding is at odds with that of Gray (2002) - and indeed with conventional wisdom - which establishes small firms as being risk averse. But it is consistent with the study of Norton and Moore (2006) in that the extent of entrepreneurial drive in firms has little or no effect on the profile of their risk behaviour. Other variables such as production and marketing experiences and environmental factors are also important factors that play significant roles in explaining the risk propensity of firms. In addition, the definition of SMEs as firms with less than 200 employees has an implication for the pattern of risk behaviour of the Thai dessert industry. The average size of firms, in terms of the number of employees in the three categories of firms, is relatively small (less than 40 employees). But all firms with less than 200 employees are classified as small firms with the same profile of risk behaviour. The law of averages, however, disguises the extent of differences between the so-called SMEs in terms of size of employment. This means that if comparative analysis were conducted between firms that are dissimilar in terms of income, capital, and employment structure, the results would be expected to show significant differences in their risk behaviour. As discussed earlier in section 5.1, the SME category in Thailand is a "mixed bag", including differences sizes of firms. Normally, the larger one would be expected to take more risk than the smaller one (Gray, 2002).

8.2.2 Social capital

Table 8.11 lists the variables and the respective measurable indicators for the various elements of social capital which respondents were asked to rate for their occurrence in their firms on a scale ranging from 1 to 5. The Kruskal-Wallis test in Table 8.12 shows that, overall, the extent of social capital significantly differs among three categories of firms. This is further confirmed by the Mann-Whitney U test which shows how each category differs from the other as shown in Table 8.13.

There is therefore significant evidence in support of the hypothesis that the occurrence of social capital in each category is different from the extent of occurrence of social capital in the other firms. It can thus be concluded from Table 8.13 that the incidence of social capital is the highest in community-based firms (3.81) followed by factory-based firms (3.52) and household-based firms (3.22).

Table 8.11 Variables and measurable indicators for items of social capital

Variables	Measurement item	Question
Trust (T)	Trust in same industry	4.2.1
	Trust in supply chain	4.2.2
	Trust in knowledge and supporting institutes	4.2.3 – 4.2.6
	Trust in relatives and friends	4.2.7, 4.2.8
	Trust in family	4.2.9
	Generalised trust	4.4.14, 4.4.15, 4.4.16
Network Embeddedness (NE)	Amount of contact time	4.3
	Strength of ties	4.4.1, 4.4.2, 4.4.3
	Honest and truthful approach to relationship	4.4.4, 4.4.5
	Norms and reciprocity	4.4.6, 4.4.7, 4.4.8
	Knowledge and information sharing	4.4.9, 4.4.10
	Reduced transaction cost, repeat transaction	4.4.11, 4.4.12
	Network development	4.4.13

Table 8.12 The Kruskal-Wallis test for social capital and

Firm category	Mean	S.D.	N	Kruskal-Wallis Test
Household-based	3.22	0.54	64	$\chi^2 = 23.197$
Community-based	3.81	0.45	25	df = 2
Factory-based	3.52	0.42	20	sig. = 0.000*
Total	**3.41**	**0.56**	**109**	($p < 0.01$)

* p < 0.01 (significant at 0.01 level)

Table 8.13 The Mann-Whitney U test for social capital

Firm category	Z	Sig. (2-tailed)
Household vs Community	-4.560	0.000*
Household vs Factory	-2.447	0.014*
Community vs Factory	-1.965	0.049*

*p < 0.05 (significant at 0.05 level)
**p < 0.01 (significant at 0.01level)

This result may appear surprising in that household-based firms are shown to have the lowest social capital, whereas the preconceived view is that they should have high social capital as they are built predominantly on the basis of family network. But it should be noted that family network is only a small aspect of the much wider relational capital or social capital.

After an overall result was obtained for social capital across the three categories of firms, further comparison on each element of social capital was conducted. Table 8.14 provides the statistical tests for social capital elements of trust and network embeddedness for firms in the three categories and the results of the Kruskal-Wallis test for differences between the three categories on each element of social capital.

Table 8.14 Statistical tests for elements of trust and network embeddedness across three categories of firms

	Household		Community		Factory		All firms		Kruskal Wallis test		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	χ^2	df	Sig.
Trust											
Trust in same industry	2.83	0.85	3.06	1.01	2.50	0.98	2.83	0.93	4.397	2	0.111
Trust in supply chain	3.59	0.82	3.83	0.88	3.60	0.58	3.65	0.80	3.569	2	0.168
Trust in knowledge and support institute	3.27	0.74	4.05	0.63	3.81	0.66	3.56	0.77	27.622	2	0.000**
Trust in relatives and friends	2.75	0.82	3.28	1.05	2.98	0.91	2.92	0.91	8.448	2	0.015*
Trust in family	4.04	0.95	4.23	1.06	4.00	1.07	4.08	0.99	1.758	2	0.415
Gereralised trust	2.77	0.57	3.32	0.47	3.12	0.65	2.97	0.60	24.285	2	0.000**
Network embeddedness											
Contact time	2.00	0.55	2.22	0.67	1.95	0.50	2.05	0.58	2.724	2	0.256
Relationship with knowledge sources and government	3.29	1.23	4.26	0.76	3.88	1.26	3.65	1.20	18.767	2	0.000**
Relationship with financial institutions	2.99	1.12	3.41	1.07	3.92	1.04	3.26	1.14	14.143	2	0.001**
Relationship with supply chain	3.78	0.91	4.37	0.71	4.44	0.65	4.05	0.87	17.853	2	0.000**
Honest and truthful approach to relationship	3.43	0.83	3.75	0.88	3.64	0.55	3.55	0.81	4.308	2	0.116
Norms and reciprocity	3.40	0.85	4.10	0.66	3.91	0.70	3.67	0.84	22.128	2	0.000**
Knowledge and information sharing	3.32	0.90	4.03	0.60	3.69	0.91	3.57	0.88	18.562	2	0.000**
Transactions cost	3.57	0.73	4.23	0.68	4.21	0.79	3.85	0.79	23.671	2	0.000**
Network development	3.46	1.02	4.37	0.67	3.68	1.11	3.74	1.03	21.497	2	0.000**

*p < 0.05 (significant at 0.05 level), **p < 0.01 (significant at 0.01level)

The mean values for the various elements of social capital corresponding to the three categories of firms show the extent of trust and network embeddedness. Higher mean values indicate higher levels of trust and network embeddedness. But is there statistically significant difference between the three firm categories on each element of trust and network embeddedness? And for which categories of firms is social capital particularly significant?

Table 8.14 shows that the three categories of firms significantly differ from one another with respect to the extent of trust in knowledge and support agencies; trust in relatives and friends; and generalised trust. The extent of trust of community-based firms in family and friends, and support agencies appears higher than the extent of trust of factory-based and household-based firms. The extent of trust in ‘firms in the same industry’ is the lowest in each category, while the extent of trust ‘in family’ is the highest. This is a phenomenon commonly observed in the literature including Sahakijpicharn (2007) among others, that trust in and relationship with family is stronger than with others. In network embeddedness, apart from ‘honest and truthful approach to relationship’ and ‘contact time’ factors, all elements are statically significant, which means that firm categories differ significantly on these social capital elements.

The study also explores the correlation between trust and network embeddedness. The test result in Table 8.15 shows a positive correlation at medium level (r = 0.534), which is nonetheless significant at 1% level. This means the more the degree of trust, the higher the extent of network embeddedness. This is consistent with the study of Carayannis (2000) that trust is crucial for network development and interactive learning. And as in Lane and Machmann (2006), trust can reduce risk in inter-firm relationship and help promote partnership for knowledge sharing and knowledge exchange.

Table 8.15 Correlation between trust and network embeddedness

	Correlations	**Trust**	**NetEmb**
Trust	Correlation Coefficient	1.000	**0.534**
	Sig. (2-tailed)	-	0.000**
	N	113	110

** Correlation is significant at 0.01 level (2-tailed).

The extent of social capital is the highest in community-based firms. This may be because community-based firms profoundly engage in social network and social cohesion (Woolcock & Narayan, 2000) more than the other two firm categories do. The social and economic activities of community-based firms build up their stock of social capital, which enables them to build and develop their networks.

Analysis of the social capital elements shows statistically significantly differences in their occurrence across the three categories of firms, except for the elements of trust in 'the same industry' and trust in 'the family'; 'frequency of contact'; and 'honesty and trustfulness'. From the interviews, the firm owners said they were honest and truthful for people who they have close relationship with but would be less so for strangers. This is because firms perceive other firms in the same industry as competitors rather than business allies.

Overall, the level of trust is highest in community-based firms followed by factory-based firms. In the 'network embeddedness' category, community-based firms have the highest score for five elements, namely 'relationship with knowledge sources and government', 'norm and reciprocity', 'knowledge and information sharing', 'network development' and 'reduced transaction cost and repeated transaction'. Strong relationship with knowledge sources and government agencies would offer community-based firms better access to both financial and technological support to promote business development. It also helps with knowledge transfer from external sources. Norm and reciprocity facilitate communication by expressing partner willingness to share benefits (Chung et al., 2000). This strengthens ties which help knowledge and knowledge and information sharing across the inter-firm network. Information obtained from the interviews shows that members in the community-based firms are willing to share knowledge by teaching other members and that they would be enthusiastic about developing linkages with external agencies. Community-based firms also incur less transactions cost than firms in the other categories in the course of searching information, market prospecting, sourcing suppliers, and promoting long-term effective transactions between existing business alliances in their network. This social routine favours an exchange of knowledge and information between them, enabling tacit knowledge to circulate in the network among community members. This is consistent with the finding of a study by Jones et al. (1997) on the social mechanism and networking.

However, in the ‘network embeddedness’ category, the scores corresponding to two elements were found highest in factory-based firms: the relationship with financial agencies and the relationship with actors on the supply chain. Their close relationship with financial institutions implies that factory-based firms have access to loans and financial support more than community-based firms. Factory-based firms also derive more advantages from their close relationship with firms on their supply chain. This kind of relationship contributes to the external sources of knowledge and information transferred from or communicated between firms on the supply chain (Hall & Andriani, 2000).

The survey data and information elicited through the interviews provide sufficient evidences that would enable us to conclude that compared with the other categories, community-based firms have the highest social capital stock. Social capital helps in connecting people, increasing communication, enabling fast learning for those in the social network and improving prospects for innovation (Lesser & Storck, 2001). By this reckoning, community-based firms would be expected to perform better than factory-based firms in terms of innovation and technological capability development. This proposition will be put to test later on in this chapter which seeks to explain technological capability development in firms through the application of multiple regression analysis.

8.2.3 Competitive pressure

The extent of competitive pressure on firms is crucial for their survival and growth. It has implications for both the reactive and proactive behaviour of firms with respect to knowledge acquisition and creativity. It all depends, however, on how firms react when subject to competitive pressure and when there is no competitive pressure on them. Firms operating in small closed markets like household-based firms, have no competitive pressure and are reluctant to make any changes. However, when the markets are open to outsiders, household-based firms would be under threat. On the other hand, firms facing open markets, like community-based and factory-based firms are subject to competition and are expected to be innovative as they have to adapt themselves to changing market and production circumstances.

In our sample survey of Thai dessert firms, respondents were asked to rate the competitive pressure they face on a scale 1 (lowest) to 5 (highest). Competitive pressure is defined here in terms of ten elements, as shown in Table 8.16, where the results of the survey are also shown. The overall mean score for competitive pressure is 3.53 for community-based firms; 3.41 for factory-based firms; and 3.03 for household-based firms. This would make the competitive pressure faced by community-based firms significant, standing somewhere in the range of medium-high level.

Table 8.16 Statistical tests for competitive pressure of firms

Competition variables	Household		Community		Factory		All firms		Kruskall Wallis test df = 2	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	χ^2	Sig.
1) Threats from new competitors	3.24	1.19	3.95	1.23	3.92	1.22	3.54	1.24	12.50	0.002**
2) Threats from new products	2.98	1.10	3.42	1.15	3.48	1.12	3.18	1.13	7.00	0.030*
3) Power of negotiation	2.47	0.94	2.05	0.84	2.08	1.00	2.29	0.94	9.52	0.009**
4) Threats from product substitution	3.34	0.93	3.79	1.12	3.24	1.20	3.44	1.04	5.20	0.074
5) Price competition	3.42	1.20	4.08	1.05	4.00	1.12	3.69	1.18	11.14	0.004**
6) Quality competition	3.26	1.19	3.58	1.24	3.60	1.19	3.40	1.20	3.14	0.208
7) Volume and lead time competition	2.82	1.40	3.76	1.22	3.64	1.25	3.21	1.39	14.98	0.001**
8) Package development competition	3.15	1.38	3.97	1.22	3.72	1.24	3.46	1.36	10.97	0.004**
9) Promotion and marketing competition	3.07	1.22	3.76	1.20	3.76	1.23	3.38	1.26	11.04	0.004**
10) Threats from poaching on qualified workers	2.65	1.2	2.92	1.18	2.65	1.41	2.72	1.23	1.04	0.595
Overall competition	**3.03**	**0.76**	**3.53**	**0.72**	**3.41**	**0.62**	**3.23**	**0.76**	**12.08**	**0.002****
N	79		37		25		141			

- p < 0.05 (significant at 0.05 level), ** p < 0.01 (significant at 0.01 level)
- Scale 1 = lowest, 5 = highest

Table 8.17 Mann-Whitney U test for overall competitive pressure

Firm category	Z	Sig. (2-tailed)
Household vs Community	-3.165	0.002**
Household vs Factory	-2.187	0.029*
Community vs Factory	-0.850	0.400

* p < 0.05 (significant at 0.05 level)
** p < 0.01 (significant at 0.01 level)

The Kruskal-Wallis test result in Table 8.16 confirms that the three categories of firms are significantly different on the extent of competitive pressure felt. However, to be more certain about this, the Mann-Whitney U test is performed to indicate the differences between community-based and factory-based firms. The results in Table 8.17 however show that the mean difference of competitive pressures faced by community-based and factory-based firms are not statistically significant at 5% level. The difference came from the household-based firms, which are facing the lowest competitive pressure compared with the other two categories. Obviously, competition is lowest in household-based firms since their market is limited to locations near their premises, while the markets of community-based and factory-based firms are much wider and, therefore, subject to competition.

Evidences from the survey data in Table 8.16 suggest that the Thai dessert industry is largely led by price competition. Price competition and threats from new competitors are high community-based and factory-based firms, while those of household-based firms are sensitive to price competition and threats from product substitution. This may be due to the fact that household-based firms have less capability to differentiate their products according to the market spectrum. Many firms put effort to undercut price rather than improve quality and product appearance or upgrade their products by other means. Price undercutting also occurs frequently with bulk sales for repackaging for retail outlets. Unlike non-price competition, this may not be sustainable as competitive advantage since it diminishes profits in the long run without increasing value added to products and makes new competitors easily enter into the market (Porter, 2008).

Packaging reflects the prevalence of a highly competitive phenomenon in this industry, since in the short term the products rely more on appearance designed to attract customers' interest than substantive changes to their value. Product substitution is also intense reflecting the intensity of competition in the industry. Thai dessert products are mainly used for gift-giving purposes and competition in the industry allows consumer choices to be exercised (Shocker et al., 2004).

The extent of competition in the industry means that Thai dessert firms do not face much problem with respect to negotiating business deals with suppliers. Nor do they face the threat of having their qualified workers poached by competitors. Poaching is rare in the industry also because those who constitute the workforce are often family and community members and people living near the firm. Family and villager loyalty rarely wears thin in connection with such firms. Dessert firms have generally because competitive and this tendency of competitiveness has cascaded down the supply chain with the result that even though products are differentiated, many supply firms exist to produce generic ingredients such as sugar, coconut, flour and milk.

Table 8.18 shows the attitude of firms in the three categories towards competition – whether they would consider it a threat or an opportunity – in terms of the mean score. Factory-based firms seem to thrive in competition more than firms in the community-based and household-based categories. However, the Kruskall Wallis test did not confirm the difference to be statistically significant at 5% level, which is surprising considering that factory-based firms would normally be expected to be more forward-looking for development opportunities than firms in the other two categories.

Table 8.18 Statistical test of attitude of firms towards competition

Attitude towards competition	Household		Community		Factory		All firms		Kruskall Wallis test		
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	χ^2	df	Sig.
Competition is more of opportunities than a threat	2.96	1.04	2.98	1.39	3.19	1.63	3.01	1.25	0.845	2	0.655
N	79		37		25		141				

p > 0.05 (not significant at 0.05 level)

8.2.4 Financial access

Respondents were asked to rate the extent of their access to financial support or loan schemes from government and non-government agencies, and financial institutions with/without special interest rate on a scale 1 (lowest) to 5 (highest). Table 8.19 shows that the overall ability of firms to access finance is the highest in community-based firms (2.50), while household-based firms (1.90) have the lowest ability to access finance from these sources. This is not surprising considering government support of community-based firms. The Kruskal-Wallis test result also confirms the difference in overall ability to access financial sources among the three categories of firms to be statistically significant at 5% level. The Mann-Whitney U test was conducted to show which category differ from the others. The results in Table 8.20

show that household-based firms have less ability to access finance significantly than community-based firms but no statistically significant difference was detected when compared with factory-based firms (2.21).

Table 8.19 indicates that community-based firms have higher ability to access finance from government and non-government agencies than factory-based firms. But there is no statistical significance of the difference between them in terms of ability to access finance from financial institutions.

Table 8.19 Statistical tests of the ability of firms to access finance

Source of financial support	Household-based		Community-based		Factory-based		All firms		Kruskal-Wallis test df = 2	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	χ^2	Sig.
1) Public institute	2.16	1.08	3.08	1.26	1.92	1.35	2.36	1.25	18.03	0.000**
2) Financial institute (special interest rate)	1.95	1.11	2.23	1.46	1.85	1.32	2.01	1.25	1.42	0.492
3) Financial institute (normal interest rate)	1.60	1.06	2.18	1.28	2.85	1.60	1.97	1.30	18.07	0.000**
Overall financial access	**1.90**	**0.92**	**2.50**	**1.10**	**2.21**	**1.11**	**2.11**	**1.03**	**8.82**	**0.012***
N	83		39		26		148			

* p < .05 (significant at 0.05 level)
** p < .01 (significant at 0.01 level)

Table 8.20 Mann-Whitney U test for overall ability to access finance

Firm category	Z	Sig. (2-tailed)
Household vs Community	-2.984	0.003**
Household vs Factory	-1.145	0.252
Community vs Factory	-1.078	0.281

** p < .01 (significant at 0.01 level)

Considering the ability of firms to access special interest rate from financial agencies, all firms in the three categories have equal opportunity to this. However, factory-based firms have the highest ability to access finance from financial agencies at prevailing market rates of interest. In contrast, household-based and community-based firms are the least disposed to do so. Obviously, community-based firms have the highest opportunity to access finance from government sources. This is because of government policy which is committed to promoting community businesses by providing financial support often to the tune of 100% of the total project budget.

Financial supports provided by the government mostly focus on SMEs, especially those registered as community-based firms. The survey data in the previous chapter however reveal that most of household-based firms (98%) are not formally registered with the government. Thus, household-based firms or unregistered firms have less access to government financial schemes. However, household-based firms may consider to use commercial bank services which offer credits at market interest rates; but this is based on collateral regulations and creditability which most of them lack. All firms interviewed had difficulties, lacking in the qualifications that would enable them to borrow from commercial banks. In the event, most of them would rather consider raising funds from relatives and friends. However, this sometimes involves the operation of informal system of microfinance in which loans would be available at very high interest rates that are often counter-productive.

All the three categories of firms similarly obtained special grants or loans at favourable low rates of interest, but only factory-based firms would be in a position to acquire loans at market rates of interest; community-based firms have the highest opportunity to access finance from government sources. The survey data are consistent with the study of Wiboonchutikula (2001) and the Bank of Thailand (2008) that small firms in Thailand face the problem of insufficient capital for investment and limited access to sources of finance.

8.2.5 Government support

Firms were asked to indicate on a scale 1 to 5 level of support received from government through policy interventions in terms of business, knowledge and technology development as shown in Table 8.21.

Overall, the results of the Kruskal Wallis test in Table 8.22 confirm that there are statistically significant differences in the extent of government intervention in and support to the three categories of firms except in the case of the item on SME funding. Household-based firms received the least support from government and were least impacted by government interventions (2.95), while community-based firms obtained the highest level of support and were most impacted by policy (3.82). Similar result is obtained from technology and innovation support, with household-based firms receiving the least support (1.77), and community-based firms (3.26) the highest. In addition, the Mann-Whitney U test in Table 8.23 shows that overall government support and impact received by household-based and factory-based firms are at the same level.

Table 8.21 Measurable variables for government supports and interventions

Government support and interventions	Variable name
1) Developing and strengthening linkages and network for cooperation and technology transfer between government, university and industry (GUI link)	GUI link
2) Establishing industrial one stop services and consultancy service centres, which may locate in university, government agency or individual organisation (NGO, industrial association etc.) for industrial technology development	One stop service
3) Improving funding support conditions for SME technological and innovation development	SME Funding
4) Promoting incentives for SME technological and innovation development - such as tax reduction, Board of investment incentives, export product and import machine incentives, etc.	Innov. incentive
5) Supporting local and community products or OTOP by promoting strategic plan and action plan for developing and promoting local community products	Com. prod. dev.
6) Promoting and supporting intellectual property rights protection	IPR promote
7) Providing and support community learning centres	Learning centre
8) Providing skill development through short courses, training courses for quality management, food safety and other skill development for food industry including technology trips	Skill development
9) Developing integrated service system and collaboration of government and university to promote technology capability building and innovation in the industrial sector	Integrated services
10) Direct support for technological capability development and innovation from government and public agencies	Tech & innov.

Table 8.22 Government support to and interventions in the Thai dessert industry

Interventions & supports	Household		Community		Factory		All firms		Kruskal Wallis test, df = 2	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	χ^2	Sig.
GUI link	2.92	1.07	3.82	0.97	3.16	1.41	3.19	1.17	17.99	0.000**
One stop service	2.95	1.16	3.77	1.04	3.24	1.54	3.21	1.24	12.51	0.002**
SME Funding	3.17	1.23	3.69	1.20	3.12	1.42	3.30	1.27	4.89	0.087
Innov. Incentives	2.98	1.15	3.72	1.08	3.48	1.23	3.25	1.18	10.89	0.004**
Com. prod. dev.	3.39	1.21	4.36	0.78	3.40	1.23	3.64	1.19	20.28	0.000**
IPR promote	3.02	1.15	3.79	1.20	3.48	1.23	3.30	1.22	12.40	0.002**
Learning centre	3.01	1.06	3.79	1.11	3.08	1.32	3.23	1.16	12.85	0.002**
Skill development	3.17	1.10	4.10	1.02	3.48	1.19	3.46	1.16	17.38	0.000**
Integrated services	3.24	1.09	3.85	0.96	3.60	1.16	3.46	1.09	8.30	0.016*
Tech & innov.	1.77	1.03	3.26	1.23	2.19	0.90	2.23	1.23	39.33	0.000**
Overall	**2.95**	**0.89**	**3.82**	**0.74**	**3.23**	**0.93**	**3.22**	**0.93**	**22.19**	**0.000****
	N = 86		N = 39		N = 26		N = 151			

- * $p < 0.05$ (significant at 0.05 level), ** $p < 0.01$ (significant at 0.01 level)
- See table 8.21 for explanation of government support and interventions

Table 8.23 Mann-Whitney U test for overall government supports and interventions

Firm category	Z	Sig. (2-tailed)
Household vs Community	-4.753	0.000**
Household vs Factory	-0.735	0.462
Community vs Factory	-2.695	0.007**

** $p < 0.01$ (significant at 0.01 level)

The concentration of government support and impact of government intervention on community-based firms is attributable to such firms being at the centre of collaborative projects between local authorities and academic institutes that attract financial and technical support, including business mentors. The focus on community business as a national agenda has helped to promote the growth of community-based firms in recent years. Household-based firms have been perceived as low potential areas of technological capability development. To receive more support from the government, they would need to join community businesses or formally register their business, which, however, would expose them to pay higher taxes and adopt complex accounting systems. In the circumstances, household-based firms may consider either to stay where they are or else evolve as factory-based firms – that is, if they have sufficient capability to do so. To the extent they choose to remain informal, unregistered as business enterprise, household-based firms would have little or no support from the government, as the survey data show.

The survey data also show that the overall level of government support and impact of government intervention to be in the medium to pretty low range, particularly with respect to technological and innovation supports. There are many reasons limiting the impact and efficiency of government intervention. The interviews revealed the main reasons to include the following: discontinuity of the support caused by lack of effective long term planning and political instability; lack of commitment, determination and honesty of public staff to the cause of technological capability in small firms; limited funding; and lack of technical advisors. Moreover, deteriorating government-university-industry links occur at the interface between firms and public agencies in the absence of good governance that would promote cooperation and strong linkages (Ritter & Gemünden, 2003). This would limit network development and knowledge transfer by reducing the trust of firms in public agencies. Inadequate provision of technology advice is another important problem that accounts for ineffective matching of the technological needs of firms and the technologies supplied. Many firms use machines to reduce labour force but capital intensive modes of operation are rather complicated as they require the availability of skills to manage, operate and maintain the machines. However, the machines used by Thai dessert firms are not of the type that can deliver mass production of acceptable products. This is because of product complexity and production difficulty, which require staff to operate and keep a close watch on such machines.

The survey data may fail to give credence to the effectiveness of government interventions to promote innovation and technological capability development in the Thai dessert industry, effective for long-term growth and development. However, evidences of best practices are still found in the industry, which will be discussed in the next chapter.

The survey results in this section have nonetheless provided evidence to support that there are differences among the three categories of Thai dessert firms in four areas – namely social capital, degree of competitive pressure, ability to access finance and government support as shown in Table 8.24.

Table 8.24 Summary of factors affecting technological capability development and innovation of the three categories of Thai dessert firms

					Significant differences at 5% level			
	Household-based (HB)	**Community-based (CB)**	**Factory-based (FB)**	**All firms**	**Kruskal Wallis test**	**Mann-Whitney U test**		
Variables	Mean	Mean	Mean	Mean	3 categories of firms	HH vs CB	HH vs FB	CB vs FB
Extent of social capital and networking	3.22	3.81	3.52	3.41	Yes	Yes	Yes	Yes
Risk taking propensity	33.38	33.47	32.15	33.17	No	-	-	-
Degree of competitive pressure	3.03	3.53	3.41	3.23	Yes	Yes	Yes	No
Ability to access finance	1.90	2.50	2.21	2.11	Yes	Yes	No	No
Government support	2.95	3.82	3.23	3.22	Yes	Yes	No	Yes

In sum, it can be concluded that the difference between community-based and factory-based firms in overall technological capability development is not statistically significant. This would nullify the hypothesis that the community-based firms would perform better than factory-based firms on account of higher stock of social capital and provision of support from government. Surprisingly, the survey results did not confirm this statement. It was also found that the difference between the two categories of firms with respect to the distribution of social capital is not robust enough; but this does not mean the value of social capital as explanatory variables to changes in the development of technological capability in Thai dessert firms of all categories can be discounted. What then would explain the scope for technological capability development in Thai dessert firms? It is to this question that we will turn to in the remainder of this chapter.

8.3 Multiple regression analysis of factors affecting technological capability development in the Thai dessert industry

Firms' technological development is expected to increase with increases in the level of social capital, access to finance, competitive pressure, government support and risk taking propensity. How each of these explanatory factors affects firms' technological development and business performances in the case of the Thai dessert industry is a question open to empirical investigation. The main purpose of this section is therefore to explore the relationship between five dependent factors performances on business and technological development as shown in Table 8.25 by conducting multiple regression analysis.

Table 8.25 Definitions of regression variables

Model	Variable Name	Dependent variables (Y)
1	TCD	Degree of technological capability development
2	PRD	Number of new/developed products and packages
3	PCD	Number of improved, newly installed processes
4	SALE	Percentage of sale growth
5	EMP	Percentage of employment growth
		Independent/explanatory variables (X)
	RISK	Risk taking propensity
	COMP	Competitive pressure
	GOV	Government support
	SOC	Social capital
	FIN	Ability to access finance
		Other variables
	β	Regression coefficients
	β_o	Constant or intercept
	ε	Error term

The regression model used involves five equations with each of the five proxies for technological capability development (shown in Table 8.25) regressed on five independent variables (also shown in Table 8.25). The five equations of the regression model could be represented in a matrix equation as shown below.

$$\mathbf{Y = \beta_o + \beta X + \varepsilon}$$

Where: $\mathbf{Y} = [\text{TCD PRD PCD SALE EMP}]^T$

$\mathbf{X} = [\text{RISK COMP GOV SOC FIN}]^T$

$\boldsymbol{\beta} = [\beta_{ij}]$, i =1, 2,…,5; j = 1, 2,…,5

$\boldsymbol{\beta_o} = [\beta_{o1}\ \beta_{o2} \ldots \beta_{o5}]^T$

$\boldsymbol{\varepsilon} = [\varepsilon_1\ \varepsilon_2 \ldots\ \varepsilon_5]^T$

For robustness of the regression analysis, the independent factors are tested for multicollinearity using a value of 'variance inflation factor' (VIF), and the tolerances of each dependent variable were calculated in all the five regression estimates (see appendix 5). The acceptable values of VIF should be less than 10 and the tolerance should be greater than 0.1 indicating that the multicollinearity of each independent variable does not degrade the precision of the estimated model (Pallant, 2007). In the five regression models, VIF and tolerances of all independent variables are less than 10 and greater than 0.1 respectively, indicating that multicollinearity is not a problem in these models. In addition, correlations between each of independent variables were also checked. If the correlation between any two independent variables is very high ($r > 0.9$), one of them will be omitted from the same model since these two variables could cause multicollinearity problem (Pallant, 2007). In contrast, if the correlations between any dependent and all explanatory variables indicate no significant relationships between them, that model would be excluded from the analysis.

Multiple regression analysis was employed at industrial and firm category level by using the standard regression and stepwise regression. In the standard method, all explanatory variables are entered into the model equation at the same time to estimate the predictive power of each variable. The stepwise method involves repeating steps of entering and removing independent variables based on the statistic criteria (enter if $p < 0.1$, remove if $p > 0.1$), but its final result yields the best predictors in the model.

8.3.1 Relationship between all independent factors and dependent factors

8.3.1.1 The industrial-wide level

The mean scores, number of valid cases and correlations of each variable included in this study, are shown in Table 8.26. The correlations show low to moderate degree of relationships between the dependent and independent variables. One dependent variable, namely, 'process development' (PCD), was not significantly related to all independent factors. Therefore PCD was excluded from the regression analyses at the industrial-wide level.

Table 8.26 Correlations (r) among measured variables and descriptive statistics at industrial-wide level (aggregated data)

	Mean	SD	N	RISK	COMP	GOV	SOC	FIN	TCD	PRD	PCD	SALE
RISK	33.19	4.47	145									
COMP	3.23	0.76	141	-0.039								
GOV	3.22	0.93	151	-0.043	0.162*							
SOC	3.41	0.55	110	0.169*	0.355***	0.354***						
FIN	2.11	1.03	148	0.185**	0.215**	0.371***	0.209**					
TCD	3.65	0.84	150	0.112	0.428***	0.357***	0.581***	0.214***				
PRD	9.36	13.54	153	0.125	0.080	0.046	0.243**	-0.075	0.256***			
PCD	5.12	9.67	153	0.026	0.050	0.046	0.064	-0.081	0.189**	0.215***		
SALE	21.51	42.44	144	0.192**	-0.022	0.113	0.162	-0.067	0.234***	-0.007	-0.045	
EMP	10.04	27.84	126	0.226**	-0.039	0.190**	0.146	0.027	0.219**	0.088	0.088	0.469***

Correlation is significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01

Four different models of technology and business development are estimated as shown in Table 8.27. Each model contains independent variables or predictors of the dependent variables. Coefficient (β_x) and R^2, Adj. R^2 of each model are reported including standardised coefficients in parenthesis. Standardised coefficient is important for comparing different variables since these values have been converted to the same scale, while coefficients are only for constructing an equation. Complete results of regression models are in appendix 5.

All models shown in Table 8.27 are statistically significant at least at 10% level. In the TCD model, both the standard and stepwise methods show competitive pressure, government support, and social capital to be statistically significant predictors of the model. The standard method of the TCD model explains 39% of the variance and the stepwise method explains 40% of the variance. RISK and FIN have virtually no influence on TCD with the t-ratio showing them both to be not statistically significant even at 10% level.

Social capital is the only significant predictor in the stepwise methods of PRD model; but the model could explain only 5% (Adj. R^2 = 0.05) of variance. In the stepwise method of SALEs model, RISK is only predictor of the model that is statistically significant at the 10% level with a very low predictive power of the model at 2.7% (Adj. R^2 = 0.027). In the stepwise method of the EMP model, RISK and GOV were important predictors, statistically significant at 5% level; but these variables could predict only 7.2% (Adj. R^2 = 0.072) of variance in employment growth.

Table 8.27 Estimate of regression models at industrial-wide level (aggregated data)

Method	N	Constant β_0	RISK β_1	COMP β_2	GOV β_3	SOC β_4	FIN β_5	R^2	Adj R^2	Model Sig.
TCD Model	106									
Standard		-0.295	0.011	0.282**	0.154*	0.640***	-0.002	0.420	0.391	0.000***
Std. Coef.			(0.058)	(0.254)	(0.170)	(0.422)	(-0.003)			
S.E.		0.627	0.015	0.093	0.079	0.134	0.070			
T-value		-0.469	0.723	3.051	1.940	4.781	-0.031			
Sig.		0.640	0.471	0.003	0.055	0.000	0.975			
Stepwise		0.035		0.275**	0.147*	0.662**		0.417	0.400	0.000***
Std. Coef.				(0.247)	(0.162)	(0.436)				
S.E.		0.429		0.090	0.073	0.130				
T-value		0.081		3.055	2.006	5.102				
Sig.		0.935		0.003	0.048	0.000				
PRD Model	106									
Standard		-20.61	0.353	0.561	0.298	5.842**	-2.112	0.088	0.043	0.095*
Std. Coef.			(0.117)	(0.031)	(0.020)	(0.239)	(-0.160)			
S.E.		12.673	0.305	1.870	1.600	2.704	1.411			
T-value		-1.626	1.159	0.300	0.186	2.160	-1.498			
Sig.		0.107	0.249	0.765	0.853	0.033	0.137			
Stepwise						5.952**		0.059	0.050	0.012**
Std. Coef.						(0.243)				
S.E.						2.326				
T-value						2.559				
Sig.						0.012				
SALE Model	104									
Standard		-75.66*	1.975**	-2.526	6.871	9.726	-7.357	0.090	0.044	0.093*
Std. Coef.			(0.208)	(-.045)	(0.150)	(0.127)	(-0.178)			
S.E.		40.075	0.963	5.912	5.060	8.551	4.460			
T-value		-1.888	2.051	-0.427	1.358	1.137	-1.649			
Sig.		0.062	0.043	0.670	0.178	0.258	0.102			
Stepwise		-38.904	1.820*					0.037	0.027	0.051*
Std. Coef.			(0.192)							
S.E.		30.901	0.923							
T-value		-1.259	1.972							
Sig.		0.211	0.051							
EMP Model	96									
Standard		-59.33**	1.492**	-2.583	6.717*	3.621	-2.730	0.107	0.058	0.065*
Std. Coef.			(0.239)	(-0.070)	0.224	0.072	-0.101			
S.E.		27.171	0.653	4.008	3.431	5.798	3.024			
T-value		-2.184	2.284	-0.644	1.958	0.624	-0.903			
Sig.		0.032	0.025	0.521	0.053	0.534	0.369			
Stepwise		-57.81*	1.461**		6.013**			0.091	0.072	0.012**
Std. Coef.			(0.235)		(0.201)					
S.E.		23.104	0.616		2.967					
T-value		-2.502	2.371		2.026					
Sig.		0.014	0.020		0.046					

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient (std. β) is in ( ) for comparison between variables

It can be concluded from the four industry-wide models that:

- ranked according to strength of impact, social capital, government support and competitive pressure each was found to have positive impact on TDC;
- only social capital has positive impact on product development;
- only risk taking had positive impact on sales growth;
- risk taking propensity and government support had positive impact on employment growth; and
- social capital, so far, had the strongest positive impact on TCD and PRD; and
- the ability to access finance had no significant effect on any of the four models.

8.3.1.2 The firm category level

Multiple regression analyses were run for each of three categories of firms in the Thai dessert industry namely household-based, community-based and factory-based firms. The correlations between each variable of the three categories of firms were calculated and are separately shown in Table 8.28.

Correlation statistics (*r*) show low to moderate relationships between the dependent and independent variables for each firm category. The correlations between the independent variables indicate little or no relationship between each other, which means that multicollinearity is not a problem at all. 'Product development' (PRD) in the community-based and factory-based firms, 'process development' (PCD) in the household-based firms, and 'sales growth' (SALE) and 'employment growth' (EMP) in the factory-based firms are not adequately explained by the estimates of the regression models. Hence these models were not included in the multiple regression analysis.

Table 8.28 Correlations (r) among measured variables and descriptive statistics classified by firm categories

Household-based firms												
	Mean	**SD**	**N**	**RISK**	**COMP**	**GOV**	**SOC**	**FIN**	**TCD**	**PRD**	**PCD**	**SALE**
RISK	33.38	3.74	81									
COMP	3.03	0.76	75	0.019								
GOV	2.95	0.89	80	0.124	-0.046							
SOC	3.22	0.54	60	0.229*	0.282**	0.269**						
FIN	1.90	0.92	81	0.248**	0.115	0.240**	0.048					
TCD	3.40	0.85	81	0.229**	0.353***	0.262**	0.548***	0.217**				
PRD	5.57	5.91	80	0.181	-0.104	-0.023	0.308**	-0.183*	0.286***			
PCD	5.51	12.07	80	0.004	0.092	0.114	0.076	*-0.147*	0.221**	0.340**		
SALE	20.15	46.43	77	0.156	-0.012	0.201*	0.231*	-0.054	0.317***	0.029	-0.064	
EMP	9.22	35.19	65	0.329***	-0.146	0.203*	0.156	-0.024	0.198	0.078	0.137	0.540***
Community-based firms												
RISK	33.47	4.60	38									
COMP	3.53	0.72	37	-0.017								
GOV	3.82	0.74	39	-0.182	0.187							
SOC	3.81	0.45	25	0.281	0.226	0.333						
FIN	2.50	1.10	39	0.060	0.366**	0.396**	0.136					
TCD	3.92	0.73	39	0.340**	0.278*	0.400**	0.394*	0.225				
PRD	11.98	15.11	41	0.215	-0.042	-0.029	0.279	-0.187	0.089			
PCD	4.02	4.45	41	-0.083	0.137	0.368**	-0.213	0.291*	0.293*	0.210		
SALE	18.83	23.67	36	0.337*	0.056	0.054	0.150	0.054	0.541***	0.025	0.223	
EMP	10.72	15.77	32	0.314*	0.238	0.290	0.562**	0.215	0.480***	-0.123	0.185	0.409**
Factory-based firms												
RISK	32.15	6.12	26									
COMP	3.41	0.62	25	-0.099								
GOV	3.22	0.91	26	-0.221	0.344*							
SOC	3.52	0.41	21	0.081	0.203	0.221						
FIN	2.21	1.11	26	0.267	-0.015	0.395**	0.261					
TCD	4.06	0.69	26	-0.263	0.633***	0.313	0.609***	-0.129				
PRD	17.77	22.29	26	0.153	0.137	-0.026	-0.024	-0.100	0.212			
PCD	5.54	6.20	26	0.234	-0.119	-0.353*	0.189	-0.065	0.189	0.523***		
SALE	29.50	49.52	26	0.265	-0.161	-0.042	-0.044	-0.198	-0.281	-0.124	-0.087	
EMP	11.35	15.59	26	0.038	0.295	0.195	-0.146	0.091	0.116	0.384*	-0.115	0.228

Correlation is significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01

8.4.1.2.1 Model 1: Technological capability development (TCD)

Table 8.29 shows estimates of the models of TCD for each firm category to be statistically significant at least 10% level (p < 0.1).

Table 8.29 Regression analysis models for technological capability development by firm category

Method	Constant β_0	RISK β_1	COMP β_2	GOV β_3	SOC β_4	FIN β_5	R^2	Adj R^2	Model Sig.
Household									
Standard	-0.677	0.019	0.249*	0.112	0.670***	0.113	0.390	0.334	0.000***
Std. Coef.		(0.082)	(0.222)	(0.118)	(0.430)	(0.122)			
S.E.	0.938	0.026	0.127	0.110	0.186	0.106			
T-value	-0.722	0.724	1.961	1.022	3.604	1.071			
Sig.	0.473	0.472	0.055	0.311	0.001	0.289			
Stepwise	0.218		0.242*		0.761***		0.344	0.321	0.000***
Std. Coef.			(0.216)		(0.488)				
S.E.	0.590		0.125		0.174				
T-value	0.370		1.929		4.359				
Sig.	0.713		0.059		0.000				
Community									
Standard	-1.026*	0.062*	0.205	0.412*	0.171	-0.350	0.387	0.226	0.076*
Std. Coef.		(0.393)	(0.201)	(0.419)	(0.106)	(-0.053)			
S.E.	1.494	0.032	0.201	0.215	0.340	0.140			
T-value	-0.687	1.963	1.017	1.917	0.504	-0.250			
Sig.	0.500	0.064	0.322	0.070	0.620	0.805			
Stepwise	-0.137	0.068**		0.469**			0.336	0.275	0.011**
Std. Coef.		(0.427)		(0.477)					
S.E.	1.251	0.028		0.174					
T-value	-0.110	2.416		2.702					
Sig.	0.913	0.024		0.013					
Factory									
Standard	-0.276	-0.019	0.510***	0.069	0.955***	-0.162	0.752	0.669	0.000***
Std. Coef.		(-0.173)	(0.463)	(0.092)	(0.577)	(-0.262)			
S.E.	0.974	0.016	0.156	0.123	0.227	0.097			
T-value	-0.284	-1.199	3.274	0.566	4.214	-1.662			
Sig.	0.781	0.249	0.005	0.580	0.001	0.117			
Stepwise	-0.840		0.563***		0.953***	-0.167*	0.709	0.658	0.000***
Std. Coef.			(0.512)		(0.575)	(-0.271)			
S.E.	0.840		0.147		0.230	0.084			
T-value	-1.000		3.822		4.148	-1.993			
Sig.	0.331		0.001		0.001	0.063			

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables
N: household-based firms = 60, community-based firms = 25, factory-based firms = 21

In the case of household-based firms, the stepwise model indicate social capital and 'competitive pressure' to have significantly positive impact on TCD. 'Social capital' (std.β = 0.488) had the most significant impact - about 2.6 times greater than the impact from 'competitive pressure' (std.β = 0.216). This model however explains 34% of the variance.

In community-based firms, the model estimates show 'risk taking propensity' and 'government support' to be important factors affecting TCD. 'Government support' (std.β = 0.477) had positive impact slightly greater than the impact from 'risk taking propensity' (std.β = 0.427). This model however explains 27.5% of the variance.

In factory-based firms, the results show 'competitive pressure', 'social capital' and 'ability to access finance' to be important factors for TCD. Both 'social capital' and 'competitive pressure' have positive impact, but the impact from 'social capital' (std.β = 0.575) is slightly greater than impact from 'competitive pressure' (std.β = 0.512). Surprisingly, the 'ability to access finance' (std.β = -0.271) is shown to have negative impact on TCD in factory-based firms but its impact was lower than that of 'social capital' and 'competitive pressure'. This model explained as high as 65.8% of the variance.

It can be concluded from the results of multiple regression analysis on technological capability development at firm category level that:

- in the case of household-based firms, increase of competitive pressure and in the stock of social capital would contribute to an improvement in technological capability development, with social capital having more impact than competitive pressure;
- in community-based firms, government support and risk taking propensity had positive impact on technological capability development; and
- in factory-based firms, social capital had slightly more positive impact than competitive pressure on technological capability development but access to finance had negative impact.

8.3.1.2.2 Model 2: Product development

In the second model involving product development, the results generated by the models for household-based firms are shown in Table 8.30. Both models obtained from standard and stepwise methods were significant at 5% level, indicating social capital to be the only significant positive predictor in the model. However, this model could explain only 7.9% (Adj R^2 = 0.079) of the variance of product development in household-based firms.

Table 8.30 Regression analysis models for product development of household-based firms

Method	Constant β_0	RISK β_1	COMP β_2	GOV β_3	SOC β_4	FIN β_5	R^2	Adj R^2	Model Sig.
Household									
Standard	-6.738	0.256	-1.492	-0.685	3.930**	-1.250	0.199	0.125	0.031**
Std. Coef.		(0.162)	(-0.191)	(-0.103)	(0.362)	(-0.194)			
S.E.	7.477	0.204	1.013	0.876	1.482	0.841			
T-value	-0.901	1.254	-1.474	-0.782	2.651	-1.487			
Sig.	0.371	0.215	0.146	0.438	0.011	0.143			
Stepwise	-5.217				3.345**		0.095	0.079	0.017**
Std. Coef.					(0.308)				
S.E.	4.431				1.355				
T-value	-1.177				2.468				
Sig.	0.244				0.017				

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables, N = 60

8.3.1.2.3 Model 3: Process development

Table 8.31 shows the third model explaining process development (PRC). Only the stepwise method of community-based firms yielded statistically significant model estimates. Government support (std.β = 0.494) has positive impact on process development. Surprisingly though social capital (std.β = -0.378) has negative impact. However, from stepwise method, these two predictors could explain 19.5% (Adj R^2 = 0.195) variance of the model.

Table 8.31 Regression analysis models for process development of community-based and factory-based firms

Method	Constant β_0	RISK β_1	COMP β_2	GOV β_3	SOC β_4	FIN β_5	R^2	Adj R^2	Model Sig.
Community									
Standard	2.445	0.119	0.666	2.817*	-4.386*	0.479	0.308	0.125	0.186
Std. Coef.		(0.123)	(0.108)	(0.472)	(-0.446)	(0.118)			
S.E.	9.653	0.206	1.300	1.388	2.197	0.907			
T-value	0.253	0.579	0.513	2.029	-1.997	0.528			
Sig.	0.803	0.570	0.614	0.057	0.060	0.603			
Stepwise	6.935			2.948**	-3.719*		0.262	0.195	0.035**
Std. Coef.				(0.494)	(-0.378)				
S.E.	7.191			1.160	1.911				
T-value	0.964			2.542	-1.946				
Sig.	0.345			0.019	0.065				
Factory									
Standard	-3.784	0.140	-0.384	-2.428	4.084	-0.183	0.217	-0.044	0.548
Std. Coef.		(0.138)	(-0.039)	(-0.357)	(0.273)	(-0.033)			
S.E.	15.630	0.259	2.496	1.966	3.635	1.561			
T-value	-0.242	0.539	-0.154	-1.235	1.124	-0.117			
Sig.	0.812	0.598	0.880	0.236	0.279	0.908			
Stepwise									

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables
N: community-based firm = 25, factory-based firms = 21

8.3.1.2.4 Model 4: Sales growth

In the fourth model focusing on sales growth, only the stepwise method of household-based firms yields a statistically significant model at the 10% level (see Table 8.32). Social capital (std.β = 0.231) has positive impact on sales growth. However, in the stepwise regression, this predictor explains only 3.7% (Adj R^2 = 0.037) of the variance in the model.

Table 8.32 Regression analysis models for sale growth of household-based and community-based firms

Method	Constant β_0	RISK β_1	COMP β_2	GOV β_3	SOC β_4	FIN β_5	R^2	Adj R^2	Model Sig.
Household									
Standard	-86.719	1.593	-2.476	8.755	14.829	-6.545	0.101	0.018	0.313
Std. Coef.		(0.128)	(-0.040)	(0.168)	(0.174)	(-0.130)			
S.E.	62.181	1.700	8.421	7.288	12.328	6.994			
T-value	-1.395	0.937	-0.294	1.201	1.203	-0.936			
Sig.	0.169	0.353	0.770	0.235	0.234	0.354			
Stepwise	-43.272				19.667*		0.053	0.037	0.076*
Std. Coef.					(0.231)				
S.E.	35.595				10.887				
T-value	-1.216				1.806				
Sig.	0.229				0.076				
Community									
Standard	-62.852	1.866	1.728	3.961	-0.002	-0.794	0.130	-0.160	0.808
Std. Coef.		(.363)	(.053)	(0.125)	(0.000)	(-0.037)			
S.E.	64.809	1.381	8.726	9.320	14.750	6.092			
T-value	-0.970	1.352	0.198	0.425	0.000	-0.130			
Sig.	0.348	0.197	0.846	0.677	1.000	0.898			
Stepwise									

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables
N: household-based firms = 60, community-based firms = 21

8.3.1.2.5 Model 5: Employment growth

Table 8.33 presents the results of the employment growth models for household-based and community-based firms. In the model for household-based firms, the stepwise method presented evidence that only risk taking propensity had a positive impact to employment growth; but the predictive power of the model is very low - only 9.2% of variance (Adj R^2 = 0.092). Only the stepwise method of community-based firms yields a statistically significant model at 5% level, indicating that social capital is the only positive predictor in the model explaining 27.6% of the model (Adj R^2 = 0.276).

Table 8.33 Regression analysis models for employment growth of household-based and community-based firms

Method	**Constant** β_0	**RISK** β_1	**COMP** β_2	**GOV** β_3	**SOC** β_4	**FIN** β_5	R^2	**Adj** R^2	**Model Sig.**
Household									
Standard	-98.431**	3.042**	-7.149	6.465	5.640	-4.979	0.179	0.097	0.072*
Std. Coef.		(0.324)	(-0.154)	(0.163)	(0.087)	(-0.130)			
S.E.	46.826	1.280	6.341	5.489	9.284	5.267			
T-value	-2.102	2.376	-1.127	1.178	0.607	-0.945			
Sig.	0.041	0.021	0.265	.244	0.546	0.349			
Stepwise	-93.944**	3.090**					0.108	0.092	0.013**
Std. Coef.		(.329)							
S.E.	40.579	1.208							
T-value	-2.315	2.558							
Sig.	0.024	0.013							
Community									
Standard	-92.522**	0.765	2.234	3.270	14.609	0.661	0.384	0.147	0.223
Std. Coef.		(0.223)	(0.102)	(0.154)	(0.419)	(0.046)			
S.E.	39.031	0.832	5.255	5.613	8.883	3.669			
T-value	-2.370	0.920	0.425	0.583	1.645	0.180			
Sig.	0.034	0.374	0.678	0.570	0.124	0.860			
Stepwise	-63.971**				19.618**		0.316	0.276	0.012**
Std. Coef.					(0.562)				
S.E.	26.836				7.002				
T-value	-2.384				2.802				
Sig.	0.029				0.012				

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables
N: household-based firms = 56, community-based firms = 19

It was seen from all models in this study that 'social capital' featured prominently with positive impact on the TCD of Thai dessert firms. This is consistent with our theoretical proposition that social capital enhances opportunities for development by creating knowledge network, and stimulating the learning process; that it also helps access to sources of knowledge which can improve internal capability and human capital. This result is consistent with an empirical study of Landry et al. (2002) that social capital determines innovation in manufacturing firms; and Kang et al. (2009) that social capital promotes innovation performance at firm level by increasing inter-firm knowledge transfer. The importance of social capital and TCD is further discussed in the next section.

According to Aghion et al. (2005), competition may have positive and negative impacts on the innovation performance of firms. In this study, competitive pressure is postulated to be a driver for development and innovation in the case of Thai dessert industry. However, development and innovation process would be slow without access to sources of knowledge and government support. Many Thai dessert firms are very small having limited capital and traditional knowledge base. Supports from government and public agencies would help such firms to access knowledge and financial sources for the development projects. A good policy framework would make public interventions a successful catalyst for the innovation process. Low impact from government interventions in the regression model of TCD would imply that policy intervention is less successful in the Thai dessert industry.

The TCD model suggested that the ability to access finance has negative impact only in the case of factory-based firms. This may be due to the fact that the firms are already highly geared and any further loans from commercial banks and financial institutions would make them vulnerable to insolvency. In contrast, financial supports from government and public agencies that are available to community-based firms are mostly grants. For factory-based firms, if business performance is not very successful after investment, increase in commercial loans would limit firm growth as the firm would liquidate to be able to meet the payments to creditors. However, this is too far-fetched a scenario as the scale of loans owed by firms to commercial banks is not expected to be large considering the capitalised value of the firms, which is normally low. What would be more realistically proper in this case would be to question the reliability of the model on account of the small number of factory-based firms used in the regression analysis.

8.3.2 Relationship between social capital, knowledge and technological capability development

The results from multiple regression analysis in the previous section confirmed that social capital has a significant positive impact on technological capability development (TCD). This section aims to explore the relationships between TCD and social capital elements shown in Table 8.34. Again stepwise multiple regression analysis was employed to investigate which elements of social capital were important to TCD at industrial and firm category levels.

Table 8.34 Elements of social capital and variable names

Measurement item	Variable name	Measurement item	Variable name
Trust (T)		**Embeddedness (NE)**	
Trust in same industry	TSI	Amount of contact time	Cont
Trust in supply chain	TSP	Strength of ties	STie
Trust in knowledge and supporting agencies	TKI	Honest and truthful approach of relationships	HonT
Trust in relatives and friends	TRF	Norms and reciprocity	Norm
Trust in family	TFA	Knowledge and information sharing	InfoS
Generalised trust	TG	Network development	Netw
		Reduced transaction cost, repeat transaction	Trans

Table 8.35 Correlations (r) among measured variables and descriptive statistics at the industrial-wide level (aggregated data)

	Mean	SD	N	TCD	TSI	TSP	TKI	TRF	TFA	TG	Cont	STie	HonT	Norm	InfoS	Netw
TCD	3.65	0.84	150													
TSI	2.83	0.93	134	0.093												
TSP	3.65	0.80	142	0.059	0.108											
TKI	3.56	0.77	130	0.450***	0.277***	0.172*										
TRF	2.92	0.91	126	0.213**	0.356***	0.188**	0.219**									
TFA	4.08	0.99	131	0.154*	0.066	0.218**	0.188**	0.402***								
TG	2.97	0.60	142	0.258***	0.110	0.192**	0.433***	0.229**	-0.046							
Cont	2.05	0.58	146	0.103	0.140	0.009	0.058	0.270***	0.231***	-0.064						
STie	3.64	0.80	143	0.374***	0.088	0.134	0.576***	0.055	0.142	0.529***	0.131					
HonT	3.55	0.81	144	0.404***	-0.003	0.390***	0.355***	0.090	0.121	0.331***	-0.020	0.481***				
Norm	3.67	0.84	145	0.501***	0.045	0.155*	0.620***	0.149*	0.219**	0.527***	0.041	0.546***	0.532***			
InfoS	3.57	0.88	142	0.519***	0.044	0.113	0.499***	0.159*	0.188**	0.416***	0.179**	0.529***	0.439***	0.719***		
Netw	3.74	1.03	145	0.521***	0.094	0.227***	0.563***	0.132	0.183**	0.422***	0.125	0.546***	0.398***	0.675***	0.722***	
Trans	3.85	0.79	142	0.488***	-0.108	0.215**	0.602***	0.128	0.213**	0.518***	0.046	0.640***	0.454***	0.682***	0.697***	0.742***

Correlation is significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01

Correlations between the independent variables in ‘trust’ and ‘network embeddedness’ at the industrial-wide level are shown in Table 8.35 to be low, moderate and high. However, the strongest relationship found between ‘network development’ and ‘reduced transaction cost and repeated transactions’ is 0.742 which is less than 0.9. In addition, VIF and tolerances of this regression model at industrial-wide level is less than 10 and more than 0.1, respectively (see Appendix 7). Thus, there is no multicollinearity problem in the multiple regression analysis involving these variables. Technological capability development (TCD) also had low to moderate relationships with explanatory variables except three variables, namely ‘trust in the same industry’ (TSI), ‘trust supply chain’ (TSP), and ‘amount of contact time’ (Cont). Correlations among these explanatory variables and TCD at firm category level were less than 0.9 (see Appendix 6), and importantly VIF and tolerances also confirmed no multicollinearity problem with these variables (see Appendix 7). Hence multiple regression analyses of TCD models were conducted at industrial and firm category level as shown in Table 8.36.

The regression models in Table 8.36 indicate the significant elements of social capital having positive impact on technological capability development (TCD) at industry and firm category levels, with all model estimates significant at 1% level. At the industrial-wide level, considering standardised coefficients, the strongest predictors of the model can be ranked as follows: ‘knowledge and information sharing’ (InfoS) (std. β= 0.213); ‘network development’ (Netw) (std.β = 0.206); ‘honest and truthful approach to relationships’ (HonT) (std.β = 0.169); and ‘trust in knowledge and supporting agencies’ (TKI) (std. β = .168, $p < 0.1$). These predictors had positive effects and could explain 33.9% of the variance of TCD model at industrial-wide level.

The results pointed out that knowledge is the most important element that enables firms to enhance their innovation and technological capability. A higher index of social capital results in a better knowledge transfer and exchange between firms; and also between firms and knowledge institutes.

Table 8.36 Regression analysis models of technological capability development and social capital elements at industrial and firm category levels

Level	Constant β_0	TSP β_1	TKI β_2	HonT β_3	InfoS β_4	Netw β_5	R^2	Adj R^2	Model Sig.
Industrial									
	1.027***		0.182*	0.176**	0.203*	0.168*	0.361	0.339	0.000***
Std. Coef.			(0.168)	(0.169)	(0.213)	(0.206)			
S.E.	0.354		1.00	0.088	0.106	0.093			
T-value	2.901		1.826	2.005	1.915	1.801			
Sig.	0.004		0.070	0.047	0.058	0.074			
Household									
	1.735***	-0.195*		0.359***		0.329***	0.369	0.340	0.000***
Std. Coef.		(-0.188)		(0.349)		(0.395)			
S.E.	0.439	0.115		0.132		0.098			
T-value	3.951	-1.699		2.710		3.372			
Sig.	0.000	0.094		0.009		0.001			
Community									
	1.229				0.669***		0.301	0.273	0.003***
Std. Coef.					(0.549)				
S.E.	0.829				0.204				
T-value	1.483				3.285				
Sig.	0.150				0.003				
Factory									
	2.749***					0.357***	0.332	0.297	0.006***
Std. Coef.						(0.577)			
S.E.	0.446					0.116			
T-value	6.167					3.076			
Sig.	0.000					0.006			

Significant at *p < 0.1 level , **p < 0.05 level , *** p < 0.01
Standardised coefficient is in ( ) for comparison between variables
N: industrial = 121, household = 70, community = 27, factory = 21

In the analysis conducted at firm category level, different results were found among the three categories. In the household-based firms, the model suggested that 'network development', 'honest and truthful approach to relationships' had positive impact, but 'trust in supply chain' had negative impact to TCD. The household model explained 34% of the variance. In community-based firms, it was found that only 'knowledge and information sharing' had positive contribution to TDC and the model explained 27.3% of the variance. In factory-based firms, only 'network development' positively contributed to TCD and the model explained 29.7% of the variance.

Networks in household-based firms are mostly limited to relatives and suppliers. Hence networking outside family circles would expose them to new sources of knowledge and information; but to make this happen, honest and truthful relationship with players in the network is needed least the household-based firms would be vulnerable to exploitation. From interviews conducted with household-based firms, the reason for negative impact of 'trust in supply chain' is that the distribution of bargaining power is biased against household-based firms, so that the more household-based firms trust their supply chain, the more they are taken advantage of by their suppliers, in the form of unfair price increases, bargaining, late delivery, low product quality etc.

In community-based firms, the extent of networks is high since they work as a group. The important factor here is the information and knowledge shared among members and between firms and external knowledge sources. In factory-based firms, enthusiasm for creating networks is the most important factor recording a high standardised coefficient (std.β = 0.577). As mentioned in earlier discussions on social capital, the more the networks, the better the access to knowledge sources. This results in an increase in development opportunities and growth.

The regression analyses and the survey results have provided sufficient evidences that enable us to conclude that, at industrial-wide level, the degree of technological capability development increases when firms increase: 1) their trust in knowledge and supporting institutes; 2) their honest and truthful approach to relationships; 3) their knowledge and information sharing; and 4) their enthusiasm for network development. These factors are the most important for creating effective networks in the Thai dessert industry. This is consistent with many other studies. For example, an increase in knowledge and information sharing between external sources and firms, and within network members results in an increase of interactive learning, knowledge accumulation (Wu & Choi, 2004). Enthusiasm for network creation speeds up network expansion, offering opportunities to meet new sources of knowledge, support systems and business development. The regression model suggested that an increase in trust in knowledge and supporting agencies would result in an increase of TCD. While Jeffrey and Kentaro (2000) found that honest and truthful approach to relationships and the extent of trust promote close relationships, facilitate effective information and knowledge exchange and collaboration by increasing social norms, fulfilling members' expectation, and preventing free riders.

The high degree of networking is useful for TCD when knowledge and information are exchanged among members along the so-called knowledge network.

8.4 Conclusion

The results of the statistical analysis in this chapter provided substantial information that enhanced an understanding of the factors affecting technological capability development in the Thai dessert industry. The study had also explored the extent of the impact each factor had on technological capability development of firms.

The empirical findings of the comparison of independent factors indicated that firms in the three categories were not significantly differentiated with respect to their disposition to risk. Generally, firms in all categories appeared to be neither risk averse nor risk lovers. Firms were however significantly differentiated on other factors – namely, social capital, competitive pressure, government support and ability to access finance. Social capital was highest in community-based firms and lowest in household-based firms. Competitive pressure was lowest in household-based firms, while factory-based and community-based firms felt the same degree of competitive pressure. Price competition and threats from new product, new package, and product substitution were strong in the Thai dessert industry. Regarding the ability to access finances, household-based firms had the lowest ability, while community-based firms had the highest ability to access funding from public agencies. Lastly, the overall support and intervention from government were significantly different among the three firm categories. Household-based firms received the least support from government and were least impacted by policy interventions, while community-based firms obtained the highest level of support. The study then focused on comparison between community-based and factory-based firms on the overall extent of technological capability development and business performances which were found to be relatively similar.

Multiple regression analysis was also employed to explore the relationship between five independent variables (‘risk taking propensity’, ‘social capital’, ‘competitive pressure’, ‘government supports’ and ‘ability to access finance’) and technological capability development. The results provided sufficient evidence to support that ‘social capital’, ‘competitive pressure’ and ‘government support’ had positive impact on the development of technological capability at industrial-wide level. However, at firm category level, risk taking propensity had positive impact on TCD in community-based firms; and ability to access finance had negative impact on TCD in factory-based firms. In addition, social capital was also found to impact on employment growth in community-based firms; sale growth in household-based firms; product development in household-based firms; and process development in community-based firms.

Based on its major objectives, the study therefore further examined the relationship between social capital elements and technological capability development. The results show that ‘knowledge and information sharing’, ‘network development’, ‘honest and truthful approach to relationship’, and ‘trust in knowledge and supporting agencies’ were key elements having strong impact on technological capability development of the Thai dessert industry.

In summary, the results of this chapter revealed empirical evidence that lend support to the thesis that social capital is a crucial factor to promote technological capability development in the Thai dessert industry. Knowledge and information plays crucial role i The next chapter discusses three case studies from the Thai dessert industry to show the importance of social capital for technological capability development and innovation.

CHAPTER 9

Social Capital and Technological Capability Development: Discussion of Case Studies and Public Interviews

This chapter presents a discussion of three cases[15] of Thai dessert firms. The cases draw on the significance of social capital development and networking for cultivating the indigenous knowledge base of the Thai dessert industry. Best practice cases in knowledge acquisition and use are discussed in the context of network development, innovation and technology improvement aiming to enhance prospects for technological capability development and long-term growth of firms in the industry. The chapter further discusses information obtained through interviews which focused on government, university, and industry linkages.

9.1 The case study of the Thai dessert industry

One of the three cases studied in this chapter is located in the central part of Thailand, and the other two in the northern part (see Figure 9.1). As communities are generally perceived to be engines for social capital development (Lesser & Storck, 2001), these three cases were selected to present the importance of social capital and networking on technology and business development. Network facilitators or leaders play a crucial role in promoting the development of entrepreneurship and social capital in the community. They act as 'gatekeepers', acquiring knowledge from outside the community and making it accessible for members to use and also engage in knowledge sharing and exchange practices. The aim is to build a culture of trust to stimulate interactive learning, creativity and innovation within the evolving social network.

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[15] This chapter is an expanded version from the article “Innovation network and technological capability development in the Thai SME sector: The case of the Thai dessert industry, which has already been published in the International Journal of Technology Management & Sustainable Development, volume 9, number 1, 2010.

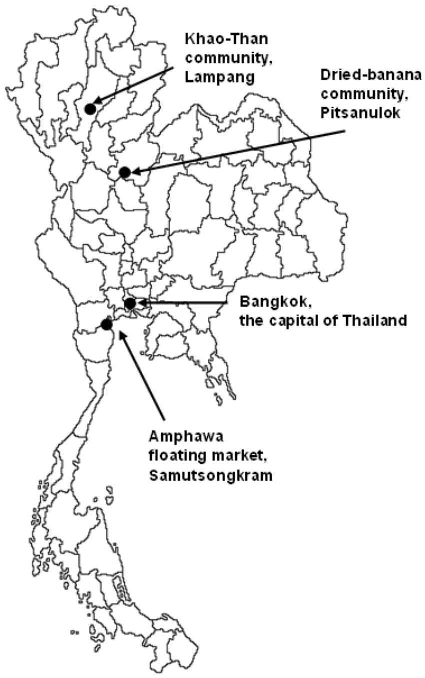

Figure 9.1 A map of Thailand showing locations of three case studies

Table 9.1 Three case studies of the Thai dessert industry

	Amphawa floating market	Khao-Than community (Thai rice cracker)	Dried banana community
Location	Central part	Northern part	Northern part
Year of establishment	2004	1995	2000
Member	81 micro enterprises (Only Thai dessert)	13 villages (~1,000 families)	18 members from 7 households
Market	Domestic/tourist	International/domestic/ tourist	Domestic/tourist
Leader of communities	Local government	Entrepreneur	Entrepreneur

9.1.1 The Amphawa floating market community business

The Amphawa floating market is a community-based business located in the central part of Thailand, with transactions conducted on boats by the local river as shown in Figure 9.2. The floating market emerged as a point of tourist attraction in 2004 and has since become a famous venue of commercial activity. Amphawa has conserved tradition as the underlying feature of its socio-economic life. In 2008, it received honourable mention from the UNESCO Asia-Pacific Heritage Awards for culture heritage conservation, and particularly for the success of collaboration between public and private initiatives in conservation and development.

Figure 9.2 The Amphawa floating market in Samut Songkram

Source: www.amphawafloatingmarket.com

Amphawa is particularly famous for Thai desserts, the production of which has a long history dating from the Rattanakosin period in late 17th Century (Luekveerawattana, 2006). At the moment, there are 81 Thai dessert micro enterprises (about 18% of total number of SMEs) in this community, most of which are family or household-based businesses. However, despite the increase in tourist turnover and market expansion, the production capability of the household-based firms in Amphawa has remained limited. The Amphawa technology and innovation network is shown in Figure 9.3.

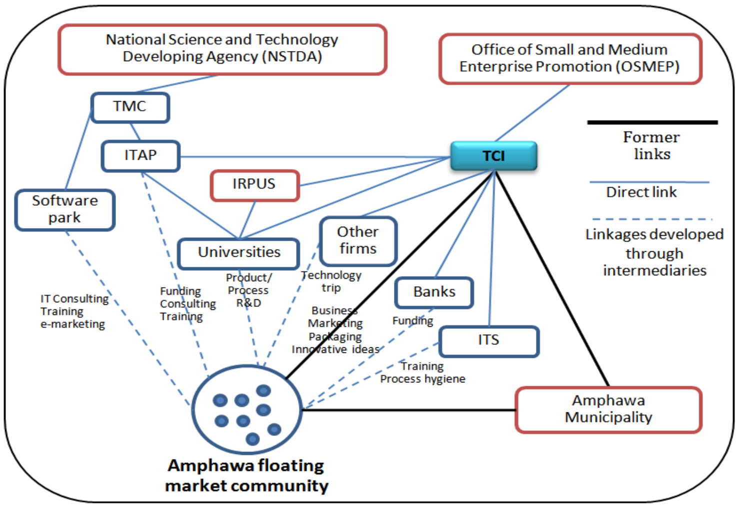

Figure 9.3 Technology and innovation network of the Amphawa floating market

Network development began with collaboration between Amphawa Municipality and the Managing Director of the Thai Confection Industry (TCI) that was set up by the Office of Small and Medium Enterprise Promotion (OSMEP). This is a link that existed before the establishment of the industrial Technology Assistance Program

(ITAP) through TCI. TCI has a mission to promote the consumption of Thai desserts and the sustainable growth of the industry. The collaboration initiative enhanced the reputation of Amphawa as a model community and centre of the unique tradition associated with the Thai dessert industry. TCI surveyed all high potential entrepreneurs in product development projects which focus on local brand creation, and product and package redesign. Products are developed based on the 'Amphawa style', which involve the exclusive use of local resources. TCI has worked closely with the community leader to ensure that all development projects matched with the 'Amphawa style' and culture. The local government has overarching authority and power over resources; TCI has creative ideas and liaises with business and universities and research centres acting as a bridge between them. This makes TCI and local government ideal partners in community development.

However, reaching local enterprises and gaining their trust takes time and could be a daunting challenge. TCI has all the same shown strong commitment and determination to win the hearts and minds of these enterprises by linking them to universities, government agencies and funding bodies. TCI also links the community with the Industrial Technology Assistance Program (ITAP), which operates under the Technology Management Center (TMC). TMC is a government agency under the National Science and Technology Development Agency (NSTDA). TMC provides integrated service that aims to match and transfer research and development results from government research institutes and universities to the private sector. ITAP operates as a broker soliciting, for example, funding and technical support for community-based firms from relevant sources. Thus, TCI collaborates with Ban Somdejchaopraya Rajabhat University in research and development aimed at new product development based on local resources in Amphawa. This initiative has already resulted in the development of flower juice drinks and flower ice creams, which are known to be healthy and rich in antioxidant (Chaturongakula, 2009).

As a strategy for promoting process improvement, TCI has also forged links with Intertek Testing Services Co., Ltd. (ITS). This enterprise provides to firms in the community training courses on good manufacturing practices and food hygiene. ITS also performs internal quality audit for the firms and gives them guidance to adopt better production processes.

Changes in the output profile of network activities confirm success in the development of community technology and innovation achieved through the setting up of learning centres, creation of new enterprises and the strengthening of existing enterprises, product promotion, package and process development, and establishment of the Thai dessert museum and a model shop.

The Thai dessert museum (Figure 9.4) and the model shop (Figure 9.5) for learning centres are considered to be the most successful outcomes of the network. The museum was established in 2008 as a collaborative initiative between the TCI and Amphawa Municipality funded by OSMEP. According to (Chaturongakula, 2008c), "The objective of Thai Dessert Museum is to preserve the rich heritage of Thai desserts and to provide inspiration for entrepreneurs to engage in innovative product development".

Figure 9.4 The Thai dessert museum at Amphawa, Samut Songkram
Source: www.manager.co.th, www.tat.or.th, www.thailandtravel-hotels.blogspot.com

Figure 9.5 Model shop at Amphawa, Samut Songkram

The model shop is used to pre-test new products and packages. It gives ideas and guidelines for anyone interested in marketing innovation. The model shop is full of innovative ideas, that would enhance quality in, for example, packaging and product design, and shop decoration, which do not in any way clash with the traditional Amphawa features. Thus, the success of the Amphawa floating market is essentially a result of the collaboration of many organisations, both in the public and private sectors.

9.1.2 Khao-Than community business

Khao-Tan is a traditional Thai rice cracker as shown in Figure 9.6. The Khao-Tan community business is located in Lampang, a province in the north of Thailand. The firm originated in 1995 from a small club of houses in the village.

Figure 9.6 Thai rice cracker or Khao-Tan

The leader of the community resigned from his previous job in a public agency and started a small firm in the community. Working full time in his firm, he also acted as a network facilitator for the community, reaching out to household-based firms within the community, other firms, government agencies and local universities to gain financial and technology supports. ITAP has provided technological consultancy service and this has helped to link the firms to local universities with the aim to improve production processes, making them more efficient and hygienic. ITAP also introduced to the community the greenhouse solar dryer developed at the Silpakorn University in the central part of Thailand. The community leader saw in this an opportunity for improving the drying process for Khao Tan rice crackers. ITAP is now collaborating with the Silpakorn University to set up a consulting project on a greenhouse solar dryer dome. TCI also assists the community of firms to be creative and innovative with marketing and business strategies, including product diversification and packaging designs.

Apart from the ITAP network development, the firms in this community are also keen to create business alliances with other firms or other communities on a supply chain basis. The Community leader also applies the supply chain strategy to manage the community business. Some household members have consequently become wholesale suppliers of raw materials. The network of the Khao-Tan community in Lampang is shown in Figure 9.7.

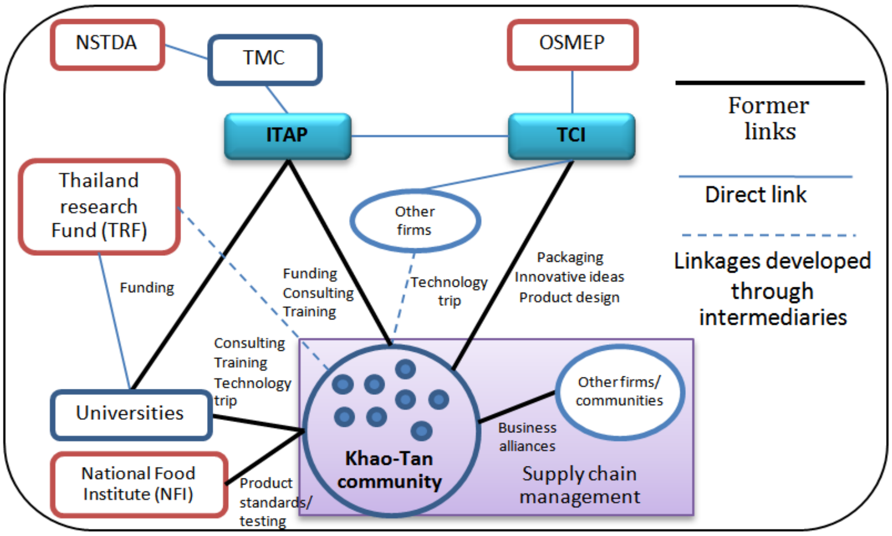

Figure 9.7 Technology and innovation network of the Khao-Tan community

Thus, organised in a supply chain framework, the community operates as one vertically integrated factory system with members supplying their products to one another. This helps the community to effectively respond to growth in market demand and also to reduce production costs and market transaction costs. It also helps to expedite knowledge/information exchange and creativity by enhancing the social capital base of the community.

At the beginning of business development, community members were not keen to engage in technology improvement, innovation and creativity. However, after ten years of development through 'learning by watching' and 'learning by doing' with reference to a model firm owned by the community leader (now used as learning and training centre for the community), members of the community have been significantly influenced to be creative. There is evidence to show that network development and the prevalence of trust and reciprocity have brought prosperity to the community. Members of the community are known to work together sharing experience and knowledge in best practice. The learning culture in the community has also changed; members are enthusiastic to learn about new technologies and are keen to explore development opportunities. The growth rate of income has, as a result, increased by more than 50% during the period 2007 – 2009 and the community network has expanded to include 329 entrepreneurs (Chaturongakula, 2008b).

9.1.3 Dried banana community business

Solar dried banana, or Kluay Tak, is a Thai snack produced using the conventional solar drying technology, which is labour-intensive. The dried banana community enterprise is located in Pitsanulok, a province in the north of Thailand. The enterprise was established in 2000 with 18 members from seven households built in the community. The leader of the community faced frustrating conditions at the initial stage with limited budget and lack of effective support and honest brokerage from local agencies. This made the community leader feel somewhat cagey about the task of developing networks and links with external agencies. Moreover, the existing solar drying technology, developed by local knowledge institutes, was found wanting in terms of efficiency when applied to large scale production. This shortfall was observed from the experience of other communities in the application of the technology.

The scheme for network development between the community business and the main supporting agencies involved in the task of promoting technological capability and business development in the community are shown in Figure 9.8.

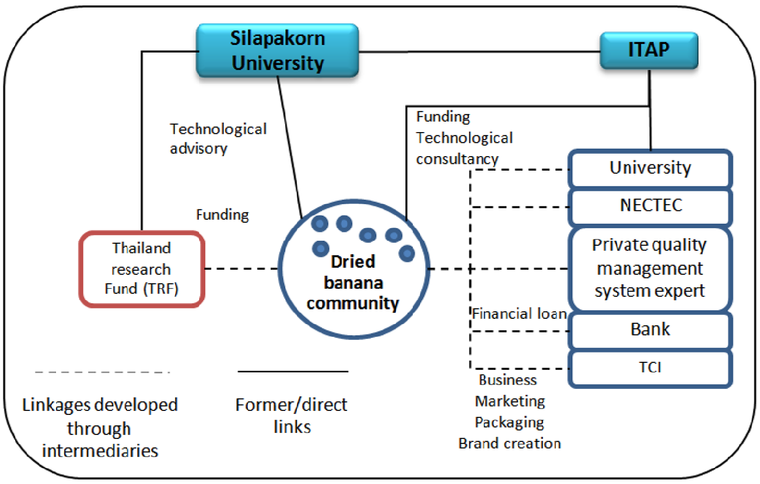

Figure 9.8 Technology and innovation network of the dried banana community

Technological and business capability development for the lead firm owned by the community leader was, strictly speaking, not so much network-driven as it was market-driven, at least at the initial stage. Since the local market was highly concentrated, the community leader was forced to improve his production technology and business capability by sourcing better technology from outside his region. The network development of the community business was in fact initiated in 2007 when the community leader forged a relationship with a lecturer of industrial technology at Silpakorn University, the proprietor of the solar drying dome technology as shown in Figure 9.9. The latter had shown strong commitment as well as honest brokerage to help the community by providing all important information, a clear set of objectives, sources of knowledge and funding, and prompt responses to any enquiries. This gradually helped to build trust and bonding between the two. The expert linked the community with ITAP, and ITAP expanded links and networks between the community and various supporting agencies, who would provide financial support and technology development projects that would help with the development of the firms' technological capability.

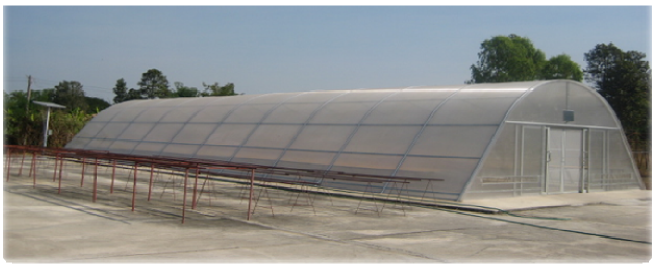

Figure 9.9 A greenhouse solar dryer developed by Silpakorn University

For five years after its establishment, in 2005, the community received steady support through the ITAP network, particularly in terms of the provision of expert advice from the multidisciplinary team at the Silpakorn University, and other universities and research and technology centres, such as the National Electronics and Computer Technology Center (NECTEC). This not only helped the community to improve its technological and business performance, but also extended the community's network further afield, enabling the community to liaise with experts from different knowledge centres with the aim to acquire and adapt their inventions for commercialisation.

ITAP-driven network development led to the development of greenhouse solar dryer dome, product and process development, good manufacturing practices, branding and packaging designs (Yuwawutto et al., 2009). The community also increased its ability to access the Thailand Research Fund (TRF), ITAP and the Bangkok Bank for credit supply. TCI also provided business consultancy for brand creation and packaging design to add value to the products of the community and increase business opportunities (Chaturongakula, 2008a). As a result of the prevailing social network and ITAP interventions, the community has significantly expanded its market catchment, and is now seeking to produce quality dried banana for export worldwide.

9.2 Discussion on the three case studies

This section discusses the issues arising from the three case studies. The three cases of community-based firms discussed above show the potential for innovation and creativity to be contingent upon network development; the trust factor underpinning transactions between enterprises within communities and between communities and government and non-government agencies; and the roles played by the actors networked in a system of transactions. These are discussed seriatim below.

9.2.1 Driving forces behind the network development

In the Amphawa case, the local authority perceived the strengths of the community and sought to bank on this by creating business opportunities for the community. The tourist industry is very popular in Thailand and Amphawa has a long history with indigenous knowledge which offered the potential for business development. The local authority saw this potential and forged alliance with the community to make the Thai dessert business a commercial success. In the case of the Khao-tan community, the owner had a good entrepreneurial flair and exploited this attribute to create business opportunities. In the case of the dried banana community, the driving force came from the concentration of the market.

Thus, the initial push came from different sources in the three cases considered – namely, the local authority, the entrepreneurial flair of the owner and the concentration of the market. Once the ball was set in motion in each case, the growth momentum had to be maintained through policy intervention that would link the community business to other agencies that would provide business and technology support. The extent to which the communities would benefit from this expanded network with universities, and government and non-government agencies would, however, depend on the role of trust within the community and the role of the actors themselves.

9.2.2 Role of Trust

The absence or existence of trust between firms is generally a reflection of the risk perception of firms. Left to their own devices, firms would be averse to risk; and when operating under market uncertainty, they would have no reason to trust other firms. Transactions between firms would consequently remain limited as would the scope for creativity and innovation. This is the situation with the household-based firms which, not surprisingly, have remained traditional in their ways of operation limited to village markets.

The community based organisation of firms has a risk mitigating effect by reducing the scope of uncertainty that firms face on both the supply and demand ends of their businesses, and by increasing trust and inter-dependence between the firms.

It is apparent from the three cases discussed above that social capital arising from the trust factor is generally high in community-based businesses. In the Khao-tan community, the leader created trust and norm of reciprocity through the adoption of a supply chain strategy. The small household firms in Amphawa engaged with the community leader and local authority based on trust. This made them receptive and enthusiastic to adopt changes prompted by the local authority.

In the Amphawa case, TCI initially introduced innovative product development that appealed to the local market and further thrived on the back of the growth of tourist turnover. However, the network development in the Amphawa case is not straightforward. It took more than five years for trust to build between firms in this community upon the provision of continued support from the government in terms of training, funding and technology development. Previously, firms in the community preferred going it alone, but now more and more firms in the community are working together sharing knowledge and complementing one another's efforts. Consequently, the community has grown stronger and more creative than before with business acumen and sensitivity to changes in market conditions, thus quickly adjusting to the changes through engagement in product and process designs.

Network development in the dried banana community resulted from the trust individual firms had in experts and other actors. Trust is easily transferred from one to another in the community and between communities with the aid of network facilitators and community leaders. This helps community members/firms to trust government agencies, and universities and to extend their network, thus increasing the benefits to be derived from knowledge exchange and transfer practices.

9.2.3 Role of actors

In the Amphawa case, the community leader is a local government employee and the network facilitator is a representative assigned by central government. In the Khao-Tan community, on the other hand, the role of the community leader and network facilitator is assumed by the same person who owns a private firm in the community. While the network facilitators in the other two cases are agents from industry and the government sector, the network facilitator in the dried banana community business originates in the academic and government sectors. Here we see the active roles assumed by agents from university, industry and government in facilitating network development for the Triple Helix system (Etzkowitz, 2008) to take root in the Thai dessert industry.

In the three cases we have considered, ITAP has acted as a bridging agency providing support from various knowledge sources, including universities and freelance experts; and financial sources, including government and local banks. While the traditional university acts largely as a generator of knowledge to be transferred to industry for application, the entrepreneurial university plays a more active role interacting with firms and linking them with other support agencies (as in the dried banana case). TCI acts as a cluster management agency pooling the Thai dessert firms together and linking them with external agencies. TCI also arranged for household firms to visit community firms. It aims to encourage knowledge exchange and learning from the experiences of others and to promote network development. Underlying the development of this network, which links actors in the system, is the evolutionary process driven by the social, economic and political dynamics and the technological trajectory arising from this.

9.3 Discussion on public sector interviews of government-university-industry linkages

This section discusses the state of network development based on government-university-industry (GUI) linkages in the eyes of representatives of government agencies; universities; and intermediary organisations focusing on policy frameworks. Interviews were conducted with academic staffs and industrial technology advisors (ITAs) of the Industrial Technology Assistance Program (ITAP) network located at regional hubs and local universities.

The roles of intermediaries and public agencies, such as research and technology organisations (RTOs) and universities, have significantly increased of late in promoting technology and innovation in the industrial sector. At implementation level, government policy framework and institutional policy at the middle level are important as these would provide guidelines for intervention in and support to the industry. Interviews with RTO and university staff have been useful in shedding light on the current situation, and on factors influencing the effectiveness of public interventions and GUI linkages.

9.3.1 Policy measures and mechanisms adopted to increase staff awareness

In accord with national policy, most of the universities and RTOs in Thailand have realised the importance of industrial and technology development for the long term prospect of the economy. As a result, technology transfer offices have been set up in many universities and RTOs. However, many of them are too inchoate, if growing, in terms of capability to impact awareness of staff about the importance of working with industry. Some university departments have set workload ratios between academic duty and industrial service duty; but the ratio has to date been rather small - for example 5% of all workload - indicating that industrial liaison is considered by staff as an *ad hoc* exercise, driven largely by personal rather than institutional objectives.

Dealing with entrepreneurs is problematic for academics in general due to differences in the orientation of their cultural and business objectives. Firms have for the most part, their eyes fixed on short term objectives to ensure that they continue to run as a going venture. Most academics have a narrow vision tied to the prospect of their career development through research and publication. Initiatives that do not promote this would hardly be of any interest to them. For instance, there is no clear direction for support staff to participate in collaborative projects between university and industry. Therefore, academic and research staff may not consider collaboration with industry as a career route since it takes long to develop relationships and to conduct joint projects. Moreover, joint research projects generally have low success rates and low rates of return. Academics feel that there are many ways in which they can advance their careers other than working with industry. As a result, not all academic staff are keen to create links with the industry or to be involved in such an enterprise.

Moreover, the system of performance evaluation and the state of working environment are considered to be not conducive enough to encourage academics and researchers to work in collaboration with industry. Research outputs are expected to be commercialised generating substantial income, but not many research projects have reached that point yet. Many universities and research and technology organisations may not, however, be expected to be proactive enough to play significant roles in industrial and economic development in the absence of clear incentive or reward system; increase in proportion of workload and weight for performance evaluation; and clear career path.

9.3.2 Project management

Some research and technology organisations, and universities do not have clearly established regulations and procedures to manage research projects and research outputs such as intellectual property rights (IPRs). Many universities have established procedures for industrial project management but sometimes these take long to get things done as they tend to be bureaucratic. No project facilitator is directly appointed to manage the projects. It is often seen in collaborative projects, between university and industry that it is the experts who also manage the projects including handling the administrative and paper work. Moreover, IP management is still weak and, when it comes to be an issue with firms, it cannot be easily solved through negotiations. However, not many firms are interested in IP protection at this stage due to the meagre understanding of its importance, and there is in any case lack of trust in the efficacy of the legal system with respect to IPRs. In addition, fund providers do not require the acquisition of IP rights as a condition for funding. For these reasons, IP management is of much less significance for university research than it is for industrial research.

9.4 Discussion on industry interviews of government-university-industry linkages and success factors

Industry interviews reveal major obstacles and weaknesses in government-university-industry (GUI) linkages, which may impede technological capability development, innovation and growth in the Thai dessert industry. Table 9.2 provides summary from industry interviews of 22 firms. Table 9.3 summarises the constraints on network development and collaboration between actors in GUI network and the critical success factors, which were brought out as a result of the interviews.

Table 9.2 Summary of main obstacles for the development of GUI network from industry interviews

Problems and obstacles weakening GUI network	**Factory-based** (N =8)		**Community-based** (N=6)		**Household-based** (N=8)		**Total** (N=22)	
	n	%	n	%	n	%	n	%
• Discontinuous support for the Thai dessert industry, political conflict, and conflict between public agencies	6	75%	3	50%	1	13%	10	45%
• Government/universities: slow to response and different perspectives	6	75%	2	33%	1	13%	9	41%
• Limited good experts for machine development and technological consultancy	5	63%	3	50%	1	13%	9	41%
• Dishonesty of public staff	3	38%	4	67%	2	25%	9	41%
• No information centre and database	3	38%	1	17%	3	38%	7	32%
• Corruption of public staff and unfair treatment	3	38%	4	67%	0	0%	7	32%
• Less effective training, no specific focus (e.g. too basic, no implementation, no good teaching materials, no good instructors)	2	25%	1	17%	3	38%	6	27%

% = percentage of firms indicate each problem

Table 9.3 Constraints and success factors for GUI network development

Constraints for network development and industrial collaboration		Success factors of universities and research staff for industrial collaboration and networking
From the perspective of public agencies and universities	From the perspective of industry	
• Weak policy measures at middle level • Unclear policy for IP management for industrial development projects • No motivation and incentives for academic staff • Unclear procedure and poor administration for collaborative project • Different point of views and management orientation between academia and business • Strict and inflexible process of public agencies that does not support quick response to the demand of industry	• Discontinuous support for the Thai dessert industry, political conflict, and conflict between public agencies • Government/universities: slow to response and have different perspectives; lack of active support agencies and information centre • Limited good experts for machine development and technological consultancy • Dishonest of public staff including corruption problem and unfair treat • Ineffective short-course training, and no specific focus and actual implementation (e.g. too basic subjects, and lack of on-site implementation, good teaching materials, and good instructors)	• Continuous projects and support for long-term development and innovation; and based on actual need of industry; • Clear action plan, project assessment and follow-up systems in each steps of collaborative projects; • Trustworthiness, patience, commitment and determination of working staff; • Ability to adjust and accept attitude and culture differences among various parties involved in the projects; • Allocation of permanent staff to manage and follow up project progress; and • Professional practices and proactive actions of public staff

The main obstacle is considered to be the non-continuity of support to the Thai dessert industry. The present government has discontinued the operation of TCI, the intermediary agency (TCI) which acts as a cluster development agency for the Thai dessert industry. Even though the government reorganised policy at macro level to promote SMEs as a whole, the direction and interventions at middle level has not been clear and focused enough to impact the Thai dessert industry. Most of the factory-based firms have experienced that some public agencies and universities are slow in responding to the need of industry. Different perspectives between business and academic staff obstruct the development of networks at all stages. Lack of skilled experts to match with firms' technological needs and limited budget also make firms feel that there is no benefit to be derived from forging links with universities and knowledge centres. Moreover, some firms perceived that they were taken advantage of by public agencies and universities, who sometimes take firms' information (e.g. details of products and processes, technological demand) without any quid pro quo – no effective collaboration, no significant outcomes that can translate to innovation capable of being successfully commercialised. Also, training and consultancy services do not focus on long-term development and innovation at the firm level. Many training courses offered by public agencies are more on basic or generic concepts that are not enough to enhance innovativeness of firms.

However, there is some evidence from firms that support the claim that interventions aimed at technological capability development and networking have been successful. Most of the cases rely on the fast response of active actors involved in the projects with clear vision and mutual commitment. This is consistent with the study of UNIDO (1999) that the key for the success of a collaborative project and network development is the people involved in the network, especially service providers. They must have the leverage and skill to perform their roles effectively.

In addition, most of the firms agreed that they would need a ‘network broker’- a person who can help them to connect, communicate with universities and public agencies. Small firms are not often keen to work in collaboration with universities and public agencies; and sometimes it is very difficult to show their real need - for example, development that is less complicated, more economic and cost saving, etc. This is because they do not want to make any conflicts with knowledge sources and support agencies that would make it difficult for them to get any support in the future. The government plays the role of policy regulator and fund provider operating through universities and support agencies. As such, involvement of government with industry is based on a top-down system of communication. Academic and research staff at universities hold budgets to conduct collaborative projects with firms. But for all that, the extent of collaboration has not yet made much headway for university-based research to impact industry at a significant level or get full commitment of industry to the collaborative projects. For collaborative projects to be effective, government and fund providers would need to set up mechanisms for monitoring and identifying the actual needs of industry; and the projects would be required to have long-term objectives to qualify for support. The limited extent of university-industry collaboration is attributed to the prevalence of policy deficiency at macro and middle levels, in that macro policies, in particular, focus not on long term achievements but are rather on a short term pay-offs.

At the middle level, organisation policy is also far from effective, lacking in a clear vision and direction at top management level. This would affect the achievement of GUI collaboration as well as teaching and research excellence at universities. At industrial-wide level, there is often reluctance to fully participate in collaborative projects, largely because the university-industry links are forged based either on personal whims or in a top-down system of communication in which government calls the tune while industry plays the second fiddle. This is reflective of the institutional or organisational bottlenecks constraining the trilateral relationship between government, university and industry. As noted in Chapter 4 of this study, these gaps can be removed over time by the intervention of bridging agencies like ITAP playing the role of a broker facilitating network development and collaboration between public and private sectors.

9.5 The importance of a public intermediary

Public intermediary agencies, like ITAP, play an increasingly significant role matching industry's demand for technologies with existing supplies. Their aim is to positively influence the direction and speed of collaboration between RTOs, universities and potential firms. In developing countries, intermediary or bridging organisations are necessary to interface knowledge sources and firms to expand GUI linkages and networks (Yokakul & Zawdie, 2009). This is because the university in developing countries are at the early stage of transition from the traditional mode to the entrepreneurial mode and they are not as yet keen to transfer, distribute and commercialise their stock of knowledge (Saad et al., 2008).

As mentioned in the three case studies, ITAP offers technological consultancy services to industry. Its aim is to create a network between RTOs, universities, government, and supporting agencies to provide integrated services to industry. As an intermediary agency, ITAP's role is to investigate and solve technical problems including upgrading technologies in firms; and to assist the private sector to search for and acquire appropriate technologies. Even though ITAP operates under the umbrella of a national research centre named NSTDA, its source of experts is not limited to only researchers in NSTDA. In contrast, technology transfer offices under universities and RTOs mainly focus on their organisations and have few links with others.

As intermediary organisations established to promote GUI network development, ITAP assists universities in ITAP network to set up the support procedures they would use when liaising with industrial enterprises. ITAP provides the budget for promoting the university-industry link, as operation of the link calls for employment of project managers and facilitators. ITAP also provides professional training for project managers, facilitators and regional ITAs to perform their intermediary role effectively. Currently, the ITAP network comprises of nine hubs located in regional universities across Thailand. ITAP employs almost 100 full time staffs to coordinate and create GUI links and looks forward to expanding the network with the involvement of more universities.

Apart from the Thai dessert cases, one of the most recent success cases of ITAP is the pioneer project, 'Mapping and matching innovation in selected agro sub-sector'. This is a joint initiative between ITAP and the Thai-German Programme for Enterprise Competitiveness under The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). This project, which is managed by ITAP, calls for pubic-private collaboration of various parties such as universities, government, local authorities and regional producers as demonstrated in Figure 9.10.

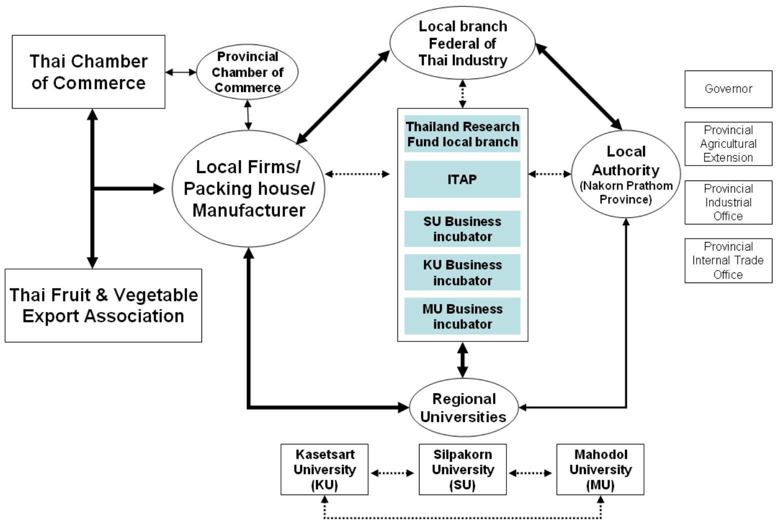

Figure 9.10 Network of regional innovation system for fresh vegetables and fruits
Source: Adapted from NSTDA (2010)

The pilot project which ITAP runs in liaison with universities, local government and NGOs and industrial enterprises, aims to create a routine system to improve regional innovation potentials by matching technological development issues and innovation partners. Success of this project would show the best practice and national guideline for the development of regional innovation system and sub-sectoral innovation system.

From interviews with staff members of the project, it was found that this intervention in industry involving universities and government agencies has certain advantages over previous government projects the actors were involved in. Firstly, the intervention mechanism, procedures and intervention roles were clearly indentified for effective implementation. Secondly, the project focused on skill development and capacity building of intervention teams, because these were the success factors for project accomplishment. Knowledge and experiences from Thai and foreign experts were transferred and circulated in the network. Thirdly, an environment that is conductive to promoting public-private linkages has been created with the aim to make it autonomous in the long run. Lastly, rather than focusing on individual organisations, the project looks at the system and value chains emphasising the interactions and interfaces between each party.

This ITAP and GTZ funded project is a long-term project created by public agencies including universities and government agencies. The above mentioned advantages of the project had increased staff confidences in the project and particularly in its long-term impact.

Intermediary organisations have become a necessity where there is incomplete GUI links, as is the case in many developing countries. Such intermediaries reduce searching and bargaining costs for knowledge source and firms seeking for their potential partnerships (Kodama, 2008). As seen in the above cases, ITAP has been a successful case of intervention initiated by a public organisation at the meso level of the economy. Moreover, they help increase the participation of industry in collaborative projects and their commitments to these, thus making the trilateral network development effective.

9.6 Conclusion

This chapter has discussed the role of an intermediary as an important factor promoting technological development and innovation in the industrial sector. The chapter also shows social capital to be a major factor for effective GUI linkages. The three case studies from the Thai dessert industry bear out points of wider significance for network development, innovation systems and industrial development, particularly at sub-sectoral and sectoral levels.

Trust, an important element of social capital, is crucial for networking among firms; between firms and government agencies; and between firms and academia. Policy would therefore be expected to create the environment that increases trust, entrepreneurship and knowledge sharing and circulation through, for instance, the continued provision of training programmes for SMEs and support for intra- and inter-industry collaboration.

In developing countries, where innovation network and cluster development are patchy, at best, and non-existent, at worst, sub-sectoral innovation networks could be a primary step to strengthen a community network development. Network facilitators who are either government-sponsored or who operate independently are needed in these communities to bridge the gap left by weak GUI links. The intervention of network facilitators is expected to promote the development of entrepreneurship, creativity and social capital among the community of firms. They play a significant role as innovation organisers for communities, acquiring knowledge from outside, and thus acting as ‘gate keepers’ promoting its transfer to members of the community; and building a culture of trust to stimulate interactive learning, creativity and innovation within the network.

Public intermediary plays a crucial role to facilitate GUI link and create environment favourable for efficient technology transfer system and regional development. As seen in the case of ITAP, the major role of intermediary is crucial for initiating the process of collaboration and also for maintaining sufficient support to warrant successful outcomes and long-term development.

CHAPTER 10

Conclusions and Recommendations

The Thai dessert industry has long been perceived as a low-tech industry having little scope for technological capability development and innovation. This view is, however, challenged in this study as being too sweeping to be valid. For a start, the industry is differentiated. Not all firms are the same in size, behaviour and business orientation. The firms in the industry can be broadly classified into three categories: household-based, community-based and factory-based firms.

The growth trajectory and technological development of Thai dessert firms is influenced by a number of factors, of which social capital is considered in this study as being crucial for networking and innovation. Other factors also discussed in this study are competitive pressures, government support, ability to access finance and risk taking behaviour. The study sought to explore the growth and evolution of firms, including empirical factors affecting technological capability development in the Thai dessert industry. The study also examined the extent of these empirical factors, with particular focus on social capital, in each category of firms and showed how it relates to technological capability development. In relation to this, the study attempted to investigate the following issues:

a) the perception profiles of the three categories of firms - namely, household-based, community-based and factory-based firms, in terms of growth of business, and prospects for growth direction;
b) the degree of social capital, competitive pressures, ability to access finance, risk taking profile and government support in the three categories of firms;
c) the comparison on technological capability development and business performances between community-based and factory-based firms;
d) to what extent these empirical factors, particularly social capital, affect technological capability development in the Thai dessert industry; and

e) to what extent the government interventions promote technological development and innovation in the Thai dessert industry

The study employed a questionnaire-based survey and interview to obtain data, and an industrial-wide and a case study method to investigate evidence on issue about social capital, innovation and technological development in the Thai dessert industry.

This chapter is divided into five parts. The first part summarises the key findings of the study. The second part recommendations for future practices. In part three, the thesis proposes future research areas. The fourth part outlines the main contributions of the study to knowledge of both theoretical and practical impart. The chapter concludes in part five.

10.1 Summary of key findings

What is interesting about the industry is the dynamics underlying the 'sociology' and evolution of the firms; and it is in this dynamics that the scope for creativity and innovation turns on. But innovative activities are not evenly distributed across the three categories of firms. The household-based firms are risk averse and are more of 'satisficers' than 'maximizers' in their behaviour. Neither the market nor government support is favourably disposed towards them. They are consequently characteristically traditional and least enterprising and innovative. Those who are exceptions to this rule would be expected to evolve into either community-based firms, which are propped by government support, or factory-based firms, which are essentially market-driven. Theoretically, innovative activities would, for different reasons, be expected to be found in community-based and factory-based firms. Community-based firms are organised through government support as an insurance against factors that forestall innovation. This insurance, it is presumed, occurs mainly in the form of social capital. Social capital is not only an insurance against the risk associated with innovation, but also a catalyst for the emergence of innovative activities. Factory-based firms, on the other hand, thrive on the Schumpeterian ethos of enterprise and competitiveness. The more competitive the market, the more the likelihood for firms to be innovative.

However, as the survey results of this study show, there is no reason to presume social capital to be the preserve of community-based firms and enterprise and competitiveness to be attributes exclusive to factory-based firms. The study, therefore, proceeded by postulating a range of factors to explain the incidence of innovation, and technological capability development and growth of firms in the Thai dessert industry, and to see how different categories of firms perform on this ground. This section summarises three key findings from this thesis – namely, growth of the Thai dessert industry, social capital and innovation, and policy implication.

10.1.1 Growth of the Thai dessert industry

The co-existence of the three categories of firms in the Thai dessert industry suggests scope for the evolution of firms from household to community or factory-based firms, following policy and market stimuli. This study has argued that community-based and factory-based firms are more receptive to new ideas than household-based firms and that the more entrepreneurially oriented firms in the household-based category are likely to evolve into entities corresponding to either the community-based or the factory-based firm categories. The choice of growth trajectories open to household firms is influenced by a number of factors, including: the extent of resource endowment in terms of capital and management skills; individual behaviour and attitudes; perception of market risk; and government policy support. Those firms in the household-based category that are relatively well-placed in terms of capital and management skill endowment would be expected to evolve as factory-based firms. Those firms that are not so well-endowed would be expected to be in the community-based firms or remain frozen where they are if environment does not favour for growth and evolution. Proximity is also important to the formation of community-based firms, which are mostly concentrated or clustered in terms of their geographical distribution.

However, social capital is, in accord with expectation, higher in the community-based firms than in the factory-based firms. Community-based firms are well networked, and this enhances interactive learning within the community of firms, and also the transfer of technological knowledge and management skills from research-based knowledge sources. Nevertheless, community-based firms were not found to be more innovative than factory-based firms. This may be because the intervention mechanism and support from the government are, as many in the interviews pointed out, neither adequate nor consistent enough to promote effective networking that could support firms' capability development for long-term competitiveness.

10.1.2 Social capital and innovation

Innovation involves social processes, and would hardly occur in the absence of social capital based on trust, norms and networks (Ruuskanen, 2004). This study confirms that social capital is important for technological capability development and innovation in SMEs, at least in the case of the Thai dessert industry. This is consistent with the findings of many scholars such as, for example, Cooke and Wills (1999) Tsau and Ghoshal (1998), Westlund (2005), Sahakijpicharn (2007) and UNIDO (2006). This study has empirically established that exposure to new ideas through networking and access to government support would have significant implications for differences among firms in terms of the effectiveness of their management and organisation systems; the quality of their products and services; and the degree of their competitiveness. Networks link firms with knowledge sources; public services and supports; and related firms across business lines. However, it is trust and norms that facilitate network development resulting in greater opportunities to access more resources, such as knowledge and information, finance, public supports etc., necessary for business and innovation performances. Therefore, network based on trust is more effective for long-term relationship and knowledge exchange.

10.1.3 Policy implication

The Thai dessert industry is an indigenous industry which could be considered as a growing industry with potential for innovation. To enhance competitiveness of SMEs through innovation and technological capability development, government intervention in the form of provision of support is considered to be essential. This study has attempted to show the importance of policy interventions to promote social capital and network development leading to inter-industry collaboration; and collaboration with university and government agencies. Results from the study suggest that policy framework should be developed for effective intervention, which is discussed in the next section.

10.2 Recommendations for future practices

This section provides recommendation for future practices to be adopted by the public sector. It addresses policy recommendation for the provision of continual support and integrated services, and practices for the establishment and development of knowledge institutes - e.g. research and technology organisations (RTOs) and universities. Intermediary organisations should be also established to expedite an innovation process.

10.2.1 Provision of continual support and integrated services

Industrial policy should be designed to provide support that would set SMEs on the course of sustainable development. The current proactive of interaction as intended in the case of the Thai dessert industry, is *ad hoc*, casual, inadequate and ineffective. What is called for, as substantiated by the evidence of this study, is a radical departure from this practice. As innovation behaviour varies across industry due to variation in social and cultural context and technological thresholds across industries, interventions should be designed to suit specific industry circumstances. One-size-fits-all policy would be inappropriate. In addition, policy interventions should not be affected by changes of government and political predilections thereof. Indeed, industrial policy should be politically neutral, lest it becomes fragmented, inconsistent and ineffective.

The public provision of integrated services or 'one-stop' services is also very important to reduce transaction cost and time to access public services. This could be done through cooperation and collaboration between public agencies relating to specific industries. Even though a 'one-stop' service approach has been incorporated into the policy framework for many years, it has not been effectively implemented for lack of a coherent implementation mechanism, which is reflected by the prevalence of weak links between public agencies, universities and RTOs.

In addition, interventions should focus on on-site implementation and long-term development programmes involving, for instance, an integrated approach to training, rather than on one-off services and short-term *ad hoc* projects and programmes. To support a wider coverage, the stringency of service regulations for eligibility for public support should be relaxed to include non-registered firms as well. Many Thai dessert firms, particularly those in the informal household sector, have little or no access to finance support from banks and public agencies since they are not formally registered with the government.

10.2.2 Universities and research technology organisations (RTOs)

The cause attributed to the low competitive ranking of Thailand in science and technology infrastructure mainly results from the educational system that is unable to sufficiently provide qualified persons and experts responding to industrial demands of technology (Ellis, 2007). In addition, there has been little interaction between agents of knowledge supply (universities and research institutes) and knowledge demand (industry). Technology transfer offices, established in many universities and RTOs, generally perform by using knowledge generated internally to connect with industry. RTOs, like universities, usually operate in traditional culture based on the principle of ‘technology push’ rather than on consideration of the real needs of industry. On the other hand, industrial and advanced research is aimed to generate applications and commercialisation. Because of resource constraints, R&D in SMEs is generally conducted through external partners such as universities and RTOs. Inter-firm collaboration and networks are limited in developing countries; therefore, universities and RTOs play important role as main sources of knowledge.

While social capital acts as a catalyst promoting activities in innovation system, it is the effectiveness with which the knowledge sector is organised and managed which ultimately counts for the transformation of SMEs into innovative and competitive entities. Given the diversity of the knowledge sector, how should it be organised to make its services to SMEs effective. This should also consider the importance of tacit knowledge as a basis for development, as well as codified knowledge (e.g. food technology, drying technology, sanitary technique, etc.) that is usually transferred from knowledge sources to firms. The integration of tacit and codified knowledge could result in the development of technologies that are suitable for local SMEs. This would call for support of effective acquisition, assimilation and exploitation of knowledge (both at individual and organisational level) leading to innovation.

In addition, to generate one-stop services based on wider knowledge sources, universities and RTOs should act as local hubs incorporated into regional science parks; and cooperating with public agencies other universities and RTOs, and financial agencies to provide fast and effective industrial services. This is the third mission of the 'entrepreneurial university', which is a new challenge for Thai universities to become increasingly competitive through the development of a culture of innovation (Saad et al., 2008). It is therefore important that policy seeks to promote the development of entrepreneurial universities and RTOs as part and parcel of the wider scheme of under-writing technological and innovation development in SMEs.

10.2.3 Public intermediary as a catalyst for innovation process

In developing countries, the persistence of social capital deficit indicates that public intermediaries should be established as a mechanism for promoting network development that helps remove the social capital deficit and other constraints on technology development and innovation in the SME sector. The study of Sahakijpicharn (2007) also suggests that public intermediary is needed to facilitate networking of the Thai SME sectors.

For collaborative projects, lack of good communication between firms and knowledge sources can decrease firms' trust and understanding of objectives that may limit further collaboration. An intermediary agent is an effective mechanism interfacing network participants to smooth communication path that allows correct information flow in the network. It also acts as a third party bridging cultural gaps between academic and industrial perspectives. Intermediaries, like the Industrial Technology Assistance Program (ITAP), can act as a third party in a monitoring system to ensure the success of collaborative projects in which the needs of each party are met. However, there are some areas of development that are open for ITAP to be more effective than hitherto in provision of service to SMEs. The scope for services could be expanded to include small firms that are not formally registered with the government but have the potential for growth and development. This will improve wider coverage of public services for indigenous SMEs like the Thai dessert industry. Moreover, the criteria for financial support should not be limited only to the development of machine prototype, but should cover all activities and resources used for machine development and commercialisation.

In addition, in terms of operation, intermediaries should be free from bureaucratic red tape to be able to respond expeditiously to changes in industrial demand. Whether it is an autonomous agency or under government control, it should be fully and continuously financially supported by the government or other sources of funding. This is because the industrial sector in developing countries in general is hardly in the position to support the development of technology and innovation.

10.3 suggestion for further research

This study has focused on the Thai dessert industry, which is dominated by small scale, labour-intensive firms. The relationship between social capital and technological development explored here at theoretical and empirical levels, can also be considered for other industries. Social network analysis would be useful to determine the relationship and degree of networking between actors in the network. It also helps to explore the effectiveness of intermediary organisations like ITAP acting as interface and nodes to link firms with one another and also firms with public agencies in order to create knowledge flow and collaboration across the network.

There is a broad scope for future research in the area of technological capability development (TCD), particularly on how it can be measured more precisely so that studies comparing firms for their TCD performance can be more effective. This would call for more elaborate data that are capable of bringing out deeper details about relationships underlying the network between firms, knowledge sources and support agencies.

This study has focused on the role of social capital facilitating knowledge transfer and exchange. Future research could be more specific on the integration of tacit knowledge with codified knowledge to better understand the role of knowledge in SME innovation.

In addition, a comparative study of social capital among different countries would provide good information showing how social capital affects technological capability development and innovation under different socioeconomic cultural conditions. This is because social capital building largely involves social interactions, cultures, and traditions that impact on the sociology of firms. Such studies are important to show how the trend of globalisation impacts the relationships between social capital and technological capability development in industry in general, and SMEs, in particular.

This study has provided an extensive background and initial public awareness about the Thai dessert industry in terms of the relationship between social capital and technological capability development. As such, it has provided the basis for further research that would help government, universities and public and private agencies to identify and create efficient intervention mechanisms to promote the growth and development of this industry.

10.4 Contribution to knowledge

This study has contributed to knowledge in four major aspects. Firstly, the empirical research regarding the relationship between social capital and technological development is still small. This study provided substantial evidence giving credence to the view that social capital positively relates to technological development at least in the case of the Thai dessert industry. The study also explored the impact and extent of social capital on technological development in the Thai dessert industry.

Secondly, there is to date no empirical study on technological capability development in the holistic context of the Thai dessert industry. Therefore, this study offers useful information for policy formulation and direction including feedback on government interventions implemented since 2005. Moreover, the study has provided evidence to support that there is a scope for the development of technology and innovation prospect in traditional industries like the Thai dessert industry, in which indigenous knowledge is embedded.

Thirdly, the study provided the conceptual argument that traditional industries are important as a carrier of indigenous knowledge that would be advanced by an infusion of new ideas and modern technology to create appropriate technology or 'disruptive technologies' that are suitable for local use. However, to make this happen, policy interventions are needed to help SMEs to overcome their limitations by improving their capabilities, both knowledge and resourcewise.

Lastly, the study pointed out the importance of intermediary organisations as policy instruments for building up social capital and creating conducive environment for knowledge network development in order to promote technology and innovation in SMEs. Public intermediaries were, however, found wanting in developing countries, like Thailand, and elsewhere in the world where 'social capital deficit' is preponderant.

10.5 Conclusion

This study on the Thai dessert industry shows that if policy interventions have failed to promote innovation networking, it is because of the lack of awareness of public agencies about the full significance of social capital, particularly trust which promotes long-term networking and collaboration.

The experience from the Thai dessert industry suggests that the role of policy interventions and public intermediary is crucial for interfacing and bridging between business and academic perspectives and building social capital base to promote strong and sustainable relationships between all actors in the network. Intermediary organisations connect firms to external sources of knowledge and other support agencies necessary for the innovation process. This would allow indigenous knowledge embedded in traditional firms to blend with modern technologies offering the scope for 'disruptive technology' and innovation. The emergence of intermediaries like ITAP in 2000 shows potential in such organisation to be an effective mechanism for promoting technological capability development and innovation in SMEs in Thailand.

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Appendix 1
Questionnaire survey (English version)

Questionnaire survey for Ph.D. research in innovation and learning & knowledge networking in the Thai dessert industry

Section 1: General information

1.1 Firm category of your business

❍ Household-based business: *running business privately from home (< 10 employees)*
❍ Community-based business: *running business with your local community*
❍ Factory-based business: *running business with more than 10 employees*

1.2 Type of ownership

❍ Single owner ❍ Partnership
❍ Limited partnership
❍ Limited liability company
❍ Other, please specify…………………..

1.3 Main products: …………………………………………………………

1.4 Year of establishment: ………………………
1.5 Province: ………………………………………..

1.6 Registered capital or fixed assets (not including land)

❍ less than 100,000 Baht ❍ 100,000 – 500,000 Baht
❍ 500,000 bath – 1 Million Baht ❍ 1-50 Million Baht
❍ 50 – 200 million bath ❍ More than 200 million bath

1.7 Number of employees: ……. employees
1.8 Number of management: …….persons;
and **number of workers directly engaged production activities: ………………… persons**

1.9 How do you produce all products by yourself?

❍ Produce all ❍ Partly produce ❍ I do not produce. I am a trader.

1.10 What were the reasons for starting the business? (can select more than one number)

❍ Carry on family-owned business ❍ Inspired by parents who own other business
❍ Personal interest ❍ Saw market opportunities
❍ Persuaded by friends ❍ Persuaded by relatives
❍ Inspired by other success business ❍ Other, please specify……………………………

1.11 Sale revenue last year: ………………… Baht **1.12 % profit / total sale:**…………..%

1.13 Production capacity: ……………………../month

Section 2: Firm growth

This section is divided into 3 subsections: household-based, community-based, and factory-based firms. Please answer only one subsection according to your firm category defined in section 1 (question number 1.1)

☐ 2.1 Household-based firm (less than 10 employees)

2.1.1 Do you have a plan to expand business in the future?

☐ **Yes**	☐ **No**
(Please provide reason can select more than 1) ❍ You have the capability and resources to expand the business ❍ Favourable market conditions ❍ Take advantages of the supports received from public agencies (financial and technology supports) ❍ Other, please specify……………………	(Please provide reason can select more than 1) ❍ Satisfied with present level of operation ❍ Afraid of failure and facing high risks ❍ Liquidity problem ❍ Do not have capability enough to cope with complicated and larger system ❍ Other, please specify……………………

2.1.2 Do you participate in your local community business?

☐ **Yes**	☐ **No**
(Please provide reason, can select more than 1) ❍ Participation generates benefits such as information sharing, technology, knowledge transfer and negotiation power ❍ Participation reduces the transactions cost of running business alone ❍ Participation creates opportunities for good business alliances ❍ Participation increases opportunities of supports from public agencies (financial and technological supports) ❍ Participation increases opportunities to expand business and earn more income ❍ Other, please specify………………………………	(Please provide reason, can select more than 1) ❍ No interest ❍ Risk of losing privacy ❍ Difficult to connect with the community business because: …..the process is too bureaucratic …..there is little or nothing known about the community business ❍ Do not see any benefits arising from participation ❍ Other, please specify…………………………… ………………………………………………………..

2.1.3 If you choose to expand your business, which types of business would you like your business to be? ❍ Community-based business ❍ Factory-based business
❍ Other, please specify……………………………………………………

❒ 2.2 Community-based firm

2.2.1 Did you start this business as a community-based firm at the beginning?
❍ Yes
❍ No, what did you do before stating the current business with the community?
❍ Household-based firm ❍ Factory-based firm
❍ Other, please identify……………………………………………………..

2.2.2 Would you like to continue running your business on a community-based firm lines indefinitely? ❍ Yes ❍ No ❍ Expand to factory-based firm
❍ Other, please identify……………………………………………………..

❒ 2.3 Factory-based firm

2.3.1 What did you do before starting the current business as a factory-based enterprise?
❍ Household-based business ❍ Community-based business
❍ Other, please specify…………………………………………………………………..

2.3.2 Do you currently join your local business community?
❍ No
❍ Yes. If yes, what was the main reason to participate your local business community?
……..

Section 3: Current business status and business perception

3.1 What do you think about your business' current status with respect to:

3.1.1) Growth of business?
❑ Higher than what you had expected before starting business
❑ Lower than what you had expected before starting business
❑ Same as what you had expected before starting business

3.1.2) Risk and uncertainty underlying business?
❑ Higher than what you expected before starting business
❑ Lower than what you expected before starting business
❑ Same as what you had expected before starting business

3.1.3) Your business as a "Going Concern"?
❑ Niche market
❑ Declining market
❑ Not stable and change over time, trying hard to survive

3.2 Overall, what do you feel about the current business condition in terms of your company's growth? (Please select only one choice)

- ❑ Really satisfied
- ❑ Satisfied up to a certain level but would need some changes
- ❑ Dissatisfied and need to see changes

3.3 Please indicate your level of agreement with the following statements, in the scale of 1 to 5	Strongly disagree ←				→ Strongly agree
1) Running community-based business is more secure than running as a factory-based business alone.	1	2	3	4	5
2) Running community-based business has more benefit than running as a factory-based business such as information sharing, technology, knowledge transfer	1	2	3	4	5
3) Running community-based business has less transaction cost than running as a factory-based business	1	2	3	4	5
4) Running community-based business saves more time to find and create business networks and alliances than running as a factory-based business	1	2	3	4	5
5) Running community-based business has more power to negotiation with other parties than running factory-based business	1	2	3	4	5
6) Running factory-based business has higher income than running community-based business	1	2	3	4	5

3.4 Please indicate the level of agreement to the following statements regarding business risk and uncertainty in the scale of 1 to 5	Strongly disagree ←				→ Strongly agree
1) There is great uncertainty when predicting how successful your new product will be when introduced to the market.	1	2	3	4	5
2) Prevailing financial conditions do not favour business operation (access of fund, liquidity problem etc.)	1	2	3	4	5
3) The overall risk of starting a new business or investing in expanding current business is very high.	1	2	3	4	5
4) In your search for opportunities, you favour bold decisions despite the riskiness or uncertainty of the outcomes they involve.	1	2	3	4	5
5) You prefer to do business in an environment that you are familiar with rather than take risks in a new environment.	1	2	3	4	5
6) You approve new projects on a 'stage-by-stage' basis rather than with 'blanket' approval.	1	2	3	4	5
7) You view business-related risk as a situation to be avoided at all cost	1	2	3	4	5
8) In making decisions, you tend to focus on investments that have low risk	1	2	3	4	5
9) If a new technology/machine is introduced to you as being good and efficient, you will not hesitate to purchase it and use it.	1	2	3	4	5
10) If your business makes a large profit, you would consider to expand business or invest elsewhere.	1	2	3	4	5

Section 4: Social capital (trust, norms, linkage/network and interactive learning)

4.1 How many organisations/firms/individuals do you have networks with?	Number
1) Firms within the same industry	
2) Your supply chain	
3) Government agencies	
4) Universities or academic institutes	
5) Research and technology organisations	
6) Intermediary and bridging organisations for promoting technology and innovation such as association, non-profit and non-government organisations that facilitate co-operation and coordination between industry, academia and government	
7) Firms owned by friends	
8) Firms owned by relatives	
9) Firms owned by family	

4.2 Please indicate the level of trust you have for the following organisations/firms/individuals you are having business links with, in the scale of 1 to 5	Minimum trust				Maximum trust
1) Firms within the same industry	1	2	3	4	5
2) Your supply chain	1	2	3	4	5
3) Government agencies	1	2	3	4	5
4) Universities or academic institutes	1	2	3	4	5
5) Research and technology organisations	1	2	3	4	5
6) Intermediary and bridging organisations for promoting technology and innovation such as association, non-profit and non-government organisations that facilitate co-operation and coordination between industry, academia and government	1	2	3	4	5
7) Firms owned by friends	1	2	3	4	5
8) Firms owned by relatives	1	2	3	4	5
9) Firms owned by family	1	2	3	4	5

4.3 How often do you contact organisations in the following categories with which you have links?	Rarely	Quarterly	Monthly	Weekly	Daily
1) Firms in the same industry					
2) Firms in your supply chain					
3) Government agencies					
4) Universities or academic institutes					
5) Research and technology organisations					
6) Intermediaries for promoting technology and innovation such as industrial association, non-profit and non-government agencies that facilitate co-operation and coordination between industry, academia and government					
7) Firms owned by friends					
8) Firms owned by relatives					
9) Firms owned by family					

4.4 Please indicate level of agreement of the following statements regarding relationship with firms/organisations/individuals that you have linkages and networks with, in the scale of 1 to 5	Strongly disagree				Strongly agree
1) You have a good working relationship with government agencies, academics or other agencies relating technology development.	1	2	3	4	5
2) You have extensive and close relationship with financial institutions.	1	2	3	4	5
3) You have extensive and close relationship with firms/individuals in your supply chain.	1	2	3	4	5
4) The people in your network are generally trustworthy and honest with you.	1	2	3	4	5
5) Your business partners in the network that have made transactions with you never act opportunistically	1	2	3	4	5
6) Individuals/organisations in the network are useful in helping you solve business and technological problems.	1	2	3	4	5
7) You would be willing to help them solve their problems upon their requests	1	2	3	4	5
8) You are willing to share business information with those in your network.	1	2	3	4	5
9) Information received from your partners in the network is usually useful and credible.	1	2	3	4	5
10) You exchange information with firms/organisations/individuals in the network frequently	1	2	3	4	5
11) Your participation in the network helps your company reduce cost of searching information about market, products, suppliers and buyers	1	2	3	4	5
12) Your business partners usually repeat their transactions with you	1	2	3	4	5
13) You are often actively engaged in extending your network	1	2	3	4	5
14) To establish trust in a business relationship, it is important that a person is your kin or relative or comes from around your native area.	1	2	3	4	5
15) It becomes easier to trust strangers introduced to you by someone who you have already known and trusted.	1	2	3	4	5
16) Satisfactory business can be conducted with someone who is neither a relative nor a friend.	1	2	3	4	5

Section 5: Competitive pressure

5.1 Please indicate your level of agreement with the following statements regarding the competitive pressure on your business in the scale of 1 to 5	Strongly disagree				Strongly agree
1) There are many new competitors entering the market.	1	2	3	4	5
2) Your competitors always introduce new products or better quality of products into the market	1	2	3	4	5
3) Your business is well positioned to negotiate with suppliers on price, volume, delivery, etc.	1	2	3	4	5
4) There are many products in the market which customers can choose as substitutes to your products	1	2	3	4	5
5) Competition is sharp with respect to:					
5.1 Price	1	2	3	4	5
5.2 Quality	1	2	3	4	5
5.3 Volume and lead time	1	2	3	4	5
5.4 Package	1	2	3	4	5
5.5 Promotion and advertisement	1	2	3	4	5
6) It is hard to keep employees and qualified workers because of poaching by competitors	1	2	3	4	5

5.2 You consider that the competition you are facing is more of a threat than an opportunities	1	2	3	4	5

Section 6: Performance of technology and innovation capability development

6.1 Please indicate your level of improvement regarding the technological capability development of your company over last 3 years, in the scale of 1 to 5	No improvement ←				→ Significant improvement
1) To what extent has your company improved its production capability (being effective and efficient with the use of existing facilities)?	1	2	3	4	5
2) To what extent has your company improved investment capability both general and technological investment (making the right investment choices and expanding business in the right or profitable direction)?	1	2	3	4	5
3) To what extent has your company improved research and development (R&D) activities either independently or in concert with others (both formal and informal)?	1	2	3	4	5

6.2 Product innovation

6.2.1 Number of improved products launched over last 3 years ………products

6.2.2 Number of new products introduced to the market over last 3 years ………products

6.2.3 Number of new packages introduced to the market over last 3 years ………packages

6.3 Process innovation

6.3.1 Number of improved production processes over last 3 years ………processes

6.3.2 Number of new production processes over last 3 years ………processes

6.4 Organisational innovation

Does your company apply business or quality management systems such as ISO 9001, ISO 14000, GMP, HACCP, GHP or other relating systems? ❍ No ❍ Yes, please specify………………………………

6.5 Marketing innovation

6.5.1 Does your company engage in campaigns/promotion to find new markets? ❍ No

❍ Yes, please specify ⟶ ❒ Food fair ❒ New market place

❒ Open new shop in department store

❒ Product promotion ❒ Pricing ❒ New brand

❒ Other, please specify………………………………

6.5.2 Do you have your own registered trademarks/brand names?

❍ No ❍ Yes, please specify number of trademarks/brand names……..……………………..

6.6 Business performance indicators regarding activities over last three years	Decrease		Equal	Increase	
	> 50%	1-50%		1-50%	>50%
1) Average percentage of total sale/turnover	1	2	3	4	5
2) Average percentage of total employee	1	2	3	4	5
3) Average percentage of total profit	1	2	3	4	5
4) Average percentage of market expansion	1	2	3	4	5
5) Average percentage of total export	1	2	3	4	5
6) Average percentage of science, technology and technical staff	1	2	3	4	5

6.7 Do your products certified formal product standard (Thai FDA) or community product standard? ❒ Yes ❒ No

6.8 Does your company get any rewards/prizes for product or business excellence?

❒ No ❒ Yes, please specify ⟶ ❍ OTOP 5 stars ❍ OTOP 4 stars ❍ OTOP 3 stars or less

❍ Other, please specify ……………………………………….

6.9 Percentage of current export ………..% (Please specify countries……………..………………...)

6.10 Do you engage in production as a subcontractor? ❍ Yes ❍ No

6.11 Please indicate your level of agreement with the following statements regarding the technological changes in your company in the scale of 1 to 5	Strongly disagree ⟵				⟶ Strongly agree
1) Your business has institutional mechanism or an established practice to obtain new technology information in the relevant fields.	1	2	3	4	5
2) You are comfortable with the continued use of existing facilities and would not be keen to make any changes to existing practices	1	2	3	4	5
3) You always benchmark your production capability or product quality with competitors or business alliances	1	2	3	4	5

Section 7: Government policy initiatives

7.1 To what extent has your company received benefit from the following government initiatives (Please indicate the level of benefit/impact in the scale of 1 to 5)	No benefit /impact ⟵				⟶ High benefit/ impact
1) Developing and strengthening linkages and network for cooperation of government, university and industry	1	2	3	4	5
2) Establishing industrial consultancy service centres, which may locate in university, government agency or individual organisation (NGO, industrial association etc.)	1	2	3	4	5
3) Improving funding support conditions for SME technological and innovation development	1	2	3	4	5
4) Promoting incentives for SME technological and innovation development - such as tax reduction, BOI incentives, export product and import machine incentives, etc.	1	2	3	4	5
5) Supporting local and community products or OTOP	1	2	3	4	5
6) Promoting and supporting intellectual property right protection	1	2	3	4	5
7) Providing and support community learning centres	1	2	3	4	5
8) Providing skill development through short courses, training courses for quality management, food safety and other skill development for food industry including technology trips	1	2	3	4	5
9) Establishing integrated, one-stop services from related public agencies for industrial technology development	1	2	3	4	5
10) Direct support for technological capability development and innovation from government and public agencies	1	2	3	4	5

Section 8: Access to finance

Please indicate your level of agreement with the following statements regarding the financial status of your business over the last 3 years in the scale of 1 to 5	Strongly disagree ⟵				⟶ Strongly agree
8.1 The liquidity position of your business has improved	1	2	3	4	5
8.2 Financial sources					
8.2.1 Your business received financial support from government for technology development and innovation	1	2	3	4	5
8.2.2 Your business has accessed low interest loans and grants from financial institutes	1	2	3	4	5
8.2.3 Your business has accessed normal loans from financial institututes	1	2	3	4	5

Please briefly provide your suggestion about how the government can effectively create a network including interactive links between industry, research units and public agencies that would help promote technological capability development and innovation in the Thai dessert industry.

……

……

Thank you very much for your kind co-operation

Appendix 2
Questionnaire survey (Thai version)

แบบสอบถามเรื่องการสร้างเครือข่าย การพัฒนาเทคโนโลยีและนวัตกรรม
และการเติบโตของอุตสาหกรรมขนมไทย ประจำปี 2552

ส่วนที่ 1 ข้อมูลทั่วไปของธุรกิจ/กิจการ

1.1 **ลักษณะทั่วไปของกิจการ** ❍ อุตสาหกรรมในครัวเรือน มีคนทำงานน้อยกว่า 10 คน ❍ อุตสาหกรรมชุมชน เช่น กลุ่มสหกรณ์ กลุ่มแม่บ้าน ฯลฯ ❍ อุตสาหกรรมขนาดเล็กและขนาดกลาง (พนักงานเกิน 10 คน)	1.2 **ประเภทของกิจการ** ❍เจ้าของคนเดียว ❍หุ้นส่วน ❍ห้างหุ้นส่วนจำกัด ❍ บริษัทจำกัด ❍อื่นๆ โปรดระบุ..
1.3 **ผลิตภัณฑ์หลัก**	1.4 **ปีที่ก่อตั้งกิจการ พ.ศ.** .... 1.5 **จังหวัดที่ดำเนินกิจการ** ....

1.6 **ทุนจดทะเบียน หรือสินทรัพย์ถาวร (ถ้าเป็นนิติบุคคล)**

❍น้อยกว่า 1 แสนบาท ❍1 แสน – 5 แสนบาท ❍5 แสน – 1 ล้านบาท

❍1 ล้าน – 50 ล้านบาท ❍ 50 ล้าน -200 ล้านบาท ❍มากกว่า 200 ล้านบาท

1.7 **จำนวนพนักงานทั้งหมด** ....**คน**

1.8 **ผู้บริหาร.............คน และพนักงานที่เกี่ยวข้องโดยตรงกับการผลิต...........คน**

1.9 **กิจการของท่านผลิตสินค้า/ผลิตภัณฑ์หลักเองหรือไม่**

❍ผลิตเองทั้งหมด ❍ผลิตเองบางส่วน ❍ไม่ได้ผลิตเอง (ซื้อมา-ขายไป)

1.10 **เหตุผลในการประกอบธุรกิจของท่าน (เลือกได้มากกว่า 1 ข้อ)**

❍สานต่อธุรกิจของครอบครัว ❍ได้แรงบันดาลใจจากบิดาหรือมารดาที่ดำเนินธุรกิจอื่นอยู่แล้ว

❍เป็นความสนใจส่วนตัว ❍เห็นโอกาสในการประกอบธุรกิจ

❍ถูกชักชวนโดยเพื่อน ❍ถูกชักชวนโดยญาติ

❍ได้แรงบันดาลใจจากธุรกิจของคนอื่นที่ประสบความสำเร็จ ❍อื่นๆ โปรดระบุ...

1.11 **ยอดขายโดยประมาณในปีที่ผ่านมา...................................บาท** 1.12 **%กำไรต่อยอดขายโดยประมาณ.............%**

1.13 **กำลังการผลิตโดยเฉลี่ยต่อเดือน..**

ส่วนที่ 2 การเติบโตของธุรกิจ

ในส่วนที่สองนี้แบ่งเป็นสามส่วนย่อย ตามลักษณะของกิจการ ได้แก่ อุตสาหกรรมในครัวเรือน อุตสาหกรรมชุมชน และอุตสาหกรรมขนาดเล็กและขนาดกลาง กรุณาเลือกตอบเพียงข้อเดียวตามลักษณะกิจการของท่านที่ระบุไว้ในข้อ 1.1

❑**2.1 อุตสาหกรรมในครัวเรือน (มีคนงานน้อยกว่า 10 คน)**

2.1.1 **ท่านคิดที่จะขยายกิจการของท่านในอีก 5 ปีข้างหน้านี้หรือไม่**

❑ ต้องการขยาย เนื่องจาก.... (เลือกได้มากกว่า 1 ข้อ) ❍ท่านมีความสามารถและทรัพยากรพอที่จะขยายกิจการ ❍สภาพตลาดเอื้ออำนวยต่อการขยายกิจการ ❍มีโอกาสได้รับการสนับสนุนจากหน่วยงานรัฐบาล และ สถาบันการเงิน ในด้านการเงิน และเทคโนโลยี ❍อื่นๆ โปรดระบุ...	❑ ไม่ต้องการขยาย เนื่องจาก.... (เลือกได้มากกว่า 1 ข้อ) ❍พึงพอใจกับการดำเนินกิจการในปัจจุบัน ❍มีความเสี่ยงสูง และธุรกิจอาจไม่ประสบความสำเร็จ ❍มีปัญหาด้านสภาพคล่องทางการเงิน ❍ไม่มีความสามารถและทรัพยากรเพียงพอที่จะขยายกิจการ ❍อื่นๆ โปรดระบุ..

2.1.2 ปัจจุบันท่านได้เข้าร่วมธุรกิจกับกลุ่มอุตสาหกรรมชุมชนหรือไม่ (หากท่านมีกิจกรรมดังต่อไปนี้แค่เพียง 1 ข้อ จะถือว่าท่านมีการเข้าร่วมฯ ได้แก่ การร่วมใช้พื้นที่ผลิต หรือค้าขาย หรือมีการร่วมลงทุน ร่วมหุ้น หรือมีความสัมพันธ์กันในเชิงกลุ่ม เป็นต้น)

❑ เข้าร่วม เนื่องจาก.... (เลือกได้มากกว่า 1 ข้อ) ❍ ท่านได้รับประโยชน์มากขึ้น เช่นการแบ่งปันข้อมูลทางธุรกิจ/ด้านเทคโนโลยี และเพิ่มอำนาจต่อรองกับหน่วยงานอื่นๆ ❍ ลดต้นทุนในการติดต่อประสานงานทางธุรกิจ การหาข้อมูลด้านการตลาด การติดต่อลูกค้า และผู้ขายวัตถุดิบ ฯลฯ ❍ เพิ่มโอกาสในการสร้างพันธมิตรทางธุรกิจที่ดีได้ ❍ เพิ่มโอกาสได้รับการสนับสนุนจากหน่วยงานรัฐบาล และสถาบันการเงิน (สนับสนุนด้านการเงิน และเทคโนโลยี) ❍ เพิ่มโอกาสในการขยายธุรกิจ และมีรายได้เพิ่มขึ้น ❍ อื่นๆ โปรดระบุ...	❑ ไม่เข้าร่วม เนื่องจาก.... (เลือกได้มากกว่า 1 ข้อ) ❍ ไม่มีความสนใจ ❍ ขาดความเป็นส่วนตัว ❍ ลำบากที่จะติดต่อกลุ่มธุรกิจชุมชน เนื่องจาก ☐ มีกระบวนการที่ยุ่งยาก ซับซ้อน ☐ ไม่รู้ข้อมูลเกี่ยวกับอุตสาหกรรมชุมชน หรือรู้เพียงเล็กน้อย ❍ ไม่เห็นประโยชน์ใดๆ ในการเข้าร่วม ❍ อื่นๆ โปรดระบุ... ....

2.1.3 หากท่านมีเงินทุนมากพอ และต้องการขยายกิจการ ท่านต้องการให้กิจการเป็นไปในรูปแบบใด

❍ กิจการแบบอุตสาหกรรมชุมชน ❍ ขยายเป็นโรงงานดำเนินการเอง ❍ อื่นๆ โปรดระบุ..

☐ 2.2 อุตสาหกรรมชุมชน เช่นกลุ่มสหกรณ์ กลุ่มแม่บ้าน หรือรูปแบบอื่น ๆที่เกี่ยวข้อง

2.2.1 กิจการของท่านเป็นแบบอุตสาหกรรมชุมชนตั้งแต่เริ่มต้นกิจการหรือไม่ ❍ ใช่ ❍ ไม่ใช่

หาก**<u>ไม่ใช่</u>** ก่อนหน้านี้กิจการของท่านเป็นลักษณะใด
❒ อุตสาหกรรมในครัวเรือน/ขนาดเล็ก
❒ กิจการที่มีคนงานมากกว่า 10 คน
❒ อื่นๆ โปรดระบุ ....

2.2.2 ท่านต้องการประกอบกิจการในรูปแบบอุตสาหกรรมชุมชนต่อเนื่องไปเรื่อย ๆ อย่างไม่มีกำหนดหรือไม่

❍ ใช่ ❍ ไม่ใช่ ❍ ขยายเป็นโรงงาน ❍ อื่นๆ โปรดระบุ..

☐ 2.3 อุตสาหกรรมขนาดเล็กและขนาดกลาง

2.3.1 ก่อนหน้าที่ท่านจะเริ่มเป็นกิจการขนาดเล็กและกลาง ท่านดำเนินกิจการนี้ในลักษณะใดมาก่อน

❍ อุตสาหกรรมในครัวเรือน ❍ กลุ่มอุตสาหกรรมชุมชน ❍ อื่นๆ โปรดระบุ…………………………....

2.3.2 ปัจจุบันท่านได้ดำเนินธุรกิจร่วมกับอุตสาหกรรมชุมชนหรือไม่

❍ ไม่ใช่ ❍ ใช่ กรุณาระบุเหตุผลหลักที่ท่านเข้าร่วมธุรกิจกับอุตสาหกรรมชุมชน …..……………………………..

<u>ส่วนที่ 3</u> มุมมองการดำเนินธุรกิจในอดีตและปัจจุบัน

3.1 ท่านมีมุมมองอย่างใดบ้างเกี่ยวกับกิจการในปัจจุบันของท่านในเรื่องต่าง ๆ ดังต่อไปนี้

3.1.1 การเติบโตของกิจการของท่านในปัจจุบัน

❍ เติบโต**<u>มากกว่า</u>**ที่ท่านคาดหวังไว้ในช่วงแรก
❍ เติบโต**<u>น้อยกว่า</u>**ที่ท่านคาดหวังไว้ในช่วงแรก
❍ เติบโต**<u>เท่ากันกับ</u>**ที่ท่านคาดหวังไว้ในช่วงแรก

3.1.2 ความเสี่ยงและความไม่แน่นอนในการดำเนินธุรกิจในปัจจุบัน

❍ **<u>มากกว่า</u>**ที่ท่านคิดไว้ไว้ในช่วงแรก
❍ **<u>น้อยกว่า</u>**ที่ท่านคิดไว้ไว้ในช่วงแรก
❍ **<u>เท่ากันกับ</u>**ที่ท่านคิดไว้ไว้ในช่วงแรก

3.1.3 กิจการของท่านในปัจจุบันอยู่ในสภาพใด

❍ มีตลาดกลุ่มเฉพาะ (Niche market) ❍ ตลาดกำลังถดถอย ความต้องการสินค้าของท่านในตลาดลดลง

❍ ตลาดผันผวน ไม่คงที่ และเปลี่ยนแปลงตามเวลา ท่านต้องพยายามอย่างมากที่จะอยู่รอดในธุรกิจนี้

3.2 โดยภาพรวมท่านพึงพอใจกับการเติบโตของกิจการของท่านหรือไม่

❍ พึงพอใจมาก ❍ พึงพอใจในระดับหนึ่ง แต่อาจจะต้องการปรับปรุง เปลี่ยนแปลงบ้าง

❍ ไม่พึงพอใจ และต้องการปรับปรุง เปลี่ยนแปลง

กรุณาวงกลมเลข 1 – 5 ตามความคิดเห็นของท่านที่มีต่อข้อความต่างๆ ในข้อ 3.3 และ 3.4
โดยที่ 1 = ไม่เห็นด้วยอย่างยิ่ง และ 5 = เห็นด้วยอย่างยิ่ง

3.3 **ท่านเห็นด้วยหรือไม่เห็นด้วยกับข้อความต่อไปนี้ ที่เกี่ยวข้องกับการดำเนินธุรกิจแบบกลุ่มอุตสาหกรรมชุมชน และการตั้งโรงงานทำธุรกิจเอง**	ไม่เห็นด้วยอย่างยิ่ง				เห็นด้วยอย่างยิ่ง
1) ทำธุรกิจร่วมกับอุตสาหกรรมชุมชนมีความมั่นคง ปลอดภัย มากกว่าการตั้งโรงงานทำธุรกิจเอง	1	2	3	4	5
2) ทำธุรกิจร่วมกับอุตสาหกรรมชุมชนได้รับผลประโยชน์มากกว่าการตั้งโรงงานทำธุรกิจเอง เช่นการแบ่งปันข้อมูลข่าวสาร การแบ่งปันข้อมูลด้านเทคโนโลยี และการถ่ายทอดเทคโนโลยี	1	2	3	4	5
3) ทำธุรกิจร่วมกับอุตสาหกรรมชุมชนมีต้นทุนในการค้นหาข้อมูลด้านการตลาด และต้นทุนการดำเนินธุรกิจที่ต่ำกว่าการตั้งโรงงานทำธุรกิจเอง	1	2	3	4	5
4) ทำธุรกิจร่วมกับอุตสาหกรรมชุมชนช่วยให้ประหยัดเวลาในการสร้างเครือข่าย และพันธมิตรทางธุรกิจดีกว่าการตั้งโรงงานทำธุรกิจเอง	1	2	3	4	5
5) ทำธุรกิจร่วมกับอุตสาหกรรมชุมชนมีพลังในการเจรจาต่อรองกับผู้ซื้อ ผู้ขาย และหน่วยงานต่างๆ มากกว่าการตั้งโรงงานทำธุรกิจเอง	1	2	3	4	5
6) การตั้งโรงงานทำธุรกิจเองมีรายได้มากกว่าทำธุรกิจร่วมกับกลุ่มอุตสาหกรรมชุมชน	1	2	3	4	5

3.4 **ท่านเห็นด้วยหรือไม่เห็นด้วยอย่างไรกับข้อความต่อไปนี้ที่เกี่ยวข้องกับความเสี่ยงและความไม่แน่นอนในการดำเนินธุรกิจ**	ไม่เห็นด้วยอย่างยิ่ง				เห็นด้วยอย่างยิ่ง
9) มีความไม่แน่นอนสูงในการคาดการณ์ว่าผลิตภัณฑ์ใหม่ของท่านจะประสบความสำเร็จในตลาด	1	2	3	4	5
10) สภาพทางการเงินโดยทั่วไปมักไม่เอื้ออำนวยต่อการดำเนินธุรกิจ เช่น การเข้าถึงแหล่งเงินทุน ปัญหาการขาดสภาพคล่อง เป็นต้น	1	2	3	4	5
11) โดยรวมแล้วมีความเสี่ยงสูงในการเริ่มดำเนินธุรกิจใหม่ หรือขยายกิจการ	1	2	3	4	5
12) ในการแสวงหาโอกาสทางธุรกิจ ท่านชอบการตัดสินใจครั้งใหญ่ แม้ว่าจะมีความเสี่ยงและความไม่แน่นอนเกิดขึ้นกับผลลัพธ์ที่เกิดขึ้น	1	2	3	4	5
13) ท่านพึงพอใจในการดำเนินธุรกิจที่ท่านคุ้นเคยกับสภาพแวดล้อมเดิม มากกว่าการทำธุรกิจในสภาพแวดล้อมใหม่ๆ ที่ท่านไม่คุ้นเคย	1	2	3	4	5
14) ท่านมีการตัดสินใจอนุมัติงบประมาณโครงการใหม่ที่ละขั้นตามความก้าวหน้าของงาน มากกว่าที่จะอนุมัติงบประมาณทีเดียวทั้งโครงการในตอนแรก	1	2	3	4	5
15) ท่านคิดว่าธุรกิจที่เกี่ยวข้องกับความเสี่ยงเป็นสิ่งที่ต้องหลีกเลี่ยงอย่างเด็ดขาด	1	2	3	4	5
16) การตัดสินใจลงทุนของท่านมีแนวโน้มที่จะมีความเสี่ยงต่ำ	1	2	3	4	5
17) หากมีการแนะนำเทคโนโลยีใหม่หรือเครื่องจักรใหม่ที่ดีและมีประสิทธิภาพ ท่านไม่ลังเลที่จะซื้อหามาปรับใช้ในธุรกิจของท่าน	1	2	3	4	5
10) หากธุรกิจของท่านสร้างผลตอบแทนได้สูง ท่านคิดขยายธุรกิจหรือนำเงินไปลงทุนในเรื่องอื่นเพิ่มเติม	1	2	3	4	5

<u>ส่วนที่ 4</u> ความสัมพันธ์ พันธมิตรการดำเนินธุรกิจ ความไว้เนื้อเชื่อใจ และการแบ่งปันข้อมูลความรู้

4.1 ธุรกิจของท่านมีความสัมพันธ์หรือสนิทกับ บุคคล/บริษัท/องค์กรต่างๆ ดังต่อไปนี้เท่าใด (โปรดระบุจำนวน)

1) บริษัทในธุรกิจเดียวกัน.......... 2) ผู้ส่งมอบ ผู้ขายวัตถุดิบ .... 3) ลูกค้า.......................

4) หน่วยงานรัฐบาล............. 5) มหาวิทยา สถาบันการศึกษา............ 6) สถาบันวิจัย...............

7) องค์กรกลางสนับสนุน และสร้างเครือข่ายการพัฒนาเทคโนโลยีในภาคอุตสาหกรรม เช่น สมาคมอุตสาหกรรม องค์กรไม่แสวงหาผลกำไร องค์กรอิสระ หอการค้า อุตสาหกรรมจังหวัด ฯลฯ ซึ่งประสานงานระหว่างภาครัฐ ภาคการศึกษา และภาคอุตสาหกรรม ……………………………..

8) ธุรกิจที่จัดตั้งโดยเพื่อน............................ 9) ธุรกิจที่จัดตั้งโดยญาติที่ไม่ใช่พี่น้องหรือบุคคลในครอบครัว………………..

10) ธุรกิจที่จัดตั้งโดยบุคคลในครอบครัว...............................

<u>**เครือข่าย**</u> หมายถึง บุคคล/บริษัท/องค์กร ที่ท่านรู้จัก สนิทสนม และมีความสัมพันธ์ที่ดีด้วยอย่างเป็นทางการ และไม่เป็นทางการ

4.2 ท่านไว้ใจ เชื่อใจบุคคล/บริษัท/องค์กรที่ท่านรู้จัก หรืออยู่ในเครือข่ายทางธุรกิจมากน้อยเพียงใด	ไว้ใจน้อยที่สุด ⟷				ไว้ใจมากที่สุด
1) บริษัทในธุรกิจเดียวกัน	1	2	3	4	5
2) ผู้ส่งมอบ ผู้ขายวัตถุดิบ ลูกค้า	1	2	3	4	5
3) หน่วยงานรัฐบาล	1	2	3	4	5
4) มหาวิทยาลัย สถาบันการศึกษา	1	2	3	4	5
5) สถาบันวิจัย	1	2	3	4	5
6) องค์กรกลางสนับสนุน และสร้างเครือข่ายการพัฒนาเทคโนโลยีในภาคอุตสาหกรรม เช่นสมาคมอุตสาหกรรม องค์กรไม่แสวงหาผลกำไร องค์กรอิสระ ฯลฯ ซึ่งคอยเชื่อมโยงระหว่างภาครัฐ ภาคการศึกษา และภาคอุตสาหกรรม	1	2	3	4	5
7) ธุรกิจที่จัดตั้งโดยเพื่อน	1	2	3	4	5
8) ธุรกิจที่จัดตั้งโดยญาติที่ไม่ใช่พี่น้องหรือบุคคลในครอบครัว	1	2	3	4	5
9) ธุรกิจที่จัดตั้งโดยบุคคลในครอบครัว (พี่ น้อง บิดา มารดา)	1	2	3	4	5

4.3 ท่านพบปะ ติดต่อกับบุคคล/บริษัท/องค์กร เหล่านี้บ่อยเพียงใด	**ไม่บ่อย**	**ทุก 3 เดือน**	**ทุกเดือน**	**ทุกสัปดาห์**	**ทุกวัน**
1) บริษัทในธุรกิจเดียวกัน					
2) ผู้ส่งมอบ ผู้ขายวัตถุดิบ ลูกค้า					
3) หน่วยงานรัฐบาล					
4) มหาวิทยาลัย สถาบันการศึกษา					
5) สถาบันวิจัย					
6) องค์กรกลางสนับสนุน และสร้างเครือข่ายการพัฒนาเทคโนโลยีในภาคอุตสาหกรรม เช่นสมาคมอุตสาหกรรม องค์กรไม่แสวงหาผลกำไร องค์กรอิสระ ฯลฯ ซึ่งคอยเชื่อมโยงระหว่างภาครัฐ ภาคการศึกษา และภาคอุตสาหกรรม					
7) ธุรกิจที่จัดตั้งโดยเพื่อน					
8) ธุรกิจที่จัดตั้งโดยญาติที่ไม่ใช่พี่น้องหรือบุคคลในครอบครัว					
9) ธุรกิจที่จัดตั้งโดยบุคคลในครอบครัว					

4.4 **ท่านเห็นด้วยหรือไม่เห็นด้วยกับข้อความต่อไปนี้ในเรื่อง ความสัมพันธ์ของท่านกับบุคคล/บริษัท/องค์กรที่ท่านหรือธุรกิจของท่านรู้จักสนิทด้วย (เครือข่าย)**	ไม่เห็นด้วยอย่างยิ่ง				เห็นด้วยอย่างยิ่ง
1) ท่านมีความสัมพันธ์ที่ดีในการทำงานกับหน่วยงานรัฐบาล สถาบันการศึกษา หรือหน่วยงานอื่นๆ ที่เกี่ยวข้องกับการพัฒนาเทคโนโลยีและนวัตกรรมในภาคอุตสาหกรรม	1	2	3	4	5
2) ท่านมีความสัมพันธ์ที่ดีกับสถาบันการเงินหลายแห่ง	1	2	3	4	5
3) ท่านมีความสัมพันธ์ที่ดีกับบริษัท/บุคคลจำนวนมาก ที่เป็นลูกค้า ผู้ส่งมอบ และผู้ขายวัตถุดิบ หรือพันธมิตรทางธุรกิจของท่าน	1	2	3	4	5
4) บุคคลที่ท่านรู้จักที่อยู่ในเครือข่ายของท่านเป็นคนที่มีความซื่อสัตย์ และจริงใจ					
5) ลูกค้าและผู้ส่งมอบ หรือพันธมิตรทางธุรกิจของท่านไม่เคยฉวยโอกาสหรือเอาเปรียบทางธุรกิจกับท่าน เช่น การโก่งราคา เป็นต้น	1	2	3	4	5
6) องค์กร/บริษัท/บุคคลในเครือข่ายของท่านให้ความช่วยเหลือท่านแก้ปัญหาทางธุรกิจ และปัญหาทางเทคโนโลยีให้กับธุรกิจของท่าน	1	2	3	4	5
7) ท่านยินดีให้ความช่วยเหลือองค์กร/บริษัท/บุคคลเหล่านั้นหากได้รับการร้องขอ	1	2	3	4	5
8) ท่านยินดีที่จะแบ่งปันข่าวสารข้อมูลทางธุรกิจกับบุคคล/องค์กร ในเครือข่ายของท่าน	1	2	3	4	5
9) ข่าวสารข้อมูลที่ท่านได้รับจากบุคคล/บริษัท/องค์กรในเครือข่ายนั้น มีความถูกต้อง น่าเชื่อถือ และนำไปใช้ประโยชน์ได้	1	2	3	4	5
10) ท่านแลกเปลี่ยนความรู้ ข้อมูล ข่าวสารกับ บุคคล/บริษัท/องค์กร ในเครือข่ายของท่านอย่างสม่ำเสมอ	1	2	3	4	5
11) การรู้จัก หรือมีเครือข่ายกับองค์กร/บริษัท/บุคคล จะช่วยให้ธุรกิจของท่านลดต้นทุนการติดต่อประสานงานทางธุรกิจ และลดต้นทุนการค้นคว้าหาข้อมูลการตลาด ผู้ซื้อ ผู้ขาย ได้	1	2	3	4	5
12) ท่านมีการติดต่อธุรกิจ ซื้อขายกับคู่ค้า ลูกค้าและผู้ส่งมอบของท่านบ่อยๆ	1	2	3	4	5
13) ท่านมีความกระตือรือร้นในการขยายเครือข่ายเพื่อรู้จักกับบุคคล/บริษัท/องค์กรอื่นๆ เพิ่มขึ้น	1	2	3	4	5
14) ท่านมีความไว้เนื้อเชื่อใจในการทำธุรกิจกับคนที่เป็นญาติพี่น้อง หรือบุคคลที่ใกล้ชิดเป็นสำคัญ	1	2	3	4	5
15) ท่านสามารถไว้ใจบุคคลที่ท่านไม่เคยรู้จักได้ง่ายขึ้น หากบุคคลนั้นได้รับการแนะนำจากคนที่ท่านรู้จักและไว้ใจอยู่ก่อนแล้ว	1	2	3	4	5
16) การทำธุรกิจที่เป็นที่พึงพอใจของทั้งสองฝ่ายสามารถเกิดขึ้นได้กับพันธมิตรทางธุรกิจที่ไม่จำเป็นว่าจะต้องเป็นเพื่อน ญาติ หรือบุคคลในครอบครัว	1	2	3	4	5

<u>ส่วนที่ 5</u> สภาวะการแข่งขันทางธุรกิจ

5.1 **ท่านเห็นด้วยหรือไม่เห็นด้วยอย่างไรกับข้อความต่อไปนี้ที่ในเรื่องสภาวะการแข่งขันในตลาดของธุรกิจของท่าน**	ไม่เห็นด้วยอย่างยิ่ง				เห็นด้วยอย่างยิ่ง
1) มีคู่แข่งขันรายใหม่ๆ เกิดขึ้นจำนวนมากในธุรกิจของท่าน	1	2	3	4	5
2) คู่แข่งขันของท่านมักจะนำเสนอสินค้าใหม่ๆ ออกสู่ตลาด	1	2	3	4	5
3) ท่านสามารถต่อรองกับผู้ส่งมอบได้ในด้าน ราคา คุณภาพ ปริมาณ และการส่งมอบ ฯลฯ	1	2	3	4	5
4) มีผลิตภัณฑ์ในตลาดจำนวนมากที่ลูกค้าสามารถซื้อเพื่อทดแทนสินค้าของท่านได้	1	2	3	4	5
5) ธุรกิจของท่านมีการแข่งขันสูงในเรื่อง					
5.1) ราคา	1	2	3	4	5
5.2) คุณภาพ	1	2	3	4	5
5.3) ปริมาณการผลิต และระยะเวลาการส่งมอบ	1	2	3	4	5
5.4) บรรจุภัณฑ์	1	2	3	4	5
5.5) การโฆษณา และประชาสัมพันธ์สินค้า	1	2	3	4	5
6) การรักษาพนักงานที่มีฝีมือให้อยู่กับบริษัทนานๆ เป็นไปได้ยากเพราะมีการซื้อตัวพนักงาน	1	2	3	4	5
5.2 สภาวะการแข่งขันในปัจจุบันเป็นปัญหากับการดำเนินธุรกิจของท่านมากกว่าที่จะเป็นแรงส่งเสริมหรือโอกาสในการปรับปรุงพัฒนาธุรกิจของท่าน	1	2	3	4	5

<u>ส่วนที่ 6</u> ความสามารถด้านเทคโนโลยีและนวัตกรรม

6.1 ธุรกิจของท่านมีการพัฒนาขีดความสามารถในด้านต่างๆ เหล่านี้มากน้อยเพียงใดในช่วง 3 ปีที่ผ่านมา (2549 – 2551)	ไม่มีการพัฒนาเลย ◄				► มีการพัฒนาที่สำคัญ
1) กระบวนการผลิตของท่านมีการพัฒนาดีขึ้นหรือไม่ เช่น ผลิตได้มากขึ้น หรือเร็วขึ้นด้วยทรัพยากรที่มีอยู่เท่าเดิม	1	2	3	4	5
2) มีการพัฒนาความสามารถในการลงทุนบ้างหรือไม่ เช่น สามารถเลือกลงทุนได้อย่างถูกต้องทำให้เกิดการขยายกิจการ และมีผลตอบแทนที่คุ้มค่า	1	2	3	4	5
3) มีการพัฒนาด้านการทำวิจัยและพัฒนาเพิ่มขึ้นหรือไม่ ทั้งทดลองทำเอง หรือทำเป็นโครงการร่วมกับหน่วยงานอื่น (อย่างเป็นทางการ และไม่เป็นทางการ)	1	2	3	4	5

6.2 กรุณาระบุจำนวนผลิตภัณฑ์ใหม่หรือผลิตภัณฑ์เดิมที่มีการพัฒนาปรับปรุงในช่วง 3 ปีที่ผ่านมา

1) จำนวนผลิตเดิมที่มีการพัฒนาปรับปรุง…….. ผลิตภัณฑ์ 2) จำนวนผลิตภัณฑ์ใหม่ที่นำเสนอสู่ตลาด…….. ผลิตภัณฑ์

3) จำนวนบรรจุภัณฑ์ใหม่ที่นำเสนอสู่ตลาด…….. บรรจุภัณฑ์

6.3 กรุณาระบุการปรับปรุงกระบวนการผลิตของท่านในช่วง 3 ปีที่ผ่านมา

1) จำนวนครั้งที่มีการปรับปรุงกระบวนการเดิม……..ครั้ง

2) จำนวนกระบวนการผลิตใหม่ เครื่องจักรใหม่ หรืออุปกรณ์ใหม่ๆ ที่มีการติดตั้งในบริษัท …………..กระบวนการ/เครื่อง

6.4 บริษัทของท่านมีการปรับปรุงโครงสร้างองค์กรเพื่อให้มีการทำงานที่ดีขึ้น หรือมีการใช้ระบบบริหารจัดการธุรกิจ การจัดการคุณภาพ การจัดการสิ่งแวดล้อม และระบบอื่นๆ ที่เกี่ยวข้องบ้างหรือไม่ เช่น ระบบ ISO 9000, ISO 14000, GMP, HACCP, GHP **เป็นต้น**

❍ ไม่มี ❍ มี โปรดระบุ…………………………………………………………………………………

6.5 การพัฒนาด้านการตลาด

1) บริษัทของท่านมีการออกรายการส่งเสริมการขายใหม่ๆ หรือเปิดตลาดใหม่ๆ ในช่วง 3 ปีที่ผ่านมาบ้างหรือไม่ ❍ ไม่มี

❍ มี โปรดระบุ --> ❐ ออกบูทงานแสดงสินค้า ❐ เปิดตลาดใหม่ ❐ เปิดตลาดห้างสรรพสินค้า

❐ ออกรายการส่งเสริมการขาย ❐ ปรับราคาใหม่ ❐ สร้างแบรนด์ใหม่

❐ อื่นๆ โปรดระบุ.............................

2) บริษัทของท่านมีตราสินค้า หรือเครื่องหมายการค้าที่จดทะเบียนหรือไม่ ❍ ไม่มี ❍ มี โปรดระบุจำนวน……..

6.6 ความสามารถด้านธุรกิจในช่วงสามปีที่ผ่านมา	ลดลง		เท่า	เพิ่มขึ้น	
	> 51%	1 - 50%	เดิม	1 - 50%	>50%
1) เปอร์เซ็นต์การเติบโตของยอดการขาย	1	2	3	4	5
2) เปอร์เซ็นต์การเติบโตของผลกำไร	1	2	3	4	5
3) เปอร์เซ็นต์การเติบโตตลาด	1	2	3	4	5
4) เปอร์เซ็นต์การเติบโตของการส่งออก	1	2	3	4	5
5) เปอร์เซ็นต์การเติบโตของพนักงานทั้งหมด	1	2	3	4	5
6) เปอร์เซ็นต์การเติบโตของพนักงานด้านวิทยาศาสตร์ เทคโนโลยี	1	2	3	4	5

6.7 ผลิตภัณฑ์ของท่านได้รับ อย. หรือ มาตรฐานผลิตภัณฑ์ชุมชน (มผช.) บ้างหรือไม่ ❑ อย. ❑ มผช ❑ ไม่ได้รับ

6.8 กิจการของท่านเคยได้รับรางวัลใดๆ ในการประกอบธุรกิจบ้างหรือไม่ ❍ ไม่มี ❍ มี โปรดระบุ…………

❑โอทอป (OTOP) 5 ดาว ❑โอทอป (OTOP) 4 ดาว ❑โอทอป (OTOP) 3 ดาว ❑ผลิตภัณฑ์ดีเด่น ❑อื่นๆ โปรดระบุ..............

6.9 เปอร์เซ็นต์การส่งออกในปัจจุบัน .... % (ประเทศ ....)

6.10 ท่านผลิตสินค้าภายใต้ตราสินค้าของผู้อื่น หรือนำไปให้ผู้อื่นแบ่งบรรจุขายหรือไม่ ❍ใช่ ❍ไม่ใช่

6.11 **ท่านเห็นด้วยหรือไม่กับข้อความต่อไปนี้เกี่ยวกับการความก้าวหน้าด้านเทคโนโลยีและการดำเนินธุรกิจของท่าน**	ไม่เห็นด้วยอย่างยิ่ง ◄──► เห็นด้วยอย่างยิ่ง				
1) ท่านมีการหาข้อมูลด้านเทคโนโลยีใหม่ๆ หรือได้กำหนดบุคคลที่ทำหน้าที่รับผิดชอบในการติดตามความก้าวหน้าด้านเทคโนโลยีที่เกี่ยวข้องกับธุรกิจของท่านอย่างต่อเนื่อง	1	2	3	4	5
2) เทคโนโลยีและอุปกรณ์เครื่องมือปัจจุบันที่ท่านใช้อยู่ดีเพียงพอแล้ว ส่วนเทคโนโลยีใหม่ๆ มักจะใช้งานค่อนข้างยาก ซับซ้อน	1	2	3	4	5
3) ท่านมีการเปรียบเทียบความสามารถในการผลิตของกิจการของท่านกับคู่แข่ง หรือบริษัทอื่นอยู่เสมอๆ	1	2	3	4	5

<u>ส่วนที่ 7</u> นโยบาย และมาตรการของภาครัฐบาล

7.1 **ท่านคิดว่านโยบายและมาตรการของรัฐเหล่านี้ในปัจจุบันมีการดำเนินงานที่มีผลกระทบมากน้อยเพียงไรในการสนับสนุนให้เกิดพัฒนาเทคโนโลยีและนวัตกรรมในอุตสาหกรรมขนมไทย และท่านได้รับประโยชน์มากน้อยเพียงใด**	น้อยที่สุด <--> มากที่สุด				
1) สร้างความเข้มแข็งในการเชื่อมโยงเครือข่ายระหว่างรัฐบาล มหาวิทยาลัย และอุตสาหกรรมเพื่อการพัฒนาเทคโนโลยีและนวัตกรรม และถ่ายทอดเทคโนโลยี	1	2	3	4	5
2) จัดตั้งศูนย์ช่วยเหลือผู้ประกอบการเพื่อให้คำปรึกษาด้านเทคโนโลยี และนวัตกรรมโดยเป็นการบริการ และคำปรึกษาแบบครบวงจรจากหน่วยงานที่เกี่ยวข้อง	1	2	3	4	5
3) ปรับปรุงการสนับสนุนด้านการเงินเพื่อแก้ไขปัญหาด้านเทคนิค การวิจัยและพัฒนาและการสร้างนวัตกรรมในภาคอุตสาหกรรม	1	2	3	4	5
4) สร้างแรงจูงใจให้ภาคอุตสาหกรรมมีการพัฒนาด้านเทคโนโลยีและนวัตกรรม เช่น การลดภาษี ส่งเสริมการลงทุน ช่วยเหลือด้านการส่งออก และลดภาษีนำเข้าเครื่องจักร ฯลฯ	1	2	3	4	5
5) สนับสนุนสินค้าชุมชน หรือ สินค้า OTOP เช่น การจัดทำแผนกลยุทธ์ และแผนปฏิบัติการเพื่อการสร้าง และพัฒนาผลิตภัณฑ์ชุมชนอย่างต่อเนื่อง	1	2	3	4	5
6) สนับสนุนและช่วยเหลือด้านการคุ้มครองทรัพย์สินทางปัญญาและการจดสิทธิบัตร	1	2	3	4	5
7) สร้างศูนย์การเรียนรู้ในชุมชนในรูปแบบต่างๆ เช่น ห้องสมุด พิพิธภัณฑ์เพื่อการเรียนรู้ ศูนย์ส่งเสริมอาชีพ ศูนย์การฝึกอบรม ฯลฯ เป็นต้น	1	2	3	4	5
8) พัฒนาทักษะบุคลากร โดยการจัดหาการฝึกอบรม การศึกษาระยะสั้น การดูงาน เพื่อการพัฒนาด้านการบริหารจัดการการผลิต ความปลอดภัยทางอาหาร และความรู้เฉพาะทางด้านเทคโนโลยีอาหาร เป็นต้น	1	2	3	4	5
9) การทำงานแบบบูรณาการของภาครัฐ และมหาวิทยาลัยที่ร่วมมือกันสนับสนุนส่งเสริมการพัฒนาขีดความสามารถด้านเทคโนโลยีและนวัตกรรมในภาคอุตสาหกรรม	1	2	3	4	5
10) การสนับสนุนโดยตรงในการพัฒนาเทคโนโลยีและนวัตกรรมโดยรวม	1	2	3	4	5

<u>ส่วนที่ 8</u> การเข้าถึงแหล่งเงินทุน

ท่านเห็นด้วยหรือไม่กับข้อความดังต่อไปนี้เกี่ยวกับสถานภาพทางการเงินและการเข้าถึงแหล่งเงินทุนของธุรกิจของท่าน<u>ในช่วง 3 ปีที่ผ่านมา</u>	ไม่เห็นด้วยอย่างยิ่ง ←				→ เห็นด้วยอย่างยิ่ง
1) ใน 3 ปีที่ผ่านมาสภาพคล่องทางการเงินของธุรกิจของท่านดีขึ้น	1	2	3	4	5
2) ธุรกิจของท่านได้รับการสนับสนุนด้านการเงินเพื่อการพัฒนาเทคโนโลยีและนวัตกรรมจากหน่วยงานรัฐบาล หรือหน่วยงานอื่นๆ ที่เกี่ยวข้อง	1	2	3	4	5
3) ธุรกิจของท่านได้รับเงินกู้ดอกเบี้ยอัตราพิเศษ หรือเงินสนับสนุนพิเศษจากสถาบันการเงิน	1	2	3	4	5
4) ธุรกิจของท่านได้รับเงินกู้จากธนาคารและสถาบันการเงิน	1	2	3	4	5

ท่านมีข้อแนะนำอย่างไรเกี่ยวกับวิธีที่จะสร้างเครือข่ายความเชื่อมโยงที่เข้มแข็งระหว่าง ภาครัฐ ภาคการศึกษา สถาบันวิจัย องค์กรอิสระ และภาคอุตสาหกรรม เพื่อให้เกิดการพัฒนาเทคโนโลยีและนวัตกรรมในภาคอุตสาหกรรมได้ดีที่สุด โดยเฉพาะอย่างยิ่งสำหรับอุตสาหกรรมขนมไทย

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ขอขอบพระคุณเป็นอย่างสูงในความร่วมมือ

Appendix 3

Open-ended questions for firm interview

Main scopes of interview

1. History and the growth of the business
    - Why did you start the business?
    - How has your firm evolved and grown from past to present?
    - How is your expectation for the future of the firm?
    - How is your perception about risk and uncertainty in doing business?

2. How do you think about running a business as household-based, community-based and factory-based firms in terms of advantages and disadvantages?

3. How is the competitive pressures in your business and how do you cope with it?

4. Linkages and network
    - Have you contacted many people in your business or had network with?
    - What are types of organisations that you have networked with?
    - How do you establish your network?
    - How do you benefit from networking?
    - How and why do you trust people in your network?

5. If you want to improve your technological capability and innovation, what would you do?

6. How frequent and how do you introduce new products and packages to the market? How is the feedback?

7. How do you think about networking with other firms, government, universities and other public agencies?

8. If you have participated in the technology development projects provided by public agencies, how do you think about the projects in terms of success and failure; and advantages and disadvantages?

9. How are your financial status, liquidity and capital fund for running business and developing technological capability?

10. Please provide your suggestion about how the government can effectively create a network including interactive links between industry, university and government that would help promote technological capability and innovation in the Thai dessert industry.

Appendix 4

Open-ended questions for public agency interview

Main scopes of interview

1. How effective is the policy in your organisation to promote collaboration of government, university and industry in terms of:
   - ensure the importance of public-private collaborations are well understood?
   - encouraging you to work with industry?
   - establishing mechanism, administrative system and procedures to support collaborative projects including intellectual property rights?

2. What are critical success factors affecting collaboration and coordination of government, university and industry and how are their effects?

3. In your experience, what and how are main obstacles of the successful collaboration?

4. How is trust important for such collaboration?

5. If you participate in the ITAP projects, how do ITAP projects differ from other supporting projects provided by other agencies?

Appendix 5 Multiple regression analysis of 5 models

Model 1: Degree of technological capability development

1.1 At industrial level

1.1.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
TCD	0.648[a]	0.420	0.391	0.65594

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
TCD	Regression	31.185	5	6.237	14.496	0.000[a]
	Residual	43.025	100	0.430		
	Total	74.211	105			

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

b. Dependent Variable: technological capability development

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
TCD	(Constant)	-0.295	0.627		-0.469	0.640		
	Risk taking	0.011	0.015	0.058	0.723	0.471	0.902	1.108
	Competitive pressure	0.282	0.093	0.254	3.051	0.003	0.837	1.195
	Gov Support	0.154	0.079	0.170	1.940	0.055	0.758	1.320
	Social Capital	0.640	0.134	0.422	4.781	0.000	0.746	1.341
	Finance access	-0.002	0.070	-0.003	-0.031	0.975	0.795	1.258

1.1.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
a	0.581[a]	0.338	0.331	0.68744
b	0.628[b]	0.394	0.382	0.66072
c	0.646[c]	0.417	0.400	0.65123

a. Predictors: (Constant), Social Capital

b. Predictors: (Constant), Social Capital, Competitive pressure

c. Predictors: (Constant), Social Capital, Competitive pressure, Gov Support

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	25.063	1	25.063	53.035	0.000[a]
	Residual	49.148	104	0.473		
	Total	74.211	105			
2b	Regression	29.247	2	14.623	33.498	0.000[b]
	Residual	44.964	103	0.437		
	Total	74.211	105			
3c	Regression	30.953	3	10.318	24.328	0.000[c]
	Residual	43.258	102	0.424		
	Total	74.211	105			

a. Predictors: (Constant), Social Capital

b. Predictors: (Constant), Social Capital, Competitive pressure

c. Predictors: (Constant), Social Capital, Competitive pressure, Gov Support

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	0.642	0.419		1.534	0.128		
	Social Capital	0.882	0.121	0.581	7.282	0.000	1.000	1.000
2b	(Constant)	0.198	0.427		0.464	0.644		
	Social Capital	0.745	0.125	0.491	5.983	0.000	0.874	1.144
	Competitive pressure	0.282	0.091	0.254	3.096	0.003	0.874	1.144
3c	(Constant)	0.035	0.429		0.081	0.935		
	Social Capital	0.662	0.130	0.436	5.102	0.000	0.783	1.277
	Competitive pressure	0.275	0.090	0.247	3.055	0.003	0.872	1.146
	Gov Support	0.147	0.073	0.162	2.006	0.048	0.873	1.146

Dependent Variable: : technological capability development

1.2 Household-based firms

1.2.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
TCD	0.625[a]	0.390	0.334	0.69391

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
TCD	Regression	16.625	5	3.325	6.905	0.000[a]
	Residual	26.002	54	0.482		
	Total	42.627	59			

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

b. Dependent Variable: technological capability development

c. Selecting only cases for which Category = Household-based

Coefficients[a,b]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
TCD	(Constant)	-0.677	0.938		-0.722	0.473		
	Risk taking	0.019	0.026	0.082	0.724	0.472	0.886	1.129
	Competitive pressure	0.249	0.127	0.222	1.961	0.055	0.881	1.135
	Gov Support	0.112	0.110	0.118	1.022	0.311	0.853	1.172
	Social Capital	0.670	0.186	0.430	3.604	0.001	0.795	1.258
	Finance access	0.113	0.106	0.122	1.071	0.289	0.869	1.151

a. Dependent Variable: technological capability development

b. Selecting only cases for which Category = Household-based

1.2.2 Method: Stepwise

Model Summary

Model	R Category = Household-based	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.548[a]	0.301	0.289	0.71691
2b	0.586[b]	0.344	0.321	0.70066

a. Predictors: (Constant), Social Capital

b. Predictors: (Constant), Social Capital, Competitive pressure

ANOVA[c,d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	12.817	1	12.817	24.937	0.000[a]
	Residual	29.810	58	0.514		
	Total	42.627	59			
2b	Regression	14.644	2	7.322	14.915	0.000[b]
	Residual	27.983	57	0.491		
	Total	42.627	59			

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	0.646	0.560		1.153	0.254		
	Social Capital	0.855	0.171	0.548	4.994	0.000	1.000	1.000
2	(Constant)	0.218	0.590		0.370	0.713		
	Social Capital	0.761	0.174	0.488	4.359	0.000	0.921	1.086
	Competitive pressure	0.242	0.125	0.216	1.929	0.059	0.921	1.086

1.3 Community-based firms
1.3.1 Method: Enter

Model Summary

Model	R Category = Community-based (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
TCD	0.622[a]	0.387	0.226	0.64360

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
TCD	Regression	4.967	5	0.993	2.398	0.076[a]
	Residual	7.870	19	0.414		
	Total	12.837	24			

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

b. Dependent Variable: technological capability development

c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
TCD	(Constant)	-1.026	1.494		-0.687	0.500		
	Risk taking	0.062	0.032	0.393	1.963	0.064	0.805	1.242
	Competitive pressure	0.205	0.201	0.201	1.017	0.322	0.824	1.213
	Gov Support	0.412	0.215	0.419	1.917	0.070	0.674	1.483
	Social Capital	0.171	0.340	0.106	0.504	0.620	0.731	1.367
	Finance access	-0.035	0.140	-0.053	-0.250	0.805	0.727	1.375

1.3.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Community-based			
1a	0.400[a]	0.160	0.123	0.68484
2b	0.580[b]	0.336	0.275	0.62251

a. Predictors: (Constant), Gov Support

b. Predictors: (Constant), Gov Support, Risk taking

ANOVA[c,d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	2.050	1	2.050	4.370	0.048[a]
	Residual	10.787	23	0.469		
	Total	12.837	24			
2b	Regression	4.311	2	2.156	5.563	0.011[b]
	Residual	8.525	22	0.388		
	Total	12.837	24			

a. Predictors: (Constant), Gov Support

b. Predictors: (Constant), Gov Support, Risk taking

c. Dependent Variable: technological capability development

d. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	2.426	0.729		3.326	0.003		
	Gov Support	0.392	0.188	0.400	2.090	0.048	1.000	1.000
2b	(Constant)	-0.137	1.251		-0.110	0.913		
	Gov Support	0.469	0.174	0.477	2.702	0.013	0.967	1.034
	Risk taking	0.068	0.028	0.427	2.416	0.024	0.967	1.034

1.4 Factory-based firms
1.4.1 Method: Enter

Model Summary

Model	R Category = Factory-based (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
TCD	0.867[a]	0.752	0.669	0.39493

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
TCD	Regression	7.090	5	1.418	9.091	0.000[a]
	Residual	2.340	15	0.156		
	Total	9.430	20			

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

b. Dependent Variable: technological capability development

c. Selecting only cases for which Category = Factory-based

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
TCD	(Constant)	-0.276	0.974		-0.284	0.781		
	Risk taking	-0.019	0.016	-0.173	-1.199	0.249	0.798	1.253
	Competitive pressure	0.510	0.156	0.463	3.274	0.005	0.827	1.210
	Gov Support	0.069	0.123	0.092	0.566	0.580	0.625	1.599
	Social Capital	0.955	0.227	0.577	4.214	0.001	0.883	1.132
	Finance access	-0.162	0.097	-0.262	-1.662	0.117	0.666	1.502

1.4.2 Method: Stepwise

Model Summary

Model	R Category = Factory-based	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.633[a]	0.400	0.369	0.54549
2b	0.801[b]	0.641	0.601	0.43362
3c	0.842[c]	0.709	0.658	0.40172

a. Predictors: (Constant), Competitive pressure

b. Predictors: (Constant), Competitive pressure, Social Capital

c. Predictors: (Constant), Competitive pressure, Social Capital, Finance access

ANOVA[d,e]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	3.776	1	3.776	12.689	0.002[a]
	Residual	5.654	19	0.298		
	Total	9.430	20			
2b	Regression	6.045	2	3.023	16.075	0.000[b]
	Residual	3.384	18	0.188		
	Total	9.430	20			
3c	Regression	6.686	3	2.229	13.810	0.000[c]
	Residual	2.743	17	0.161		
	Total	9.430	20			

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1a	(Constant)	1.688	0.677		2.492	0.022		
	Competitive pressure	0.696	0.195	0.633	3.562	0.002	1.000	1.000
2b	(Constant)	-0.848	0.907		-0.934	0.362		
	Competitive pressure	0.584	0.159	0.531	3.683	0.002	0.959	1.043
	Social Capital	0.830	0.239	0.501	3.474	0.003	0.959	1.043
3c	(Constant)	-0.840	0.840		-1.000	0.331		
	Competitive pressure	0.563	0.147	0.512	3.822	0.001	0.954	1.048
	Social Capital	0.953	0.230	0.575	4.148	0.001	0.889	1.124
	Finance access	-0.167	0.084	-0.271	-1.993	0.063	0.927	1.078

Model 2: Product development

2.1 At industrial level

2.1.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
PRD	0.297[a]	0.088	0.043	13.251

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRD	Regression	1696.873	5	339.375	1.933	0.095[a]
	Residual	17557.660	100	175.577		
	Total	19254.533	105			

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

b. Dependent Variable: Product development

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
PRD	(Constant)	-20.606	12.673		-1.626	0.107		
	Risk taking	0.353	0.305	0.117	1.159	0.249	0.902	1.108
	Competitive pressure	0.561	1.870	0.031	0.300	0.765	0.837	1.195
	Gov Support	0.298	1.600	0.020	0.186	0.853	0.758	1.320
	Social Capital	5.842	2.704	0.239	2.160	0.033	0.746	1.341
	Finance access	-2.112	1.411	-0.160	-1.498	0.137	0.795	1.258

a. Dependent Variable: Product development

2.1.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.243[a]	0.059	0.050	13.197

a. Predictors: (Constant), Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	1140.467	1	1140.467	6.548	0.012[a]
	Residual	18114.066	104	174.174		
	Total	19254.533	105			

a. Predictors: (Constant), Social Capital

b. Dependent Variable: Product development

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-10.952	8.041		-1.362	0.176		
	Social Capital	5.952	2.326	0.243	2.559	0.012	1.000	1.000

2.2 Household-based firms

2.2.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
PRD	0.446[a]	0.199	0.125	5.532

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRD	Regression	409.997	5	81.999	2.680	0.031[a]
	Residual	1652.283	54	30.598		
	Total	2062.280	59			

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

b. Dependent Variable: Product development

c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
PRD	(Constant)	-6.738	7.477		-0.901	0.371		
	Risk taking	0.256	0.204	0.162	1.254	0.215	0.886	1.129
	Competitive pressure	-1.492	1.013	-0.191	-1.474	0.146	0.881	1.135
	Gov Support	-0.685	0.876	-0.103	-0.782	0.438	0.853	1.172
	Social Capital	3.930	1.482	0.362	2.651	0.011	0.795	1.258
	Finance access	-1.250	0.841	-0.194	-1.487	0.143	0.869	1.151

2.2.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
1a	0.308[a]	0.095	0.079	5.673

a. Predictors: (Constant), Social Capital

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	195.986	1	195.986	6.091	0.017[a]
	Residual	1866.294	58	32.177		
	Total	2062.280	59			

a. Predictors: (Constant), Social Capital
b. Dependent Variable: Product development
c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-5.217	4.431		-1.177	0.244		
	Social Capital	3.345	1.355	0.308	2.468	0.017	1.000	1.000

2.3 Community-based firms

2.3.1 Method: Enter

Model Summary

Model	R Category = Community-based	R Square	Adjusted R Square	Std. Error of the Estimate
PRD	0.389[a]	0.151	-0.072	15.639

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRD	Regression	829.485	5	165.897	0.678	0.645[a]
	Residual	4646.701	19	244.563		
	Total	5476.185	24			

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support
b. Dependent Variable: Product development
c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
PRD	(Constant)	-30.266	36.298		-0.834	0.415		
	Risk taking	0.504	0.773	0.153	0.652	0.522	0.805	1.242
	Competitive pressure	-0.369	4.887	-0.018	-0.075	0.941	0.824	1.213
	Gov Support	0.056	5.220	0.003	0.011	0.991	0.674	1.483
	Social Capital	9.006	8.261	0.269	1.090	0.289	0.731	1.367
	Finance access	-3.137	3.412	-0.228	-0.919	0.369	0.727	1.375

2.3.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

2.4 Factory-based firms

2.4.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Factory-based			
PRD	0.267[a]	0.071	-0.238	24.802

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRD	Regression	709.668	5	141.934	0.231	0.943[a]
	Residual	9226.824	15	615.122		
	Total	9936.492	20			

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

b. Dependent Variable: Product development

c. Selecting only cases for which Category = Factory-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
PRD	(Constant)	-15.725	61.197		-0.257	0.801		
	Risk taking	0.822	1.014	0.226	0.811	0.430	0.798	1.253
	Competitive pressure	5.341	9.774	0.150	0.546	0.593	0.827	1.210
	Gov Support	1.132	7.697	0.046	0.147	0.885	0.625	1.599
	Social Capital	-2.126	14.233	-0.040	-0.149	0.883	0.883	1.132
	Finance access	-3.324	6.112	-0.166	-0.544	0.595	0.666	1.502

2.4.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

Model 3: Process development

3.1 At industrial level

3.1.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
PRC	0.146[a]	0.021	-0.028	9.80213

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRC	Regression	207.855	5	41.571	0.433	0.825[a]
	Residual	9608.182	100	96.082		
	Total	9816.037	105			

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

b. Dependent Variable: Process development

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
PRC	(Constant)	-2.900	9.375		-0.309	0.758		
	Risk taking	0.110	0.225	0.051	0.487	0.627	0.902	1.108
	Competitive pressure	0.710	1.383	0.056	0.513	0.609	0.837	1.195
	Gov Support	0.799	1.184	0.077	0.675	0.501	0.758	1.320
	Social Capital	0.661	2.001	0.038	0.331	0.742	0.746	1.341
	Finance access	-1.301	1.043	-0.138	-1.247	0.215	0.795	1.258

a. Dependent Variable: Process development

3.1.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

3.2 Household-based firms

3.2.1 Method: Enter

Model Summary

Model	R (Category = Household-based)	R Square	Adjusted R Square	Std. Error of the Estimate
PRC	0.247[a]	0.061	-0.026	12.23037

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRC	Regression	523.725	5	104.745	0.700	0.626[a]
	Residual	8077.426	54	149.582		
	Total	8601.151	59			

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

b. Dependent Variable: Process development

c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
PRC	(Constant)	-5.315	16.531		-0.321	0.749		
	Risk taking	0.106	0.452	0.033	0.234	0.816	0.886	1.129
	Competitive pressure	1.957	2.239	0.123	0.874	0.386	0.881	1.135
	Gov Support	2.254	1.938	0.166	1.163	0.250	0.853	1.172
	Social Capital	-0.016	3.277	0.000	-0.005	0.996	0.795	1.258
	Finance access	-2.743	1.859	-0.209	-1.475	0.146	0.869	1.151

3.2.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

3.3 Community-based firms

3.3.1 Method: Enter

Model Summary

Model	R Category = Community-based	R Square	Adjusted R Square	Std. Error of the Estimate
PRC	0.555[a]	0.308	0.125	4.15874

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRC	Regression	145.979	5	29.196	1.688	0.186[a]
	Residual	328.607	19	17.295		
	Total	474.585	24			

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

b. Dependent Variable: Process development

c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
PRC	(Constant)	2.445	9.653		0.253	0.803		
	Risk taking	0.119	0.206	0.123	0.579	0.570	0.805	1.242
	Competitive pressure	0.666	1.300	0.108	0.513	0.614	0.824	1.213
	Gov Support	2.817	1.388	0.472	2.029	0.057	0.674	1.483
	Social Capital	-4.386	2.197	-0.446	-1.997	0.060	0.731	1.367
	Finance access	0.479	0.907	0.118	0.528	0.603	0.727	1.375

3.3.2 Method: Stepwise

Model Summary

Model	R Category = Community-based	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.368[a]	0.135	0.098	4.22407
2b	0.512[b]	0.262	0.195	3.98931

a. Predictors: (Constant), Gov Support

b. Predictors: (Constant), Gov Support, Social Capital

ANOVA[c,d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	64.201	1	64.201	3.598	0.070[a]
	Residual	410.384	23	17.843		
	Total	474.585	24			
2b	Regression	124.464	2	62.232	3.910	0.035[b]
	Residual	350.121	22	15.915		
	Total	474.585	24			

a. Predictors: (Constant), Gov Support

b. Predictors: (Constant), Gov Support, Social Capital

c. Dependent Variable: Process development

d. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1a	(Constant)	-4.356	4.498		-0.968	0.343		
	Gov Support	2.196	1.158	0.368	1.897	0.070	1.000	1.000
2b	(Constant)	6.935	7.191		0.964	0.345		
	Gov Support	2.948	1.160	0.494	2.542	0.019	0.889	1.125
	Social Capital	-3.719	1.911	-0.378	-1.946	0.065	0.889	1.125

3.4 Factory-based firms

3.4.1 Method: Enter

Model Summary

Model	R (Category = Factory-based)	R Square	Adjusted R Square	Std. Error of the Estimate
PRC	0.465[a]	0.217	-0.044	6.33450

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
PRC	Regression	166.481	5	33.296	0.830	0.548[a]
	Residual	601.888	15	40.126		
	Total	768.369	20			

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

b. Dependent Variable: Process development

c. Selecting only cases for which Category = Factory-based

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
PRC	(Constant)	-3.784	15.630		-0.242	0.812		
	Risk taking	0.140	0.259	0.138	0.539	0.598	0.798	1.253
	Competitive pressure	-0.384	2.496	-0.039	-0.154	0.880	0.827	1.210
	Gov Support	-2.428	1.966	-0.357	-1.235	0.236	0.625	1.599
	Social Capital	4.084	3.635	0.273	1.124	0.279	0.883	1.132
	Finance access	-0.183	1.561	-0.033	-0.117	0.908	0.666	1.502

3.4.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

Model 4: Sale growth

4.1 At industrial level

4.1.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
SALE	0.301[a]	0.090	0.044	41.49892

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
SALE	Regression	16762.243	5	3352.449	1.947	0.093[a]
	Residual	168771.724	98	1722.160		
	Total	185533.967	103			

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital
b. Dependent Variable: Sale growth

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
SALE	(Constant)	-75.663	40.075		-1.888	0.062		
	Risk taking	1.975	0.963	0.208	2.051	0.043	0.902	1.108
	Competitive pressure	-2.526	5.912	-0.045	-0.427	0.670	0.837	1.195
	Gov Support	6.871	5.060	0.150	1.358	0.178	0.758	1.320
	Social Capital	9.726	8.551	0.127	1.137	0.258	0.746	1.341
	Finance access	-7.357	4.460	-0.178	-1.649	0.102	0.795	1.258

4.1.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
SALE	0.192[a]	0.037	0.027	41.85844

a. Predictors: (Constant), Risk taking

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	6816.814	1	6816.814	3.891	0.051[a]
	Residual	178717.153	102	1752.129		
	Total	185533.967	103			

a. Predictors: (Constant), Risk taking
b. Dependent Variable: Sale growth

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-38.904	30.901		-1.259	0.211		
	Risk taking	1.820	0.923	0.192	1.972	0.051	1.000	1.000

4.2 Household-based firms

4.2.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
SALE	0.318[a]	0.101	0.018	46.00442

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
SALE	Regression	12899.298	5	2579.860	1.219	0.313[a]
	Residual	114285.941	54	2116.406		
	Total	127185.239	59			

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support
b. Dependent Variable: Sale growth
c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
SALE	(Constant)	-86.719	62.181		-1.395	0.169		
	Risk taking	1.593	1.700	0.128	0.937	0.353	0.886	1.129
	Competitive pressure	-2.476	8.421	-0.040	-0.294	0.770	0.881	1.135
	Gov Support	8.755	7.288	0.168	1.201	0.235	0.853	1.172
	Social Capital	14.829	12.328	0.174	1.203	0.234	0.795	1.258
	Finance access	-6.545	6.994	-0.130	-0.936	0.354	0.869	1.151

4.2.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
SALE	0.231[a]	0.053	0.037	45.56358

a. Predictors: (Constant), Social Capital

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	6774.939	1	6774.939	3.263	0.076[a]
	Residual	120410.301	58	2076.040		
	Total	127185.239	59			

a. Predictors: (Constant), Social Capital
b. Dependent Variable: Sale growth
c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-43.272	35.595		-1.216	0.229		
	Social Capital	19.667	10.887	0.231	1.806	0.076	1.000	1.000

4.3 Community-based firms

4.3.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Community-based			
SALE	0.360[a]	0.130	-0.160	25.49016

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

Model Summary

Model	R (Category = Community-based)	R Square	Adjusted R Square	Std. Error of the Estimate
SALE	0.360[a]	0.130	-0.160	25.49016

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
SALE	Regression	1455.493	5	291.099	0.448	0.808[a]
	Residual	9746.221	15	649.748		
	Total	11201.714	20			

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

b. Dependent Variable: Sale growth

c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
SALE	(Constant)	-62.852	64.809		-0.970	0.348		
	Risk taking	1.866	1.381	0.363	1.352	0.197	0.805	1.242
	Competitive pressure	1.728	8.726	0.053	0.198	0.846	0.824	1.213
	Gov Support	3.961	9.320	0.125	0.425	0.677	0.674	1.483
	Social Capital	-0.002	14.750	0.000	0.000	1.000	0.731	1.367
	Finance access	-0.794	6.092	-0.037	-0.130	0.898	0.727	1.375

4.3.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

4.4 Factory-based firms

4.4.1 Method: Enter

Model Summary

Model	R (Category = Factory-based)	R Square	Adjusted R Square	Std. Error of the Estimate
SALE	0.472[a]	0.223	-0.037	50.41441

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
SALE	Regression	10917.812	5	2183.562	0.859	0.530[a]
	Residual	38124.188	15	2541.613		
	Total	49042.000	20			

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

b. Dependent Variable: Sale growth

c. Selecting only cases for which Category = Factory-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
SALE	(Constant)	-34.612	124.395		-0.278	0.785		
	Risk taking	3.428	2.061	0.424	1.663	0.117	0.798	1.253
	Competitive pressure	-18.367	19.867	-0.231	-0.924	0.370	0.827	1.210
	Gov Support	16.281	15.645	0.300	1.041	0.315	0.625	1.599
	Social Capital	2.010	28.931	0.017	0.069	0.946	0.883	1.132
	Finance access	-19.466	12.424	-0.437	-1.567	0.138	0.666	1.502

4.4.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

Model 5: Employee growth

5.1 At industrial level

5.1.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
EMPL	0.328[a]	0.107	0.058	27.02199

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
EMPL	Regression	7903.353	5	1580.671	2.165	0.065[a]
	Residual	65716.936	90	730.188		
	Total	73620.289	95			

a. Predictors: (Constant), Finance access, Risk taking, Competitive pressure, Gov Support, Social Capital

b. Dependent Variable: Employee Growth

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
EMPL	(Constant)	-59.334	27.171		-2.184	0.032		
	Risk taking	1.492	0.653	0.239	2.284	0.025	0.902	1.108
	Competitive pressure	-2.583	4.008	-0.070	-0.644	0.521	0.837	1.195
	Gov Support	6.717	3.431	0.224	1.958	0.053	0.758	1.320
	Social Capital	3.621	5.798	0.072	0.624	0.534	0.746	1.341
	Finance access	-2.730	3.024	-0.101	-0.903	0.369	0.795	1.258

5.1.2 Method: Stepwise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.226[a]	0.051	0.041	27.26139
2b	0.302[b]	0.091	0.072	26.82181

a. Predictors: (Constant), Risk taking

b. Predictors: (Constant), Risk taking, Gov Support

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	3761.045	1	3761.045	5.061	0.027[a]
	Residual	69859.244	94	743.183		
	Total	73620.289	95			
2b	Regression	6715.215	2	3357.608	4.667	0.012[b]
	Residual	66905.074	93	719.409		
	Total	73620.289	95			

a. Predictors: (Constant), Risk taking

b. Predictors: (Constant), Risk taking, Gov Support

c. Dependent Variable: Employee Growth

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-36.684	20.955		-1.751	0.083		
	Risk taking	1.408	0.626	0.226	2.250	0.027	1.000	1.000
2b	(Constant)	-57.814	23.104		-2.502	0.014		
	Risk taking	1.461	0.616	0.235	2.371	0.020	0.998	1.002
	Gov Support	6.013	2.967	0.201	2.026	0.046	0.998	1.002

5.2 Household-based firms

5.2.1 Method: Enter

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Category = Household-based			
EMPL	0.423[a]	0.179	0.097	33.44899

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
EMPL	Regression	12170.973	5	2434.195	2.176	0.072[a]
	Residual	55941.758	50	1118.835		
	Total	68112.732	55			

a. Predictors: (Constant), Finance access, Social Capital, Competitive pressure, Risk taking, Gov Support

b. Dependent Variable: Employee growth

c. Selecting only cases for which Category = Household-based

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
EMPL	(Constant)	-98.431	46.826		-2.102	0.041		
	Risk taking	3.042	1.280	0.324	2.376	0.021	0.886	1.129
	Competitive pressure	-7.149	6.341	-0.154	-1.127	0.265	0.881	1.135
	Gov Support	6.465	5.489	0.163	1.178	0.244	0.853	1.172
	Social Capital	5.640	9.284	0.087	0.607	0.546	0.795	1.258
	Finance access	-4.979	5.267	-0.130	-0.945	0.349	0.869	1.151

5.2.2 Method: Stepwise

Model Summary

Model	R Category = Household-based	R Square	Adjusted R Square	Std. Error of the Estimate
EMPL	0.329[a]	0.108	0.092	33.54146

a. Predictors: (Constant), Risk taking

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	7361.153	1	7361.153	6.543	0.013[a]
	Residual	60751.579	54	1125.029		
	Total	68112.732	55			

a. Predictors: (Constant), Risk taking

b. Dependent Variable: Employee growth

c. Selecting only cases for which Category = Household-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	-93.944	40.579		-2.315	0.024		
	Risk taking	3.090	1.208	0.329	2.558	0.013	1.000	1.000

5.3 Community-based firms

5.3.1 Method: Enter

Model Summary

Model	R Category = Community-based	R Square	Adjusted R Square	Std. Error of the Estimate
EMPL	0.620[a]	0.384	0.147	14.56388

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
EMPL	Regression	1720.820	5	344.164	1.623	0.223[a]
	Residual	2757.387	13	212.107		
	Total	4478.208	18			

a. Predictors: (Constant), Finance access, Risk taking, Social Capital, Competitive pressure, Gov Support

b. Dependent Variable: Employee growth

c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
EMPL	(Constant)	-92.522	39.031		-2.370	0.034		
	Risk taking	0.765	0.832	0.223	0.920	0.374	0.805	1.242
	Competitive pressure	2.234	5.255	0.102	0.425	0.678	0.824	1.213
	Gov Support	3.270	5.613	0.154	0.583	0.570	0.674	1.483
	Social Capital	14.609	8.883	0.419	1.645	0.124	0.731	1.367
	Finance access	0.661	3.669	0.046	0.180	0.860	0.727	1.375

5.3.2 Method: Stepwise

Model Summary

Model	R (Category = Community-based)	R Square	Adjusted R Square	Std. Error of the Estimate
EMPL	0.562[a]	0.316	0.276	13.42438

a. Predictors: (Constant), Social Capital

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	1414.571	1	1414.571	7.849	0.012[a]
	Residual	3063.637	17	180.214		
	Total	4478.208	18			

a. Predictors: (Constant), Social Capital

b. Dependent Variable: Employee growth

c. Selecting only cases for which Category = Community-based

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1a	(Constant)	-63.971	26.836		-2.384	0.029		
	Social Capital	19.618	7.002	0.562	2.802	0.012	1.000	1.000

5.4 Factory-based firms

5.4.1 Method: Enter

Model Summary

Model	R (Category = Factory-based)	R Square	Adjusted R Square	Std. Error of the Estimate
EMPL	0.412[a]	0.170	-0.107	16.40757

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
EMPL	Regression	824.182	5	164.836	0.612	0.692[a]
	Residual	4038.126	15	269.208		
	Total	4862.308	20			

a. Predictors: (Constant), Finance access, Competitive pressure, Risk taking, Social Capital, Gov Support

b. Dependent Variable: Employee growth

c. Selecting only cases for which Category = Factory-based

Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
EMPL	(Constant)	2.206	40.485		0.054	0.957		
	Risk taking	0.246	0.671	0.097	0.366	0.719	0.798	1.253
	Competitive pressure	7.855	6.466	0.314	1.215	0.243	0.827	1.210
	Gov Support	2.284	5.092	0.133	0.449	0.660	0.625	1.599
	Social Capital	-10.132	9.416	-0.269	-1.076	0.299	0.883	1.132
	Finance access	1.228	4.043	0.088	0.304	0.766	0.666	1.502

5.4.2 Method: Stepwise

- No variables entered into the equation (no statistically significant variable) -

Appendix 6

Correlations between technological capability development and social capital elements by firm categories

1. Household-based firms

	Mean	**SD**	**N**	TCD	TSI	TSP	TKI	TRF	TFA	TG	Cont	STie	HonT	Norm	InfoS	Netw
TCD	3.40	0.85	85													
TSI	2.83	0.85	76	.105												
TSP	3.59	0.82	81	0.067	-0.050											
TKI	3.27	0.74	74	0.451**	0.189	0.046										
TRF	2.75	0.82	73	0.146	0.287*	0.002	0.183									
TFA	4.04	0.95	77	0.260*	-0.321**	0.154	0.202	0.254*								
TG	2.77	0.57	82	0.178	0.097	0.089	0.306**	0.139	-0.040							
Cont	2.00	0.55	82	-0.020	0.046	-0.040	-0.110	0.115	0.133	-0.274*						
STie	3.36	0.77	82	0.323**	-0.009	0.050	0.547**	-0.074	0.338**	0.418**	0.043					
HonT	3.43	0.83	81	0.479**	-0.151	0.465**	0.423**	-0.050	0.293*	0.291**	-0.128	0.399**				
Norm	3.40	0.85	82	0.399**	-0.020	0.148	0.623**	-0.036	0.293*	0.482**	-0.193	0.594**	0.627**			
InfoS	3.32	0.90	81	0.463**	0.016	0.083	0.494**	0.000	0.193	0.305**	0.083	0.590**	0.570**	0.690**		
Netw	3.46	1.02	82	0.543**	0.044	0.234*	0.619**	0.066	0.209	0.313**	-0.052	0.607**	0.550**	0.693**	0.734**	
Trans	3.57	0.73	81	0.460**	-0.134	0.224*	0.594**	0.030	0.375**	0.430**	-0.109	0.701**	0.605**	0.637**	0.693**	0.767**

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

2. Community-based firms

	Mean	**SD**	**N**	TCD	TSI	TSP	TKI	TRF	TFA	TG	Cont	STie	HonT	Norm	InfoS	Netw
TCD	3.92	0.73	39													
TSI	3.06	1.01	34	0.180												
TSP	3.83	0.88	36	-0.082	0.286											
TKI	4.05	0.63	32	0.241	0.349	0.351*										
TRF	3.28	1.05	29	0.304	0.410*	.0452*	0.116									
TFA	4.23	1.06	31	0.026	0.622**	0.325	0.333	0.452*								
TG	3.32	0.47	37	0.220	-0.043	0.432**	0.326	0.180	-0.166							
Cont	2.22	0.67	39	0.343*	0.042	0.005	0.015	0.456*	0.308	-0.004						
STie	4.01	0.69	37	0.227	0.178	0.152	0.478**	-0.040	-0.055	0.704**	0.115					
HonT	3.75	0.88	38	0.227	0.256	0.220	0.209	0.216	-0.077	0.601**	0.119	0.630**				
Norm	4.10	0.66	38	0.480**	0.049	0.040	0.352*	0.198	0.000	0.416*	0.306	0.451**	0.494**			
InfoS	4.03	0.60	37	0.549**	0.238	0.089	0.378*	0.247	0.063	0.366*	0.220	0.548**	0.378*	0.637**		
Netw	4.37	0.67	38	0.262	0.135	0.158	0.329	0.082	0.157	0.391*	0.277	0.582**	0.229	0.503**	0.421**	
Trans	4.23	0.68	37	0.220	-0.108	0.102	0.420*	0.024	-0.136	0.499**	0.099	0.551**	0.326*	0.564**	0.351*	0.603**

3. Factory-based firms

	Mean	**SD**	**N**	TCD	TSI	TSP	TKI	TRF	TFA	TG	Cont	STie	HonT	Norm	InfoS	Netw
TCD	4.06	0.69	26													
TSI	2.50	0.98	24	0.034												
TSP	3.60	0.58	25	0.152	0.229											
TKI	3.81	0.66	24	0.165	0.368	0.042										
TRF	3.02	0.91	24	-0.064	0.425*	0.139	0.007									
TFA	4.00	1.04	23	-0.067	0.276	0.221	-0.131	0.717**								
TG	3.12	0.65	23	0.011	0.245	0.038	0.395	0.136	-0.059							
Cont	1.95	0.50	25	0.039	0.402	-0.006	0.490*	0.261	0.334	0.117						
STie	4.06	0.69	24	0.109	0.278	0.311	0.275	0.010	-0.206	0.263	0.298					
HonT	3.64	0.55	25	0.147	-0.160	0.315	-0.169	-0.027	-0.270	-0.187	-0.166	0.432*				
Norm	3.91	0.70	25	0.552**	0.132	0.179	0.466*	0.217	0.218	0.364	0.193	-0.086	-0.109			
InfoS	3.69	0.91	24	0.455*	-0.208	0.031	0.232	0.165	0.214	0.358	0.213	-0.063	-0.242	0.686**		
Netw	3.68	1.11	25	0.577**	-0.020	0.117	0.257	-0.014	0.078	0.353	0.186	0.105	-0.129	0.571**	0.708**	
Trans	4.21	0.79	24	0.500*	-0.197	0.243	0.394	0.005	0.099	0.372	0.181	0.128	-0.096	0.701**	0.840**	0.731**

Appendix 7

Multiple regression analysis of social capital and technological capability development

Dependent variable: Degree of technological capability development
Method: Stepwise regression

1.1 At industrial level

Model Summary

Model	R Industrial level	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.521[a]	0.272	0.266	0.72050
2b	0.563[b]	0.317	0.306	0.70046
3c	0.586[c]	0.343	0.326	0.69006
4d	**0.601[d]**	**0.361**	**0.339**	**0.68327**

a. Predictors: (Constant), NETW
b. Predictors: (Constant), NETW, HONT
c. Predictors: (Constant), NETW, HONT, INFOS
d. Predictors: (Constant), NETW, HONT, INFOS, TKI

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	23.037	1	23.037	44.378	0.000[a]
	Residual	61.775	119	0.519		
	Total	84.813	120			
2b	Regression	26.916	2	13.458	27.429	0.000[b]
	Residual	57.897	118	0.491		
	Total	84.813	120			
3c	Regression	29.100	3	9.700	20.371	0.000[c]
	Residual	55.713	117	0.476		
	Total	84.813	120			
4c	**Regression**	**30.657**	**4**	**7.664**	**16.417**	**0.000[d]**
	Residual	**54.155**	**116**	**0.467**		
	Total	**84.813**	**120**			

Coefficients

Model		Unstandardized Coef.		Standardized Coef.	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	2.059	0.248		8.302	0.000		
	NETW	0.426	0.064	0.521	6.662	0.000	1.000	1.000
2b	(Constant)	1.482	0.317		4.676	0.000		
	NETW	0.350	0.068	0.428	5.166	0.000	0.841	1.188
	HONT	0.243	0.086	0.233	2.812	0.006	0.841	1.188
3c	(Constant)	1.303	0.323		4.033	0.000		
	NETW	0.223	0.089	0.273	2.500	0.014	0.471	2.125
	HONT	0.198	0.088	0.190	2.262	0.026	0.794	1.260
	INFOS	0.228	0.106	0.239	2.142	0.034	0.452	2.214
4c	**(Constant)**	**1.027**	**0.354**		**2.901**	**0.004**		
	NETW	**0.168**	**0.093**	**0.206**	**1.801**	**0.074**	**0.422**	**2.371**
	HONT	**0.176**	**0.088**	**0.169**	**2.005**	**0.047**	**0.778**	**1.285**
	INFOS	**0.203**	**0.106**	**0.213**	**1.915**	**0.058**	**0.445**	**2.250**
	TKI	**0.182**	**0.100**	**0.168**	**1.826**	**0.070**	**0.652**	**1.533**

1.2 Household-based firms

Model Summary

Model	R Household-based	R Square	Adjusted R Square	Std. Error of the Estimate
1a	0.543[a]	0.295	0.285	0.71890
2b	0.584[b]	0.342	0.322	0.69997
3c	**0.608[c]**	**0.369**	**0.340**	**0.69032**

a. Predictors: (Constant), NETW

b. Predictors: (Constant), NETW, HONT

c. Predictors: (Constant), NETW, HONT, TSP

ANOVA[d,e]

Model		Sum of Squares	df	Mean Square	F	Sig.
1a	Regression	14.709	1	14.709	28.461	0.000[a]
	Residual	35.143	68	0.517		
	Total	49.852	69			
2b	Regression	17.025	2	8.513	17.374	0.000[b]
	Residual	32.827	67	0.490		
	Total	49.852	69			
3c	**Regression**	**18.400**	**3**	**6.133**	**12.870**	**0.000[c]**
	Residual	**31.452**	**66**	**0.477**		
	Total	**49.852**	**69**			

a. Predictors: (Constant), NETW

b. Predictors: (Constant), NETW, HONT

c. Predictors: (Constant), NETW, HONT, TSP

d. Dependent Variable: Tech Cap Dev

e. Selecting only cases for which Category = Household-based

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1a	(Constant)	1.837	0.306		6.005	0.000		
	NETW	0.452	0.085	0.543	5.335	0.000	1.000	1.000
2b	(Constant)	1.337	0.377		3.550	0.001		
	NETW	0.334	0.099	0.401	3.378	0.001	0.697	1.435
	HONT	0.266	0.122	0.258	2.174	0.033	0.697	1.435
3c	**(Constant)**	**1.735**	**0.439**		**3.951**	**0.000**		
	NETW	**0.329**	**0.098**	**0.395**	**3.372**	**0.001**	**0.696**	**1.436**
	HONT	**0.359**	**0.132**	**0.349**	**2.710**	**0.009**	**0.577**	**1.732**
	TSP	**-0.195**	**0.115**	**-0.188**	**-1.699**	**0.094**	**0.783**	**1.277**

a. Dependent Variable: Tech Cap Dev

b. Selecting only cases for which Category = Household-based

1.3 Community-based firms

Model Summary

Model	R Community-based	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.549[a]	0.301	0.273	0.62336

a. Predictors: (Constant), INFOS

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.192	1	4.192	10.788	0.003[a]
	Residual	9.714	25	0.389		
	Total	13.906	26			

a. Predictors: (Constant), INFOS
b. Dependent Variable: Tech Cap Dev
c. Selecting only cases for which Category = Community-based

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.229	0.829		1.483	0.150		
	INFOS	0.669	0.204	0.549	3.285	0.003	1.000	1.000

a. Dependent Variable: Tech Cap Dev
b. Selecting only cases for which Category = Community-based

1.4 Factory-based firms

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	Factory-based			
1	0.577[a]	0.332	0.297	0.57562

a. Predictors: (Constant), NETW

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.134	1	3.134	9.459	0.006[a]
	Residual	6.295	19	0.331		
	Total	9.430	20			

a. Predictors: (Constant), NETW
b. Dependent Variable: Tech Cap Dev
c. Selecting only cases for which Category = Factory-based

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.749	0.446		6.167	0.000		
	NETW	0.357	0.116	0.577	3.076	0.006	1.000	1.000

a. Dependent Variable: Tech Cap Dev
b. Selecting only cases for which Category = Factory-based

Appendix 8A

A formal letter for questionnaire survey

TMC
a member of NSTDA

ที่ วท 5408/ว.0309

12 มีนาคม 2552

เรื่อง ขอความอนุเคราะห์ในการตอบแบบสอบถาม

เรียน ท่านผู้บริหารระดับสูงหรือท่านเจ้าของกิจการ

สิ่งที่ส่งมาด้วย แบบสอบถามเรื่อง "การสร้างเครือข่าย การพัฒนาเทคโนโลยีและนวัตกรรม และการเติบโตของอุตสาหกรรมขนมไทย ประจำปี 2552"

ด้วยนางสาวณัฐกา โยคะกุล เจ้าหน้าที่ของโครงการสนับสนุนการพัฒนาเทคโนโลยีของอุตสาหกรรมไทย (ITAP) ศูนย์บริหารจัดการเทคโนโลยี สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ (สวทช.) ดำเนินการวิจัยเพื่อศึกษาปัจจัยต่างๆ องค์ประกอบของสถาบัน และกลไกของการสร้างเครือข่ายนวัตกรรมระหว่างภาครัฐ ภาคการศึกษา และภาคอุตสาหกรรม เพื่อการพัฒนาเทคโนโลยีในภาคอุตสาหกรรมไทย โดยกลุ่มอุตสาหกรรมเป้าหมายคือผู้ประกอบการในกลุ่มอุตสาหกรรมขนมไทย งานวิจัยนี้จะเป็นประโยชน์อย่างยิ่งต่อศูนย์บริหารจัดการเทคโนโลยีในการสร้างกลไกที่ดียิ่งขึ้นในการสนับสนุนภาคอุตสาหกรรมแบบครบวงจร เพื่อตอบสนองกับความต้องการของกลุ่มอุตสาหกรรมขนาดกลางและเล็ก (SME) และสนับสนุนการเติบโตของอุตสาหกรรมขนมไทย และงานวิจัยนี้จะเป็นส่วนหนึ่งของวิทยานิพนธ์ระดับปริญญาเอก

เนื่องจากงานวิจัยนี้ต้องการข้อมูลจากผู้บริหารระดับสูงหรือเจ้าของกิจการในอุตสาหกรรมขนมไทย จึงใคร่ขอความอนุเคราะห์จากผู้บริหารระดับสูงหรือเจ้าของกิจการในการตอบแบบสอบถาม(ตามเอกสารแนบท้าย) ในครั้งนี้ โดยการตอบของท่านไม่มีคำตอบถูกหรือผิด ผู้วิจัยต้องการทราบความคิดเห็นในมุมมองของผู้บริหารระดับสูง หรือเจ้าของกิจการ ***โดยข้อมูลที่ได้รับจะถูกเก็บเป็นความลับอย่างเคร่งครัด และการนำเสนอผลงานวิจัยจะนำเสนอในภาพรวมเท่านั้น***

อนึ่ง หากท่านสนใจสรุปย่อผลงานวิจัย โปรดแจ้งความจำนงในแบบสอบถาม เพื่อที่จะจัดส่งเอกสารผลสรุปการศึกษาเมื่อการวิจัยเสร็จสิ้นแล้วให้ท่านเพื่อเป็นประโยชน์ต่อไป

จึงเรียนมาเพื่อโปรดพิจารณาอนุเคราะห์ข้อมูล และขอขอบพระคุณในความอนุเคราะห์ของท่านเป็นอย่างสูง มา ณ ที่นี้

ขอแสดงความนับถือ

(นายสมชาย ฉัตรรัตนา)
รองผู้อำนวยการศูนย์บริหารจัดการเทคโนโลยี
สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ

โครงการสนับสนุนการพัฒนาเทคโนโลยีของอุตสาหกรรมไทย (ITAP)
โทรศัพท์ 0-2564-7000 ต่อ 1365 (ณัฐกา) email : nattaka@tmc.nstda.or.th
โทรสาร 0-2564-7082, 0-2564-7003

ศูนย์บริหารจัดการเทคโนโลยี
สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ
111 อุทยานวิทยาศาสตร์ประเทศไทย ถนนพหลโยธิน ตำบลคลองหนึ่ง อำเภอคลองหลวง จังหวัดปทุมธานี 12120 โทรศัพท์ 0 2564 7000 โทรสาร 0 2564 7003-5

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Appendix 8B

Translation of the formal letter sent out to individuals covered in questionnaire survey

Re: Questionnaire survey

Attachment: A questionnaire survey on “network development, innovation, technological capability development, and growth of the Thai dessert industry in 2009”

Miss Nattaka Yokakul is a staff of the Industrial Technology Assistance Program (ITAP), Technology Management Center operating under National Science and Technology Development Agency (NSTDA). She is conducting a PhD research on “Factors affecting technological capability development in the Thai dessert industry”. The study explores the institutional context and mechanism for the development of innovation network linking government, industry and university. This study would provide important information and knowledge that would help the Technology Management Center to improve its effectiveness for industrial support and interventions, particularly with respect to Thai SMEs and the growth of Thai dessert industry.

It is, therefore, important that the questionnaire enclosed with this letter is filled out by firms’ owners or top management who would have the relevant information about the industry. It would greatly help the researcher if you set aside a few minutes to complete the questionnaire. Please note that there are no right or wrong answers since the questionnaire is aimed to obtain personal opinions and perspectives on details about your firms. ***The information obtained from firms will be treated as confidential and will be presented as aggregate data applying to the industry as a whole.***

If you are interested in a summary of final results of this study, please indicate your interest in the questionnaire. The results of the study will be administrated to you as soon as the study is completed. Thank you very much for your kind cooperation in providing useful information.

Yours sincerely,

Somchai Chatrattana, Ph.D. Associate professor
Deputy Director, Technology Management Center (TMC)
National Science and Technology Management Agency (NSTDA)

Appendix 9A

A formal letter for interview

ที่ วท 5408/ว.0305

12 มีนาคม 2552

เรื่อง ขอความอนุเคราะห์ในการให้สัมภาษณ์

เรียน ท่านผู้บริหารระดับสูงหรือท่านเจ้าของกิจการ

สิ่งที่ส่งมาด้วย หัวข้อการสัมภาษณ์ เรื่อง "การสร้างเครือข่าย การพัฒนาเทคโนโลยีและนวัตกรรม และการเติบโตของอุตสาหกรรมขนมไทย"

ด้วยนางสาวณัฐกา โยคะกุล เจ้าหน้าที่ของโครงการสนับสนุนการพัฒนาเทคโนโลยีของอุตสาหกรรมไทย (ITAP) ศูนย์บริหารจัดการเทคโนโลยี สำนักงานพัฒนาวิทยาศาสตร์และเทคโนโลยีแห่งชาติ (สวทช.) ดำเนินการวิจัยเพื่อศึกษาปัจจัยต่างๆ องค์ประกอบของสถาบัน และกลไกของการสร้างเครือข่ายนวัตกรรมระหว่างภาครัฐ ภาคการศึกษา และภาคอุตสาหกรรม เพื่อการพัฒนาเทคโนโลยีในภาคอุตสาหกรรมไทย โดยกลุ่มอุตสาหกรรมเป้าหมายคือผู้ประกอบการในกลุ่มอุตสาหกรรมขนมไทย งานวิจัยนี้จะเป็นประโยชน์อย่างยิ่งต่อศูนย์บริหารจัดการเทคโนโลยีในการสร้างกลไกที่ดียิ่งขึ้นในการสนับสนุนภาคอุตสาหกรรมแบบครบวงจร เพื่อตอบสนองกับความต้องการของกลุ่มอุตสาหกรรมขนาดกลางและเล็ก (SME) และสนับสนุนการเติบโตของอุตสาหกรรมขนมไทย และงานวิจัยนี้จะเป็นส่วนหนึ่งของวิทยานิพนธ์ระดับปริญญาเอก

เนื่องจากงานวิจัยนี้ต้องการข้อมูลจากผู้บริหารระดับสูงหรือเจ้าของกิจการในอุตสาหกรรมขนมไทย จึงใคร่ขอความอนุเคราะห์จากผู้บริหารระดับสูงหรือเจ้าของกิจการในการให้สัมภาษณ์ในครั้งนี้ในหัวข้อเรื่อง "การสร้างเครือข่าย การพัฒนาเทคโนโลยีและนวัตกรรม และการเติบโตของอุตสาหกรรมขนมไทย" (หัวข้อตามเอกสารแนบ) ***โดยข้อมูลที่ได้รับจะถูกเก็บเป็นความลับอย่างเคร่งครัด และการนำเสนอผลงานวิจัยจะนำเสนอในภาพรวมเท่านั้น***

อนึ่ง หากท่านสนใจสรุปย่อผลงานวิจัย โปรดแจ้งความจำนงกับผู้สัมภาษณ์ เพื่อที่ทาง ITAP จะจัดส่งเอกสารผลสรุปการศึกษาเมื่อการวิจัยเสร็จสิ้นแล้วให้ท่านเพื่อเป็นประโยชน์ต่อไป

จึงเรียนมาเพื่อโปรดพิจารณาอนุเคราะห์ข้อมูล และขอขอบพระคุณในความอนุเคราะห์ของท่านเป็นอย่างสูง มา ณ ที่นี้

ขอแสดงความนับถือ

(นายสมชาย ฉัตรรัตนา)
รองผู้อำนวยการศูนย์บริหารจัดการเทคโนโลยี
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Appendix 9B

Translation of the formal letter addressed to interviewees

Re: Interviews

Attachment: Interview topics on "network development, innovation, technological capability development, and growth of the Thai dessert industry"

Miss Nattaka Yokakul is a staff of the Industrial Technology Assistance Program (ITAP), Technology Management Center operating under National Science and Technology Development Agency (NSTDA). She is conducting a PhD research on "Factors affecting technological capability development in the Thai dessert industry". The study explores the institutional context and mechanism for the development of innovation network linking government, industry and university. This study would provide important information and knowledge that would help the Technology Management Center to improve its effectiveness for industrial support and interventions, particularly with respect to Thai SMEs and the growth of Thai dessert industry.

The interview is required to be conducted with firms' owners or top management in order to gain concrete information from the industry. You are, therefore, kindly asked to participate in the interview which will focus on the topics enclosed with this letter. ***The information obtained from firms will be treated as confidential and will be presented as aggregate data applying to the industry as a whole.***

If you are interested in a summary of final results of this study, please inform the researcher during the interview. The results of the study will be administrated to you as soon as the study is completed. Thank you very much for your kind cooperation.

Yours sincerely,

Somchai Chatrattana, Ph.D. Associate professor
Deputy Director, Technology Management Center (TMC)
National Science and Technology Management Agency (NSTDA)

Appendix 10

Guideline for observation

Main actors	Issue for investigation
Firms	- How they react to the visitors from outside company (government, university, technical expert and ITAP)? - Do they react differently for these organisations? - Are they open/enthusiastic for communication, conversation, and provision of required information? - How do they cooperate or do not? (for example, show production plant, equipments or tell the details of their problems) - Do they have any claims/complaints about the visit or experiences from other support agencies and how do they complain? - How they feel about support agencies (negative/positive)?
Experts (university, RTOs, etc.)	- How do they react and communicate with firms? - What types of language experts use with firms? (more technical term or try to make it easier for firm to understand) - Do they clearly explain objectives, problems, actions and supports to firms and how do they explain this to firms? - Are they very formal conducting or trying to be very friendly? - Are they happy to answer all questions that firms would like to know and how do they answer?
ITAP or other intermediary organisation	- How do they clearly introduce/explain objectives of visit, visitors, experts and procedures to firms? - How do they facilitate any conflicts or clarify some issues that might not be well understood by firms and experts? - In what way that they persuade firm to participate or link with other agencies that may benefit firms?
Environmental circumstances	- Have any further appointments, actions or follow-up been set after the visit? - Does everyone enjoy and happy with the visit? - Why the visit success or fail? - What are critical factors affecting collaborative projects? - What are other environmental circumstances that may affect the situation?